



UNIVERSAL DESTINATIONS & EXPERIENCES UK PROJECT

Former Kempston Hardwick Brickworks
and adjoining land, Bedford

Environmental Statement Volume 3

Appendix 12.1 - Flood Risk Assessment

Part 1/6

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EXECUTIVE SUMMARY – FOR INFORMATION

This Flood Risk Assessment (FRA) has been prepared in support of the planning proposal for the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)** of the Environmental Statement (ES).

The Site comprises a total area of 268 hectares (ha) and is located approximately 5km southwest of Bedford town centre. The Ordnance Survey Grid Reference for the approximate centre of the Site is National Grid Reference 502812, 244795.

This FRA investigates flood risk on-Site and, in the area, and outlines the mitigation measures proposed to ensure the sustainable and safe development of the Site in consideration of the requirements of the National Planning Policy Framework², the Flood Risk and Coastal Change Planning Practice Guidance³ and the Environment Agency's (EA) Standing Advice¹.

The Site is mostly located in Flood Zone 1 (this zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)), however there are areas to the north and west within the Site boundary which fall within Flood Zone 2 (this zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%)), Flood Zone 3a (this zone comprises land assessed as having a 1 in 100 or greater probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%)) and Flood Zone 3b (this zone is the functional flood plain and comprises land where water has to flow or be stored in times of flood) respectively. Flood Zone compensation is proposed on a level for level basis where levels are to be raised within Flood Zone 3. Safe routes of access and egress from the Site are to be set at 600mm above maximum fluvial flood levels.

Available baseline information indicates that within the Site there are areas which are at risk of surface water flooding from on-Site effects. However, as detailed in **Appendix 12.3: Drainage Strategy (Volume 3)** the Proposed Development includes a surface water drainage strategy that has been designed in line with the most recent EA Climate Change Guidance²¹ to consider and manage the impact of a 100-year plus climate change rainfall event. Where surface water originates from off-site, the sitewide level strategy will ensure that flood water is directed to sustainable drainage systems features or existing watercourses, natural storage volumes will be retained, and levels will ensure that exceedance flows are not directed off-Site.

The Site sits within the maximum extent of potential reservoir flooding from the nearby Stewartby Lake, the potential for flooding from this receptor is highly unlikely but possible due to the maintenance requirements of the asset. Potential increase of off-site risk has been mitigated by providing exceedance flow routes through the site and storage has been allocated within the Site for volumes displaced by the proposed raising of levels.

¹Environment Agency (2024) *Preparing a flood risk assessment: standing advice*. Available at: <https://www.gov.uk/guidance/flood-risk-assessment-standing-advice> [Accessed: 29 October 2024].

The impermeable nature of the bedrock within the Site in combination with shallow deposits of alluvium and head in isolated areas of the Site presents the possibility of emergence of groundwater when surface flows are unable to infiltrate away, however the implementation of the Drainage Strategy presented in **Appendix 12.3: Drainage Strategy (Volume 3)** will mitigate this risk by capturing surface water and attenuating the flows.

Other potential sources of flooding have been investigated and have been deemed low or negligible.

Engagement with the EA, Bedford Borough Council Lead Local Flood Authority and the Internal Drainage Board has been carried out throughout the preparation of this FRA to ensure their awareness of the proposals, and their ability to advise on Site constraints and flood risk

1. INTRODUCTION – FOR INFORMATION

1.1. APPOINTMENT AND BRIEF

- 1.1.1. This Flood Risk Assessment (FRA) has been prepared in support of the planning proposal for the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)** of the Environmental Statement.

1.2. OBJECTIVE OF STUDY AND METHODOLOGY

- 1.2.1. Sections 6, 7 and 8 of this report contains the proposed mitigation measures including the sequential and exception test and flood mitigation measures. Sections 1, 2, 3, 4, 5, 9 and 10 are labelled 'For Information' and are intended to be for information only, as they contain an Introduction, Policy and Guidance, Climate Change, Existing Site Information and Flood Risk Maps which provide context for the mitigation measures.
- 1.2.2. This report investigates flood risk within the Site and the surrounding area relative to the source of flooding in **Section 5 Sources of Flood Risk** and includes:
- Fluvial - Within 0.5km offset from the Site boundary for upstream incoming flows and downstream localised outgoing flows relative to Elstow Brook;
 - Surface Water – Within the Site boundary and including 1km offset from the southern boundary for upstream localised surface water runoff contribution from Stewartby Residential Estate. Land located to the west of the Site for the upstream contributing catchment of approximately 2km²; and
 - Artificial Reservoir – Within the Site boundary and including 1.5km offset from the southern boundary to include Stewartby Reservoir as the source of flood risk.
- 1.2.3. The report establishes the mitigation measures required to ensure the sustainability and safety of the Proposed Development over its lifetime.
- 1.2.4. Where reference is made to agreements with the Environmental Agency (EA) and Bedford Group of Internal Drainage Boards (IDB) these discussions and agreements are captured in the Summaries of Agreed Position (SoAP) (Appendix 6 of the **Planning Statement (Document Reference 6.1.0)**).
- 1.2.5. The report has been produced in line with the requirements of the *National Planning Policy Framework* (NPPF)², the *Flood Risk and Coastal Change Planning Practice Guidance* (PPG)³ and the *Environment Agency (EA) Standing Advice*, as well as through engagement with the Lead Local Flood Authority (LLFA), Bedford Group IDB and AW.
- 1.2.6. Site visits were undertaken in April 2024 and April 2025 by representatives of the WSP team undertaking this FRA to assess the general topography of the area, understand the existing drainage regime and to identify any flood risk sources that may affect the site.

² Ministry of Housing, Communities and Local Government (2023) *National Planning Policy Framework*. Available at: https://assets.publishing.service.gov.uk/media/669a25e9a3c2a28abb50d2b4/NPPF_December_2023.pdf [Accessed: 13 August 2024].

³ Ministry of Housing, Communities and Local Government (2022) *Planning Practice Guidance*. Available at: <https://www.gov.uk/guidance/flood-risk-and-coastal-change> [Accessed: 13 August 2024].

1.2.7. The following documents and policies have been reviewed to inform this report:

- LLFA - Strategic Flood Risk Assessment (SFRA - Level 1) (2020)⁴;
- LLFA - Strategic Flood Risk Assessment (SFRA - Level 2 (2022)⁵;
- LLFA - Preliminary Flood Risk Assessment (PFRA) (2011)⁶;
- LLFA - Local Flood Risk Management Strategy (LFRMS) (2022)⁷;
- Bedford BC - Local Plan 2030 (Adopted 2020)⁸;
- 40SEVEN - Topographical Survey (2023) (**Annex 1**);
- Anglian Water Asset Records (2024) (**Annex 2**);
- British Geological Society (BGS) Online Viewer, 1:50,000 Bedrock and Superficial deposits⁹;
- Department for Environment Food and Rural Affairs' (Defra) online Magic Map¹⁰;
- IDB Fluvial Flood Mapping¹¹;
- Flood Map for Planning¹²;
- Long Term Flood Maps¹³ and;
- Delta-Simons 'Bedford Business Park Environmental Statement Appendix 10' 2018¹⁴.

1.2.8. In undertaking this study, the local policies discussed in Section 2 of this report have also been considered.

1.2.9. This report makes use of third-party information and contains EA information.

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- ⁴ Bedford Borough Council (2020) *Bedford Borough Council Level 1 Strategic Flood Risk Assessment*. Available at: <https://edrms.bedford.gov.uk/OpenDocument.aspx?id=li3cQOt63E3W8glO2AEmuQ%3d%3d&name=BBC%20Strategic%20Flood%20Risk%20Assessment%20Level%201%20Nov%202020.pdf> [Accessed: 13 August 2024].
- ⁵ Bedford Borough Council (2022) *Bedford Borough Council Level 2 Strategic Flood Risk Assessment*. Available at: <https://www.bedford.gov.uk/media/5087/download?inline> [Accessed: 13 August 2024].
- ⁶ Bedford Group of Internal Drainage Board (2011) *Upper River Great Ouse Tri Lead Local Flood Authority Preliminary Flood Risk Assessment for Bedford Borough Council, Central Bedfordshire Council and Milton Keynes Council*. Available at: https://www.centralbedfordshire.gov.uk/migrated_images/preliminary-flood-risk-assessment_tcm3-7812.pdf [Accessed 13 August 2024].
- ⁷ Bedford Borough Council (2022) *Local Flood Risk Management Strategy*. Available at: <https://www.bedford.gov.uk/media/4802/download?inline> [Accessed: 13 August 2024].
- ⁸ Bedford Borough Council (2020) *Local Plan 2030*. Available at: <https://www.bedford.gov.uk/media/4011/download?inline> [Accessed: 13 August 2024].
- ⁹ British Geological Survey (n.d.) *BGS Geology Viewer*. Available at: https://geologyviewer.bgs.ac.uk/?_ga=2.132188366.1163400577.1730132662-1184848800.1730132662 [Accessed: 28 October 2024].
- ¹⁰ Department for Environment Food and Rural Affairs (n.d.) *Magic Map*. Available at: <https://magic.defra.gov.uk/> [Accessed: 28 October 2024].
- ¹¹ Internal Drainage Boards Map (2020) Association of Drainage Authorities. Available at: <https://www.ada.org.uk/idb-map/> [Accessed: 13 August 2024].
- ¹² Environment Agency (n.d.) *Get flood risk information for planning in England*. Available at: <https://flood-map-for-planning.service.gov.uk/> [Accessed: 28 October 2024].
- ¹³ Environment Agency (n.d.) *Check the long term flood risk for an area in England*. Available at: <https://www.gov.uk/check-long-term-flood-risk> [Accessed: 28 October 2024].
- ¹⁴ Delta Simons (2018) *Bedford Business Park ES, Appendix 10*.

- 1.2.10. The insurance industry applies its own assessments to properties in terms of determining premiums and the insurability for flood risk. Those intending to undertake development in areas which may be at risk of flooding are advised to contact their insurers or the Association of British Insurers to seek further guidance prior to commencement.
- 1.2.11. WSP does not warrant that the advice in this flood risk assessment will guarantee the availability of flood insurance either now or in the future.

2. FLOOD RISK POLICY CONTEXT – FOR INFORMATION

2.1. NATIONAL PLANNING POLICY FRAMEWORK

- 2.1.1. The NPPF² was initially published in March 2012 (last updated in December 2024) with the aim of protecting the environment and to promote sustainable growth. There is an overarching presumption in favour of sustainable development that should be the basis of every plan and every decision.
- 2.1.2. The following paragraphs/policies within the NPPF² are considered relevant to this assessment:
- Paragraph 170: Requires that *“Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.”*;
 - Paragraph 173: Explains that *“A sequential risk-based approach should also be taken to individual applications in areas known to be at risk now or in the future from any form of flooding.”*;
 - Paragraph 174: Explains that *“The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source.”*;
 - Paragraph 175 States that *“The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, except in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk).”*;
 - Paragraph 181: Explains that *“When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere”*; and
 - Paragraph 182: Recommends that *“Applications which could affect drainage on or around the site should incorporate sustainable drainage systems to control flow rates and reduce volumes of runoff, and which are proportionate to the nature and scale of the proposal. These should provide multifunctional benefits wherever possible, through facilitating improvements in water quality and biodiversity, as well as benefits for amenity. Sustainable drainage systems provided as part of proposals for major development should:*
 - *take account of advice from the lead local flood authority;*
 - *have appropriate proposed minimum operational standards; and*
 - *have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development”*.

2.2. PLANNING PRACTICE GUIDANCE

- 2.2.1. The PPG³ includes Flood Zone definitions and flood risk vulnerability classifications for different land uses.

2.2.2. The assessment of flood risk is based on the definitions in Table 1 of the PPG³ and these definitions are detailed in **Table 2-1** below.

Table 2-1 - Flood Zone Definitions

Flood Zone	Definition
Flood Zone 1	<p>As that which has a “Low Probability” of flooding. The definition provided in Table 1 of the PPG is:</p> <ul style="list-style-type: none"> • “Land having a less than 0.1% annual probability of river or sea flooding.”
Flood Zone 2	<p>As that which has a “Medium Probability” of flooding. The definition provided in Table 1 of the PPG is:</p> <ul style="list-style-type: none"> • “Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding”
Flood Zone 3a	<p>As that which has a “High Probability” of flooding. The definition provided in Table 1 of the PPG is:</p> <ul style="list-style-type: none"> • “Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea [flooding].”
Flood Zone 3b	<p>As “the functional floodplain”. The definition provided in Table 1 of the PPG is:</p> <ul style="list-style-type: none"> ▪ <i>“This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:</i> <ul style="list-style-type: none"> • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). ▪ Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.”

2.2.3. Included within the “Policy aims” of Table 1 of the PPG for Flood Zone 3a is reference to flood storage. This is not required in Flood Zone 2 but for Flood Zone 3a it is stated as follows:

“In this zone, developers and local authorities should seek opportunities to:

Create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.”

- 2.2.4. The EA will often refer to this as “flood compensation storage” and require that the existing flood storage in the development area is maintained on a “level-for-level” basis. Typically, they will ask for evidence that the volume available for flooding is the same at every 200mm vertical slice post-development as it was pre-development up to the level of the 1 in 100 annual probability flood, i.e. the extent of Flood Zone 3a.
- 2.2.5. The NPPF² (in its Annex 3) classifies the Flood Risk Vulnerability of various land uses as described in **Table 2-2** (reproduced below). The Proposed Development comprises a range of land uses, following a review of the table, the risk classifications for the development are as follows;
- The proposed strategic road network, Utility Compound and Transport Hubs are classified as Essential Infrastructure.
 - The proposed accommodation and mixed use development including hotels, retail, dining, entertainment and camping facilities is classified as More Vulnerable.
 - The theme park, theme park support and car parking are classified as Less Vulnerable.
 - Ecological Enhancement Area and landscaping are classified as Water Compatible.

Table 2-2 - Flood Risk Vulnerability Classification

Vulnerability Classification	Description
Essential Infrastructure	<ul style="list-style-type: none"> ▪ Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk; ▪ Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; and water treatment works that need to remain operational in times of flood; ▪ Wind turbines; and ▪ Solar farms.
Highly Vulnerable	<ul style="list-style-type: none"> ▪ Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding; ▪ Emergency dispersal points; ▪ Basement dwellings; ▪ Caravans, mobile homes and park homes intended for permanent residential use; and ▪ Installations requiring hazardous substances consent (where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations or need to be located in other high flood risk areas, in these instances the facilities should be classified as “Essential Infrastructure”).
More Vulnerable	<ul style="list-style-type: none"> ▪ Hospitals; ▪ Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels;

Vulnerability Classification	Description
	<ul style="list-style-type: none"> ▪ Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels; ▪ Non-residential uses for health services, nurseries and educational establishments; ▪ Landfill and sites used for waste management facilities for hazardous waste; and ▪ Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	<ul style="list-style-type: none"> ▪ Police, ambulance and fire stations which are not required to be operational during flooding; ▪ Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in “More Vulnerable”, and assembly and leisure; ▪ Land and buildings used for agriculture and forestry; ▪ Waste treatment (except landfill and hazardous waste facilities); ▪ Minerals working and processing (except for sand and gravel working); ▪ Water treatment works which do not need to remain operational during times of flood; ▪ Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place); and ▪ Car Parks.
Water-compatible development	<ul style="list-style-type: none"> ▪ Flood control infrastructure; ▪ Water transmission infrastructure and pumping stations; ▪ Sewage transmission infrastructure and pumping stations; ▪ Sand and gravel working; ▪ Docks, marinas and wharves; ▪ Navigation facilities; ▪ Ministry of Defence installations; ▪ Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; ▪ Water-based recreation (excluding sleeping accommodation); ▪ Lifeguard and coastguard stations; ▪ Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms; and ▪ Essential ancillary sleeping or residential accommodation for staff required by uses in this category, <i>subject to a specific warning and evacuation plan.</i>

- 2.2.6. The overall aim of the NPPF² and PPG³ is to steer new development to Flood Zone 1. Where there are no reasonably available sites within Flood Zone 1, local planning authorities allocating land in local plans or determining planning applications for development at any particular location should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required (see **Table 2-3** below).

Table 2-3 - Flood Risk Vulnerability and Flood Zone ‘incompatibility’

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test Required	✓	✗	Exception Test Required	✓
	Zone 3b	Exception Test Required	✓	✗	✗	✗

✓ Exception Test is not required

✗ Development should not be permitted

2.3. UPPER RIVER GREAT OUSE TRI LEAD LOCAL FLOOD AUTHORITY PRELIMINARY FLOOD RISK ASSESSMENT FOR BEDFORD BOROUGH COUNCIL, CENTRAL BEDFORDSHIRE COUNCIL AND MILTON KEYNES COUNCIL (JUNE 2011)

- 2.3.1. This report⁶ was prepared to assist Bedford Borough Council (Bedford BC), Central Bedfordshire Council (CBC) and Milton Keynes Council (MKC) meet their duties to manage local flood risk and deliver the requirements of the *Flood Risk Regulations (2009)*¹⁵. Bedford BC, CBC and MKC are each defined as a LLFA under the Regulations and the *Flood and Water Management Act 2010*¹⁶. The PFRA⁶ is the first stage of the requirements of the Regulations.
- 2.3.2. The report was prepared in accordance with the *PFRA final guidance document*¹⁷ (07/12/2010) produced by the EA and in partnership with Bedford BC, CBC, and MKC, and the EA, Anglian Water Service Limited (AWS) and the IDB under a Memorandum of Understanding.

¹⁵ HM Government (2009) *Flood Risk Regulations* Available at: <https://www.legislation.gov.uk/uksi/2009/3042/contents> [Accessed 28 October 2024].

¹⁶ HM Government (2010) *Flood and Water Management Act*. Available at: <https://www.legislation.gov.uk/ukpga/2010/29/contents> [Accessed 28 October 2024].

¹⁷ Environment Agency (2010) *PFRA final guidance document*.

- 2.3.3. The PFRA⁶ was aimed at providing a high-level overview of flood risk from local flood sources and included flooding from surface water, groundwater, ordinary watercourses and canals. The *PFRA Guidance*¹⁷ issued by Central Government requires that LLFAs exclude flood risk from main rivers, the sea and reservoirs, which are assessed nationally by the EA.
- 2.3.4. The EA has used a national methodology, which has been set out by Defra, to identify areas of significant risk as Indicative Flood Risk Areas across England where 30,000 people or more are at risk of flooding. Accordingly, there are no Indicative Flood Risk Areas within Bedford BC area (this is still the case with the most recent, 2018 update of Flood Risk Areas¹⁸).
- 2.3.5. In order to develop a clear overall understanding of the flood risk across Bedford BC, CBC and MKC, flood risk data and records of historic flooding were collected from at least 20 different local and national sources including the Local Authorities, EA, Internal Drainage Boards, water companies, emergency services and other flood risk management authorities.
- 2.3.6. Information relating to 2,468 records of flood events, caused by flooding from local sources, was collected and analysed. However, comprehensive details on flood source, extents and consequences of these events were largely unavailable. Based on the evidence that was collected, no past flood events were considered to have had 'significant harmful consequences'.
- 2.3.7. However, it must be noted that there is a high risk of flooding from local sources across Bedford BC, CBC and MKC, particularly from surface water. Based on national surface water modelling, approximately 6,400 properties in Bedford BC, 10,000 properties in CBC and 6,600 properties in MKC are estimated to be at risk from flooding to a depth of 0.3m during a rainfall event with a 1 in 200 annual chance of occurring.
- 2.3.8. The LLFAs have a plethora of new roles, responsibilities and deliverables under the *Act and Regulations*. The Local Flood Risk Management Strategy seeks to collate and consolidate information from the PFRA and the SFRA to cover flood risks within the partnership framework.

2.4. BEDFORD BOROUGH COUNCIL LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT (NOVEMBER 2020)

- 2.4.1. The council is required to carry out a Strategic Flood Risk Assessment (SFRA) for its area, which assesses the risk of flooding from all sources, now and in the future, taking account of the impacts of climate change.
- 2.4.2. JBA Consulting were commissioned by Bedford BC to prepare a Level 1 SFRA⁴. This study provides a comprehensive and robust evidence base to support the production of the 2030 Local Plan. This document provides an update to the 2015 SFRA for Bedford BC.

¹⁸ Department for Environment Food and Rural Affairs (2018) *Flood Risk Areas*. Available at: <https://environment.data.gov.uk/dataset/f3d63ec5-a21a-49fb-803a-0fa0fb7238b6> [Accessed: 14 May 2025].

- 2.4.3. An original Level 2 SFRA was produced by Atkins consultants for Bedford BC in May 2010¹⁹. Since that date, there have been a number of significant changes. These include the revocation of Regional Spatial Strategies, the introduction of the NPPF² and the *Flood and Water Management Act*¹⁶. In addition, many of the data sets used to inform the 2010 SFRA have since been updated, and/or improved through the use of new modelling approaches.
- 2.4.4. The SFRA was used by the Local Planning Authority (LPA) to support the development of spatial planning options, including the allocation of development sites. The Level 1 SFRA⁴ informed the LPA to undertake sequential testing in line with the Government's principles of flood risk and planning set out in the NPPF².
- 2.4.5. The policy details and flood risk information contained within have been considered when compiling this FRA along with the Level 2 SFRA⁵ referenced below.

2.5. BEDFORD BOROUGH COUNCIL LEVEL 2 STRATEGIC FLOOD RISK ASSESSMENT (MAY 2022)

- 2.5.1. *"The Level 2 Strategic Flood Risk Assessment (SFRA) document was created with the purpose of supporting the production of the Bedford Borough Council Local Plan. It follows on from the Level 1 SFRA completed in 2020 and referenced above.*
- 2.5.2. *It involved the assessment of a wide range of proposed development sites of which there are 22 in the Level 2 assessment, including the Site. The Level 2 SFRA has updated information on flood data and recommendations for the cumulative impact of development.*
- 2.5.3. *The aim of the Level 2 assessment is to build on identified risks from the Level 1 document for proposed development sites and to provide a greater understanding of fluvial, surface water, groundwater, and reservoir related flooding risks to the sites. From this the Local Council and Developers can make more informed decisions and pursue development in an effective and efficient manner. The Level 2 assessment also identifies sites for further risk analysis at the site-specific Flood Risk Assessment (FRA) stage"⁵.*
- 2.5.4. A site summary table has been produced for 'Land at Kempston Hardwick' (Site code: 745-809-898-898-1050-905) as part of the SFRA which can be found in **Annex 5**, this includes the vast majority of the site, including the Core Zone, Lake Zone and the West Gateway Zone as well as some additional land to the north of the West Gateway Zone which is not being assessed in this FRA. The East Gateway Zone is not included within this summary table, as the SFRA was undertaken to support the local plan site allocation in 2022, which did not include the zone of land on which the East Gateway Zone sits. This table summarises: the Sources of Flood Risk, any existing Flood Management Infrastructure, Emergency Planning, Climate Change implications, Requirements for drainage control and impact mitigation and the NPPF² and planning implications. Reference has been made to this information when undertaking this FRA.
- 2.5.5. The site summary delivers a number of key messages, and states that the development is likely to be able to proceed if:
- The most at-risk areas of the sites are left undeveloped;

¹⁹ Bedford Borough Council (2010) *Bedford Borough Council Level 2 Strategic Flood Risk Assessment*. Available at: www.edrms.bedford.gov.uk/OpenDocument.aspx?id=VdpMVDX%2f1SGNCrclmGVISQ%3d%3d&name=Strategic%20Flood%20Risk%20Assessment%20Level%202%20Report.pdf [Accessed: 13 August 2024].

- The unnamed watercourse through 745 (the Core Zone) and Elstow Brook south of 809N (the Lake Zone) are modelled as part of a site-specific FRA with the most up-to-date climate change allowances to investigate the implications of climate change on the site;
- If flood mitigation measures are implemented then they are tested to ensure that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another);
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered;
- The proposed site should discharge surface water at the original pre-development (greenfield) run-off rate. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA, IDB or AW);
- Safe access and egress routes must not be in the areas of high fluvial and surface water risk and raising of access routes should not impede surface water flows; and
- A Flood Warning and Evacuation Plan should be prepared for the site if safe access and egress cannot be demonstrated during the 0.1% AEP event.

2.6. BEDFORD BOROUGH COUNCIL LOCAL FLOOD RISK MANAGEMENT STRATEGY (APRIL 2022)

- 2.6.1. Local Flood Risk Management Strategies have been developed by local authorities in England to help manage flood risk within their area over a five-year period, the 2022 Local Flood Risk Management Strategy supersedes the 2015 version of the document. The executive summary can be found below.
- 2.6.2. *“Following the severe flooding in 2007 the Government delegated to local authorities the responsibility to manage local flood risk in a more coordinated way. The Flood and Water Management Act 2010 requires Bedford BC to lead the coordination of flood risk in their local area and therefore develop, implement and maintain a strategy for local flood risk management in the area.*
- 2.6.3. *Since the Local Flood Risk Management Strategy (LFRMS) was produced in 2015 Bedford BC has been working to ensure flood risk management is more effective across the Borough. The Strategy in 2015 set out a series of objectives and actions to determine how the Borough and its partners worked to meet the strategy objectives. The LFRMS 2022 continues to build on the previous work of the Council and progress the new challenges they face today and into the future.*
- 2.6.4. *The revised strategy has built on what has been learnt since 2015 to include the December 2020 flood event. It takes on the visions and aspirations of new and emerging policies and legislation to create a strategy which will inform local flood risk management into the next 5 years.*
- 2.6.5. *The purpose of the strategy is to help individuals, communities, businesses, and authorities understand and manage flood risk within the Borough. Its primary focus is on flooding from surface water, groundwater, or ordinary water courses such as streams and ditches. The LFRMS was developed in a staged approach to allow for a graduated consultation and engagement with those organisations and members of the public who will be affected by a flooding risk.*

- 2.6.6. *The LFRMS follows the vision of the National Strategy which seeks to build a nation of people who understand their (individual) risk to flooding and know their responsibilities and how to act. It seeks to make a more resilient Borough who are ready to respond and continue to work together to better understand, manage and mitigate flood risk across the Borough. The objectives in the Strategy include statutory requirements from legislation, complementary objectives stated in relevant plans and strategies and preferences expressed, or known, within local communities¹⁷.*
- 2.6.7. The Strategy objectives are:
- *“Understand and, where possible, mitigate flood risk across the Borough;*
 - *Build resilience into the Borough, communities, and residents;*
 - *Build resilience into future developments by promoting the best land use and development choices of future development, considering areas at risk of flooding, and ensuring Sustainable Drainage Systems are appropriately designed into developments taking account of relevant technical standards and best practice;*
 - *Work in partnership with other Risk Management Authorities to understand and where possible mitigate flood risk across the catchment; and*
 - *Continue to raise awareness of Flood Risk across the Borough from all sources of flooding including fluvial and surface water”.*

2.7. BEDFORD BOROUGH COUNCIL LOCAL PLAN 2030 (ADOPTED IN JANUARY 2020)

- 2.7.1. The risk of flooding can come from various sources which include rivers (fluvial flooding) overloaded sewers (sewer flooding), rainfall or extreme weather events which can cause ground water flooding (where the water table rises) and surface water flooding (where excess water is unable to soak into the ground or water drainage infrastructure).
- 2.7.2. Local Plan Policy 96⁸ states in considering new development water management and flood risk must be addressed by:
- i. *“Directing development to areas at lowest risk of flooding by applying the sequential test and, where necessary, the exception test, in line with national policy. Development will not be permitted in flood zone 3b unless defined as ‘Water Compatible’ in table 2 of the Planning Practice Guidance. Development will not be permitted in flood zone 3a unless defined as ‘Less Vulnerable’ or ‘Water Compatible’ in table 2 of the Planning Practice Guidance.*
 - ii. *Considering all sources of flooding including fluvial, groundwater, surface water, reservoir overspill, infrastructure/sewer failure. Allowances for climate change must be included in the assessment of flood risk in accordance with latest national guidance.*
 - iii. *Demonstrating that suitable infrastructure capacity is present or can be provided to serve the development.*
 - iv. *Ensuring proposed development assesses and mitigates its impact on flood risk on and off site and includes measures to reduce overall flood risk.*

- *Where the assessment has identified that the proposed development is at flood risk (from any source) it must be demonstrated that the development will be safe for its lifetime through appropriate flood resilient and resistant design and include the provision of safe access and egress to an area of safe refuge.*
- v. *Demonstrating how the cumulative impact of development on flooding to the immediate and surrounding area, and the Natura 2000 sites Portholme (SAC) and the Ouse Washes (SAC/SPA/Ramsar) downstream, has been addressed and reduced through the proposed development.*

Site specific flood risk assessments will need to be submitted in support of development where:

- vi. *Development proposals in flood zone 1 exceed 1ha, in accordance with national policy; or*
- vii. *Development proposals are in flood zones 2, 3a or 3b; or*
- viii. *Evidence exists (e.g. in the Strategic Flood Risk Assessment or areas identified by the Lead Local Flood Authority) of areas with a high risk of flooding or known to be at risk of flooding from other sources, such as surface water.*

Where an increase in built footprint is proposed in undefended flood zone 3a or flood zone 3b, a site-specific flood risk assessment should demonstrate that level-for-level and volume-for-volume floodplain compensation can be provided to ensure there is no increase in flood risk elsewhere.”

2.7.3. Furthermore, Local Plan Policy 97 states “all development proposals must incorporate suitable surface water drainage systems appropriate to the nature of the site. Post-development run off rates should aim to achieve greenfield equivalents. The fact that a site is previously developed and has an existing high run-off rate will not constitute justification. Development proposals will need to demonstrate:

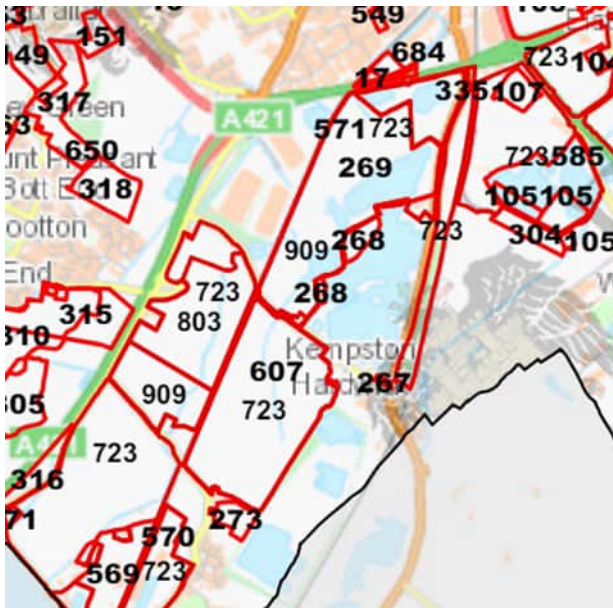
- i. *The discharge location has sufficient capacity to receive the post development flows.*
- ii. *The proposed surface water drainage system has been designed to prevent flooding of internal property and neighbouring for all rainfall events up to the 1% annual exceedance probability event including the appropriate allowance for climate change.*
- iii. *Sufficient treatment stages have been incorporated to adequately remove pollutants and protect the local water environment, following the principles of the latest national guidance.*
- iv. *Provisions for safe conveyance and storage of flood waters should the capacity of the proposed drainage system become exceeded.*
- v. *“Adequate arrangements for the management and maintenance of the proposed drainage system for its lifetime have been provided.*
- vi. *Compliance with national guidance, and that regard has been given to Bedford Borough Council’s SuDS Supplementary Planning Document, and industry best practice.*
- vii. *Opportunities to improve water quality, amenity and biodiversity benefits have been realised.*

Priority should be given to the following order of discharge locations:

- i. *To ground via infiltration techniques;*
- ii. *To an above ground water body;*
- iii. *To a surface water sewer”.*

- 2.7.4. Local Plan Policy 51S states that “*development must not adversely affect the quality, quantity and flow of both ground and surface water. Development should avoid designated Source Protection Zones unless it can be demonstrated that there would be no adverse effect from the proposal*”.
- 2.7.5. “*Proposals involving non-mains drainage will only be considered acceptable where it can be demonstrated that it is not feasible to connect to an existing public sewer and that the proposal would not have a detrimental impact on ground or surface water.*”
- 2.7.6. The majority of the Site has been allocated to development in the local plan across various numbered sites, **Image 2-1** below shows the sites as per the Local Plan numbering.

Image 2-1 - Bedford Local Plan 2030 Site Allocations



2.8. THE SURFACE WATERS PLAN - PLAN FOR STRATEGIC MANAGEMENT OF SURFACE WATERS AND THEIR LOCAL ENVIRONMENT IN THE FOREST OF MARSTON VALE (JUNE 2002)

- 2.8.1. The Surface Waters Plan was developed by the Marston Vale Surface Waters Group (including representatives of Bedfordshire Borough Council, BBC, Mid-Beds District Council, Forest of Marston Vale, the EA and the Bedfordshire and River Ivel IDB) and aims to highlight risks and opportunities, provide guidance to developers and landowners and support local plan policies in relation to surface waters. The executive summary of the document can be found below.
- 2.8.2. “*This Plan describes some of the key challenges and opportunities facing Planning and Land Drainage Authorities, Landowners and Developers, and other parties with interests in management of surface waters and their local environment in the area of the Forest of Marston Vale.*”
- 2.8.3. *The Plan was published on behalf of the Marston Vale Surface Waters Group whose members represent the major Planning and Drainage Authorities with responsibility for rivers, watercourses and other surface waters in the Marston Vale.*

Strategic Surface Water Facilities

- 2.8.4. [...] It is essential to protect and desirable to enhance the existing functions and environmental features of the Elstow Brook and its tributaries. Many of the developments envisaged described above could have an adverse impact on the existing drainage arrangements, increasing run-off and flood risk if appropriate mitigation measures were not taken.
- 2.8.5. Mitigation can be achieved in a number of ways, including (generally in order of preference):
- Source control methods such as soakaways and swales that allow surface run-off to percolate into the ground in the immediate locality of the development.
 - Strategic watercourse improvements and/or balancing ponds/lakes designed to serve large development or collections of smaller developments and that are adopted by a body which is publicly accountable.
 - Balancing tanks or similar flow attenuation facilities forming part of the adopted piped sewerage system.
 - Private, unadopted balancing tanks or ponds serving individual developments. (These are undesirable, for the reasons given on Pages 17 and 18, 5.1 to 5.5, and should generally be avoided).
- 2.8.6. Over much of the Marston Vale, clayey soils persist, and these provide limited scope for source control methods such as soakaways. These methods are generally only suitable where free draining soils with a low ground water table underlie the site, and where there is no risk to water resources. They are best not utilised unless ground conditions are clearly favourable as they are usually left in private ownership and receive little if any maintenance.
- 2.8.7. [...] Increased attenuation of surface water run-off and flood flows can be achieved by on-line enlargement of existing watercourses, combined as necessary with flow controls to limit peak discharges, as has already taken place along parts of the Elstow Brook. Limited enlargement of the watercourses to increase on-line attenuation can be combined with introduction of a wider variety of water conditions and habitats. However, application of this approach is often limited by practical considerations and would not suffice for the development scenarios outlined above.
- 2.8.8. Fortuitously located, existing large excavations can have great potential to provide effective surface water attenuation associated with environmental and recreational facilities, albeit that ecological variety is generally limited to the fringes. The Forest of Marston Vale is 'blessed' with several such existing water bodies and others in the making. These appear to present the most promising opportunities for creation of large-scale surface water facilities to serve future generations in the area.

Flood Plains and Flood Protection

- 2.8.9. Whilst the emphasis of the above is focussed on mitigation of the effects of increased surface water run-off from developments, it is also essential to protect and, if possible, enhance existing flood management systems including flood plains. In general, this will mean avoidance of development within flood plains.²⁰

²⁰ Marston Vale Surface Waters Group (2002) *The Surface Waters Plan*. Available at: <https://www.idbs.org.uk/wp-content/uploads/2024/04/the-surface-waters-plan-appendices-compressed.pdf> [Accessed: 13 August 2024].

3. CLIMATE CHANGE – FOR INFORMATION

3.1.1. EA guidance *Flood risk assessments: climate change allowances* was issued on 19 February 2016 (updated May 2022)²¹ and, forming part of the NPPF² technical guidance, provides up to date information on expected changes in rainfall, river flows and sea level rise as a consequence of climate change.

3.1.2. Climate change allowances for peak river flows and rainfall are based on the lifespan of the development, in this case typically 75 years for a non-residential development, as per PPG Flood Risk and Coastal Change Paragraph 006:

The lifetime of a non-residential development depends on the characteristics of that development but a period of at least 75 years is likely to form a starting point for assessment.

3.1.3. PPG also states:

Where development has an anticipated lifetime significantly beyond 100 years such as some major infrastructure projects, or where it would create significant land-use change such as a new settlement or substantial urban extension, it may be appropriate to consider a longer period for the lifetime of development when assessing the potential impacts of climate change on flood risk or coastal change and considering the future prospects for flood and coastal erosion risk management infrastructure. It may also be a consideration when identifying existing development that may not be sustainable in the long term, and seeking opportunities for relocation.

3.1.4. As a cautious worst case approach when selecting the appropriate climate change allowances the highest available Epoch for Rivers (2080s) and Rainfall (2070s) has been used based on the Environment Agency climate change allowances.

**Use '2050s' for development with a lifetime up to 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.*

3.1.5. Allowances for peak river flows are shown as variable on a regional basis; allowances are also based on percentiles, whereby a percentile is a measure used in statistics to describe the proportion of possible scenarios that fall below an allowance level (e.g. a 50th percentile means that the allowance has a 50% chance of not being exceeded).

3.1.6. On this basis key allowances for peak river flows based on percentiles are:

- Central allowance - based on the 50th percentile;
- Higher central allowance - based on the 70th percentile; and
- Upper end allowance - based on the 90th percentile.

3.1.7. These allowances are detailed in Table 1 (Peak river flow allowances by river basin District) of the EA guidance.

²¹ Environment Agency (2022) *Flood risk assessments: climate change allowances*. Available at: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> [Accessed: 13 August 2024].

- 3.1.8. As stated in the EA guidance *Flood risk assessments: climate change allowances*²¹, the choice of the appropriate allowance for peak river flow (e.g. central or higher central) should reflect the risk for the Proposed Development and therefore is linked to the expected hazard, vulnerability, and resilience of the scheme; recommendations on the appropriate allowances to be considered are provided in the EA Guidance. For this Site, based on the guidance the development proposals (considered More Vulnerable in flood risk terms) should be reviewed against the central allowance for peak river flow and given the development lifespan, the 2080s epoch should be assessed. The river basin for the Site is the Upper and Bedford Ouse Management Catchment.
- 3.1.9. Rainfall allowances are also shown as variable on a regional basis and are based on percentiles in the same way as peak river flow explained above, with a central and upper end allowance.
- 3.1.10. The EA recommends that development with a lifespan beyond 2100, such as the Site, uses the upper allowance for rainfall in the 2070s epoch within the catchment, in this case the Upper and Bedford Ouse Management Catchment.

Table 3-1 - Summary of Climate Change Factors

Flood Criteria	Climate Change Factor
Peak River Flow	19% (central allowance in the Upper and Bedford Ouse Management Catchment for the 2080s epoch)
Peak Run-off	40% for the 2070s epoch (upper end allowance for the Upper and Bedford Ouse Management Catchment)

4. EXISTING SITE – FOR INFORMATION

4.1. SITE LOCATION

- 4.1.1. The Site is located approximately 5km southwest of Bedford town centre. The Site is bound by the A421 to the north, Midland Main Railway Line to the east, Marston Vale Railway Line to the west and Broadmead Road to the south. Manor Road bisects the Site between the Core Zone and the Lake Zone. The OS Grid Reference for the approximate centre of the Site is National Grid Reference 502812, 244795.

4.2. SITE DESCRIPTION

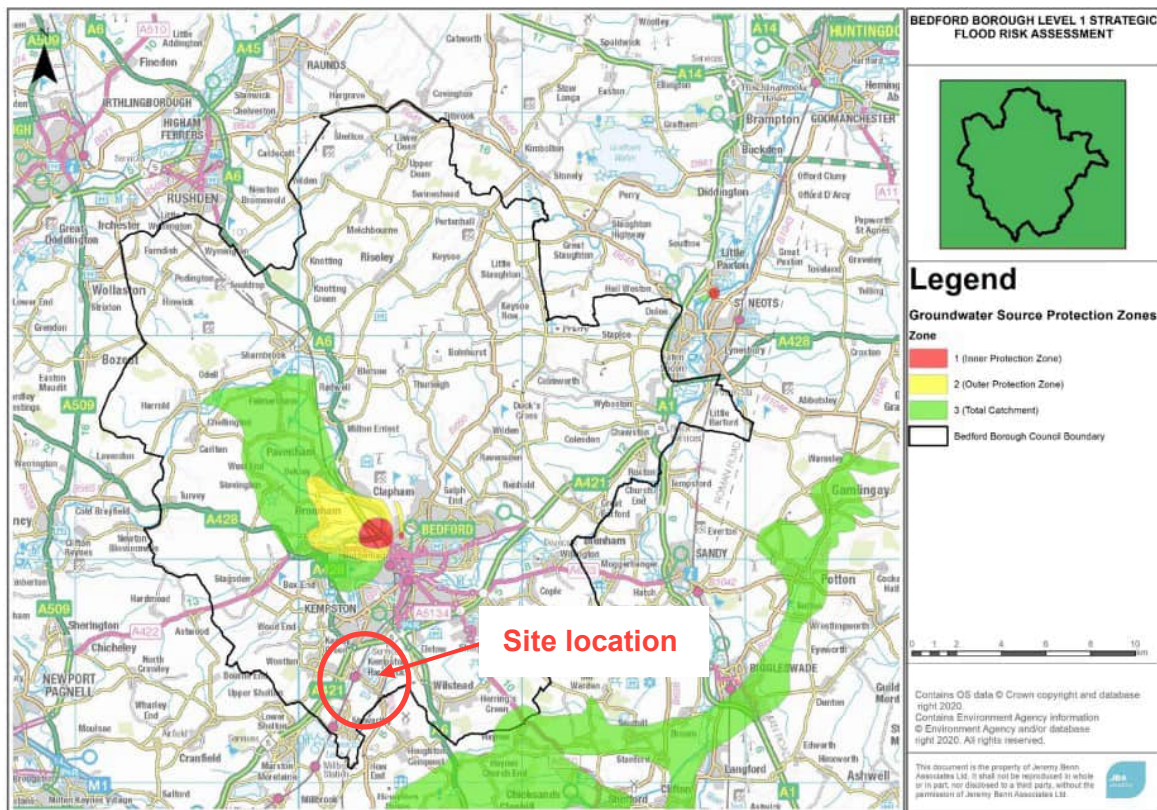
- 4.2.1. The Site comprises a total area of 268.0 hectares (ha), split between a number of Zones and ancillary uses: the Lake Zone (101.2 ha), the Core Zone (96.7 ha), the West Gateway Zone (42.8 ha) and the East Gateway Zone (27.6 ha) as can be seen in **Zonal Plan (Document Reference 1.8.0)**. The Site's existing land use includes areas of grass scrub and arable farmland. The northern area of the Site, within the Lake Zone is partially brownfield land and flooded clay pits, part of the former Kempston Hardwick Brickworks. There are small areas of residential land along Manor Road, Kempston Hardwick Station is also located to the west of Manor Road, and the A421 bounds the western part of the Site. Coronation Business Park is located to the east of the Site on Manor Road, outside of the Site boundary. The Site Location Plan is provided in **Site Location Plan (Document Reference 1.6.0)**.

4.3. GEOLOGY AND HYDROGEOLOGY

- 4.3.1. The BGS online Geology of Britain Viewer⁹ indicates the whole Site is underlain by Peterborough Member (Mudstone). The superficial deposits vary with Head deposits (clay, silt, sand and gravel) present in the West Gateway Zone and some areas of the Core Zone, and alluvium (clay and silt) present adjacent to the existing watercourses.
- 4.3.2. The underlying geology of the Site is described in detail in **Appendix 11.2: Ground Investigation Technical Note (Volume 3)**.
- 4.3.3. The findings from **Appendix 11.2: Ground Investigation Technical Note (Volume 3)** broadly correspond with the published geological mapping.
- 4.3.4. Made Ground was found to vary in thickness between 0.60m and 10.80m across the Site. A greater proven thickness of Made Ground was identified towards the east of the Site. Made Ground was generally found to comprise of brick rubble overlying reworked sandy/silty clay containing various artificial inclusions such as asphalt, clinker, wood, metal, plastic, concrete and suspected asbestos tiles.
- 4.3.5. The Made Ground was underlain by deposits of the Oxford Clay Formation (Peterborough Member) to a proven depth of 14.4m below ground level (bgl). These deposits were recorded as firm to stiff dark grey, thinly laminated silty clays with frequent shells/fragments.
- 4.3.6. An approximately 5.0 to 5.5m thick layer of clay and sand members of the Kellaway's Formation, was encountered beneath the Oxford Clay Formation, prior to encountering an interface of strong grey limestone of the Cornbrash Formation, between 17.25m and 19.55m bgl.
- 4.3.7. **Chapter 12: Water Resources (Volume 1)** describes the groundwater conditions for the Site in detail in Section 12.5: Baseline Conditions.

- 4.3.8. The alluvium superficial deposits underlying the Site are classified as a secondary A aquifer¹⁰. The source of local groundwater recharge to the superficial deposits is predominantly from rainfall and artificial sources, i.e. land drains/ditches and existing Site drainage infiltrating to the ground. The other type of superficial deposit present is head, which is classed as a secondary (undifferentiated) aquifer. The Peterborough Member is classified as an unproductive aquifer²² and the Kellaways Formation (sandy member) and Cornbrash Formation that underlie the Site at depth are classified as secondary A aquifer and principal aquifer, respectively²². A medium groundwater vulnerability is designated for the majority of superficial deposit aquifers at the Site²³. The bedrock aquifers are confined by the overlying Peterborough Member, which provides substantial protection from surface pollution sources because of its low permeability. Therefore, the principal aquifer is considered to have a low groundwater vulnerability.
- 4.3.9. According to the DEFRA's online Magic Map¹⁰ for Groundwater Source Protection Zones, and the SFRA, the Site is not located within a Source Protection Zone, refer to **Image 4-1** below.

Image 4-1 - Bedford Borough Council Level 1 Strategic Flood Risk Assessment - Groundwater Source Protection Zone



4.4. EXISTING WATERCOURSES, FLOOD DEFENCES AND STRUCTURES

- 4.4.1. The existing drainage regime drawing, reference 320-1000-P-CE-000, can be found in **Annex 4**, and a detailed description of the drainage regime can be found below. The description of the

²² DEFRA (2024). *Magic Map Application*. [online] Defra.gov.uk.

²³ Groundsure (2022) *Enviro+Geo Insight Report*.

existing drainage regime is based upon the findings of the topographical survey and Site walkovers undertaken.

EXISTING WATERCOURSES

- 4.4.2. The IDB maintained watercourse, Elstow Brook, flows south-north through the east of the West Gateway Zone, leaving the Site at its northern boundary. It then continues to flow north, crossing Manor Road in a culvert to the west of the Site and then turns east to flow back to the west border of the Site via a culvert under the Marston Vale Railway Line on the western boundary of the Lake Zone. It then flows north directly adjacent to the rail line, before leaving the border of the Site at the northern boundary and continuing north under the road bridge on the A421, flowing to its confluence with the River Great Ouse at Willington approximately 8.6km from the Site.
- 4.4.3. The upstream catchment for the Elstow Brook includes a number of reservoirs, most significantly Brogborough Lake (5.3km southwest of the Site) and Stewartby Lake (1.5km south of the Site).
- 4.4.4. There are two IDB managed tributaries of the Elstow Brook present within the Site. One unnamed tributary flows through the centre of the Core Zone, from southeast-northwest, entering the Site at its southeastern boundary and then flowing north beneath Manor Road in a culvert (thought to be 850mm in diameter) and discharging to the Claypits in the Lake Zone. The other flows west-east along the northern boundary of the West Gateway Zone and discharges to the Elstow Brook within the Site.
- 4.4.5. A further watercourse within the IDB Management District has been identified at the southern end of the East Gateway Zone, flowing east through a culvert under the Sheffield to London St Pancras Midland Main Railway Line. The watercourse then flows south and east, discharging to the Harrowden Brook. The Harrowden Brook has been realigned under the works associated with the Harrowden Green development, this is not reflected on IDB mapping.

WATERBODIES

- 4.4.6. There are a number of disused claypits within the extents of, and in close proximity to, the Site.
- 4.4.7. To the southeast, outside of the Site boundary, is the Coronation Pit (indicated in **Image 4-2** below), which is understood to be filling from surface water discharges from the adjacent Stewartby Park residential development. There is not currently any discharge from this pit, but it is proposed the pit will discharge to the watercourse routing through the Core Zone in the future once peak water levels have been reached. Further details can be found in Section 9.
- 4.4.8. There are two further clay pits to the south of the Lake Zone referred to in **Image 4-2** as Kempston Hardwick Clay Pits (South) and is partially within the Site boundary. It is understood the pit receives surface water flows from the Coronation Business Park and overflows to the west to a former Kempston Brickworks clay pit located in the south of the Lake Zone than is now an artificial lake ('artificial lake'). Based on topographical survey information it is understood the top water level in the Kempston Hardwick Clay Pits (South) is approximately 29.74m Above Ordnance Datum (AOD). The overflow pipe to the artificial lake has been identified on the western edge of the pits at a level of 29.80m AOD.

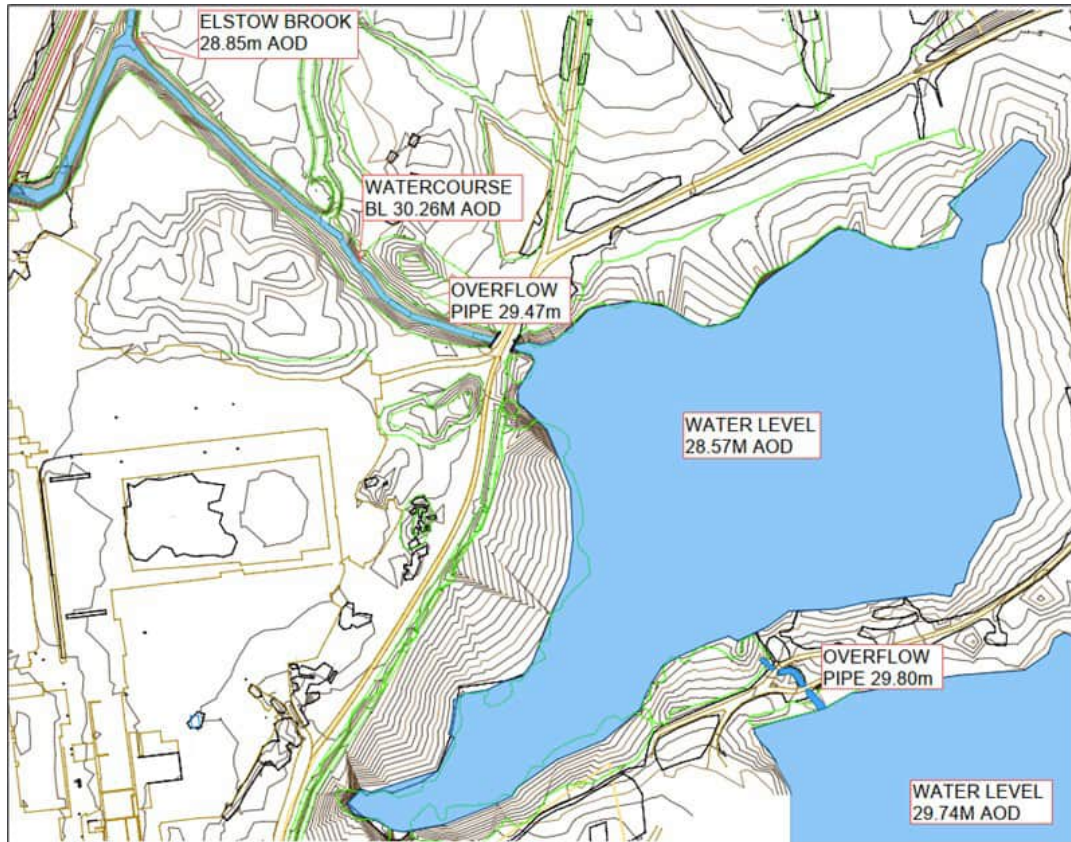
Image 4-2 - Kempston Hardwick Clay Pits (South) Overflow



There are further claypits located in the northwest of the Lake Zone referred to as Kempston Hardwick Clay Pits (North). The westerly of the two pits is identified as an artificial lake and the northerly pit or series of interlinked pits are identified as disused pits in **Image 4-4** , below.

- 4.4.9. The artificial lake in the south of the Lake Zone is understood to receive flows from the watercourse running through the Core Zone and beneath Manor Road as well as the Kempston Hardwick Clay Pits (South) once the level in that pit reaches the overflow pipe. The water level in the artificial lake at time of survey was identified as 28.57m AOD. A further overflow to a watercourse running east-west towards the Elstow Brook from the artificial lake has been identified on its western edge, at an invert level of 29.47m AOD. The overflow watercourse channel levels continue to rise by 0.79m to a high point of 30.26m AOD approximately 80m west of the artificial lake, before then falling by 1.41m across its remaining length toward Elstow Brook (28.85m AOD). This is illustrated in **Image 4-3** below.
- 4.4.10. A high-level greenfield run-off calculation has been undertaken to understand the likelihood of overflow to the exceedance channel from the artificial lake based on the current surveyed water levels, this shows that a storm would have to exceed the 1 in 100-year, six-hour event for overflow to occur, meaning discharge to the Elstow Brook from the artificial lake will only occur in extreme rainfall events - however this could change based on any prolonged periods of antecedent rainfall or accumulation of surface waters overtime. The parameters for this high-level calculation are listed below:
- The artificial lake top water level has an area of approx. 37,500m²;
 - The level difference between the surveyed water level and the exceedance overflow is 0.9m;
 - Therefore, the approximate capacity below the outlet is 33,750m³; and
 - Greenfield run-off volume for the six hour 100-year return period storm for the upstream Core Zone is 33,200m³.
- 4.4.11. No other outfalls from either the Clay Pits South or artificial lake have been identified. Any losses from the artificial lake or Pits are likely due to evaporation, infiltration or historic pumping.

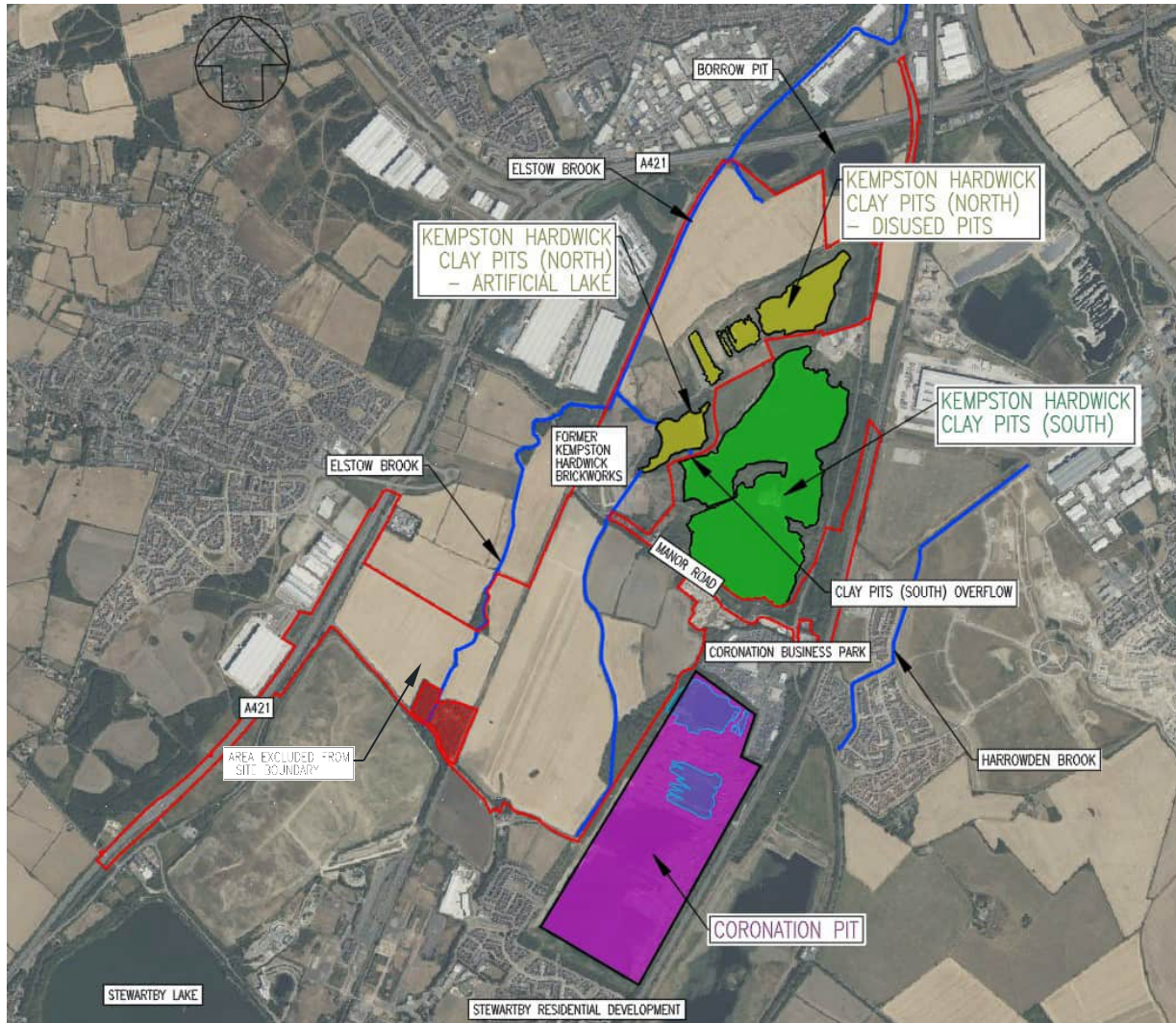
Image 4-3 - Kempston Hardwick Clay Pits (North) Artificial Lake Flow Regime



- 4.4.12. It is understood that the disused pits are filling via an accumulation of direct rainfall and surrounding area overland run-off and do not have a formal discharge or overflow. It is understood they were drained partially in 2018 to the more westerly of the artificial lake via a pump (Bedford Business Park ES, Appendix 10, Delta Simons 2018)¹⁴. The purpose of the draining is not known. The disused pits are split into three distinct terraced features, with the most southerly, and smallest pit, having the highest water level at 23.76m AOD, the middle pit has a water level of 22.42m AOD and the largest and most northerly pit has a water level of 20.38m AOD.

There are a further three waterbodies outside of the Site boundary to the north and west of the Lake Zone. The eastern most of these is a former Borrow Pit for the construction of the new A421 Junction, as indicated in **Image 4-4**, below.

Image 4-4 - Existing Site Waterbodies Flood Defences



- 4.4.13. The EA confirms in correspondence (found in **Annex 3**) that there are no flood defences within the Site or its vicinity. The mapping from the Bedford BC SFRA Level 2⁵ and Flood Maps for planning confirms this.

4.5. EXISTING SEWERS/DRAINAGE

- 4.5.1. AW Asset Records provide information for the public drainage network surrounding the Site. Based on asset information there is a 225mm diameter foul rising main that runs north along the eastern boundary of the Core Zone, following the existing access track and exits the Site to the east just north of Coronation Pit. There are no known records of public surface water sewers located within the Site. Refer to **Annex 2** for the sewer records.

- 4.5.2. There is an existing Land Drainage network within the Lake Zone and the Core Zone (details can be found in Annex 4 of **Appendix 12.3: Drainage Strategy (Volume 3)**). Within the Lake Zone, this consists of a series of clay pipes ranging in size from 75-150mm, conveying flows west to Elstow brook in the western area and east in the eastern area towards the existing ordinary watercourse network routing east. Within the Core Zone the system is confined to the north-west and consists of porous plastic pipes ranging in diameter between 60 and 170mm. From records the majority of the land drainage discharges directly to the IDB watercourse, with approximately 3.2ha towards the centre of the zone discharging west beneath the Marston Vale Railway line towards Elstow Brook. Refer to **Annex 6** for the Land Drainage Records.
- 4.5.3. It is however assumed that there will be a drainage system serving the local road network, rail lines and the existing Kempston Hardwick Station. Consideration for the reuse, diversion or abandonment of this systems will be made in future stages of design when details are known.

4.6. TOPOGRAPHY

- 4.6.1. The Site is relatively flat and generally falls from south-north with ground levels ranging between approximately 35.2m and 21.2m AOD.

CORE ZONE

- 4.6.2. The Zone is bounded by the Marston Vale Railway Line to the west and Broadmead Road to the south. Manor Road runs along the northern boundary and Coronation Pits is located to the east of the Zone. An existing watercourse routes through the Zone from south - north and outfalls under Manor Road.
- 4.6.3. Levels range between 35.2m AOD at the southern end of this Zone, to 32m AOD at the northern end of the Site. Average gradients result in approximately 1 in 460 falling from south - north. Cross falls range between 1 in 40 to 1 in 200 from west to east toward the existing watercourse. The arable mound located in the northern area has a level of 38m AOD at the peak, falling in multiple directions towards local watercourses at 33m and 32m AOD.

LAKE ZONE

- 4.6.4. The Zone is bounded by the Marston Vale Railway Line to the west and Manor Road to the south. The A421 is located to the north, with Ampthill Road and Kempston Hardwick Clay Pits (South) located to the east of the Zone.
- 4.6.5. In the southern area (Kempston Hardwick former brickworks) existing ground levels range between 35m to 32m AOD falling south - north at between 1 in 260 to 1 in 640 average gradient. In the central area existing ground levels range between 32m to 30m AOD falling south -north at between 1 in 120 to 1 in 320 average gradient. In the northern area (arable land) existing ground levels range between 30m to 29m AOD falling south to north at between 1 in 620 to 1 in 3000 average gradient, indicating a very flat part of this Zone.

- 4.6.6. A section of Elstow Brook routes along the western boundary of Lake Zone approximately 1250m length and flows from south - north before discharging through a large culvert beneath the A421. Surveyed top of bank levels range between 32.6m AOD and 28.99m AOD, and bottom of bank levels range between 29.25m AOD and 25.63m AOD. The development side bank slope varies between 1 in 0.6 and 1 in 1.3, and is vegetated. Upon visiting Site during April 2024 and April 2025, the brook appeared well maintained and cleared of vegetation growth, with constant clear shallow running water (less than 500mm depth visually estimated on both occasions).
- 4.6.7. The Kempston Hardwick Clay Pits (North) are artificially made from the former Kempston Hardwick Brickworks (1930s to 1980s). The southern pit has a top of bank level ranging between 35m and 30m AOD and a surveyed water level of 28.57m AOD with a direct outfall to the Elstow Brook via a watercourse. The northern pits comprise of three excavations with top of bank levels ranging between 32m and 25m AOD and surveyed water levels ranging between 23.8m and 20.4m AOD. There is no visible drainage outfall or recorded connection to the wider drainage network. The pits were drained via pumping in 2018, indirectly into the Elstow Brook (via the Lake) and based on surveyed water levels have filled with rainfall and overland runoff from the pits since then.

WEST GATEWAY ZONE

- 4.6.8. The West Gateway Zone is bounded by the A421 to the west and the Marston Vale Railway Line to the east. Broadmead Road runs along the southern boundary. Levels range between 35m AOD at the southern end of the site, to 32m AOD at the northern end of the site. Average gradients result in approximately 1 in 500 falling from south-north.

EAST GATEWAY ZONE

- 4.6.9. The East Gateway Zone is bisected by the Sheffield to London St Pancras Midland Main Railway Line running north-south. To the west of the railway, levels range between 38.6m AOD at the northern boundary, to 33.2m AOD at the southern boundary. Average gradients are approximately 1 in 73 falling from north-south. To the east of the railway, levels fall in multiple directions. Along the western boundary levels are at 35m AOD. At the northwestern corner levels are at 36m AOD. At the central eastern area levels plateau at approximately 35m to 36.6m AOD. Low points are noted at the southwestern corner of 34m AOD and the northwestern corner of 32.3m AOD. Average gradients vary between 1 in 24 to 1 in 60 falling towards to the northeastern corner, and between 1 in 55 to 1 in 140 falling to the southeast.
- 4.6.10. Refer to **Annex 1** for the Topographical Survey.

5. SOURCES OF FLOOD RISK – FOR INFORMATION

5.1. SOURCES AND MECHANISMS OF FLOODING

- 5.1.1. The assessment of flood risk has been undertaken based on a cautious worst case (*“a cautious worst case that provides a robust assessment of likely significant effects”*) based on available information. Reference is made to the most appropriate existing modelled flood information for each scenario. This approach is agreed with the IDB/EA as set out in the SoAP.
- 5.1.2. References to the Bedford BC SFRA Levels 1⁴ and 2⁵, Surface Waters Plan²⁰, LFRMS⁷ and the PFRA⁶ as well as the EA Flood Risk Map for Planning¹² and Long Term Flood Risk maps¹³ are made, where appropriate, in the following sections and relevant maps are included in **Annex 5**.
- 5.1.3. References to correspondence with the AW, IDB, EA and LLFA are made in the following sections, copies of which are included in **Annex 3**. As stated in the EA and IDB SoAP, appended to the **Planning Statement (Document Reference 6.1.0)**, site specific detailed flood modelling will be developed post planning consent to inform detailed design. The output will be submitted to and approved by the EA/IDB under future applications which may include Land Drainage Consent, Permits and an evidence based information review or similar.
- 5.1.4. **Table 5-1** summarises the findings of the assessment. A more detailed explanation of the flood risk issues on-Site and determination of flood risk is presented in this report.

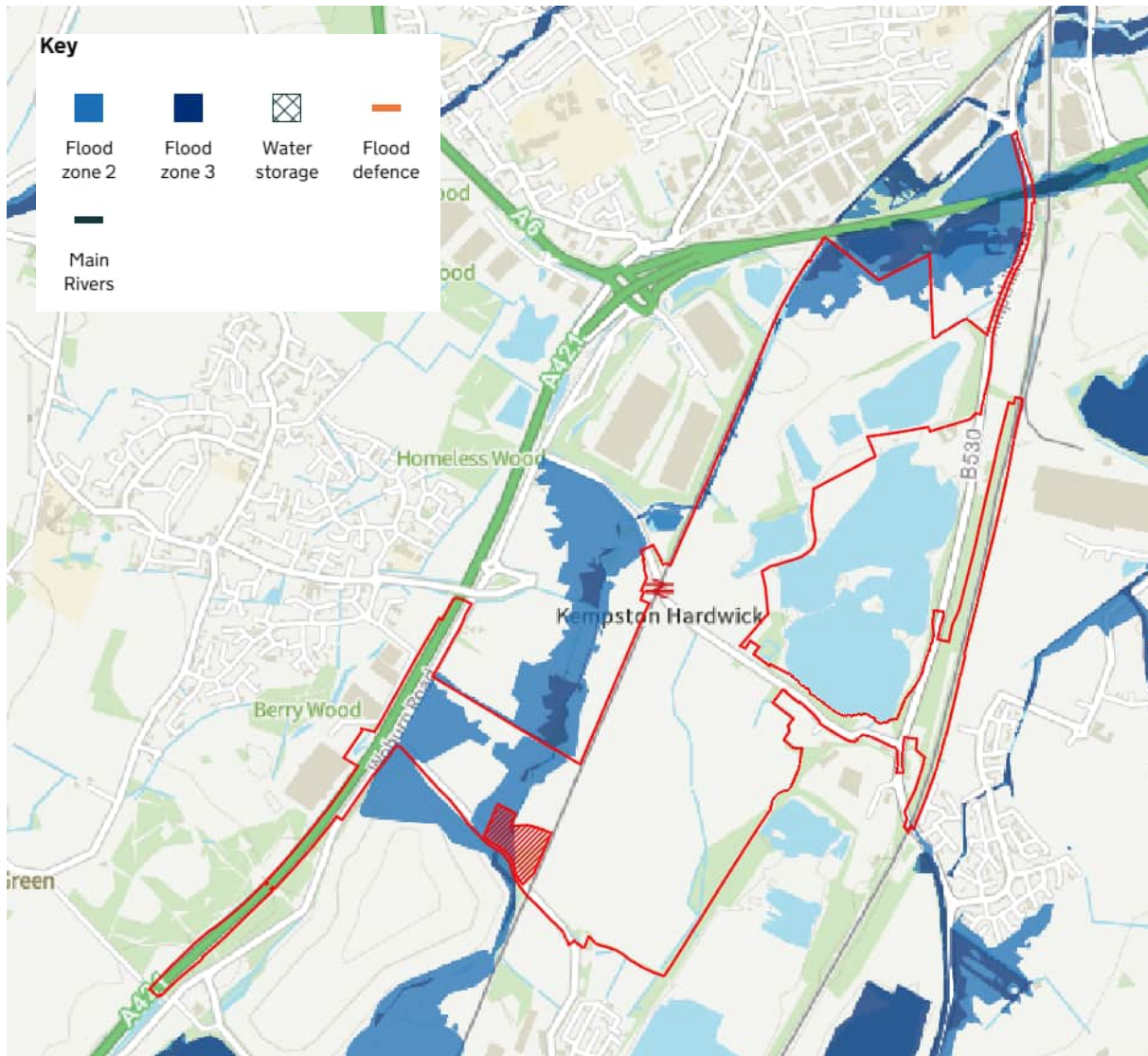
Table 5-1 - Summary of Flood Risks

Source	Risk
Fluvial	Low
Ground Water	Possible
Sewer	Negligible
Surface Water	Low
Other - Reservoir	Possible

5.2. FLUVIAL AND TIDAL FLOODING

- 5.2.1. The Bedford BC Level 1 SFRA (2020)⁴ states the primary fluvial flood risk in the Borough comes from the River Great Ouse and the Elstow Brook and its unnamed tributaries.
- 5.2.2. Based on the online Flood Map for Planning¹², the majority of the Site is located in Flood Zone 1 (low probability), (as show in **5-1**). The Site is located approximately 100km from the sea, therefore all flooding extents indicated within the Flood Map for Planning¹² are considered to be from Fluvial sources only

Image 5-1 - Environment Agency Flood Map for Planning - Flood Zones



- 5.2.3. The Lake Zone has a small area to the northern periphery located in Flood Zone 2 (medium probability) and Flood Zone 3 (high probability), adjacent to the Elstow Brook and A421.
- 5.2.4. The Core Zone and East Gateway Zone are entirely located within Flood Zone 1 and therefore have a low probability of flooding from fluvial sources. The West Gateway Zone has a large area in Flood Zone 2 and a small area within Flood Zone 3 which aligns with the extents of the Elstow Brook.
- 5.2.5. The EA have confirmed their mapping was taken from their 'Mid Great Ouse Flood Mapping Detailed' model, dated August 2011 and this information is superseded by the latest IDB model.

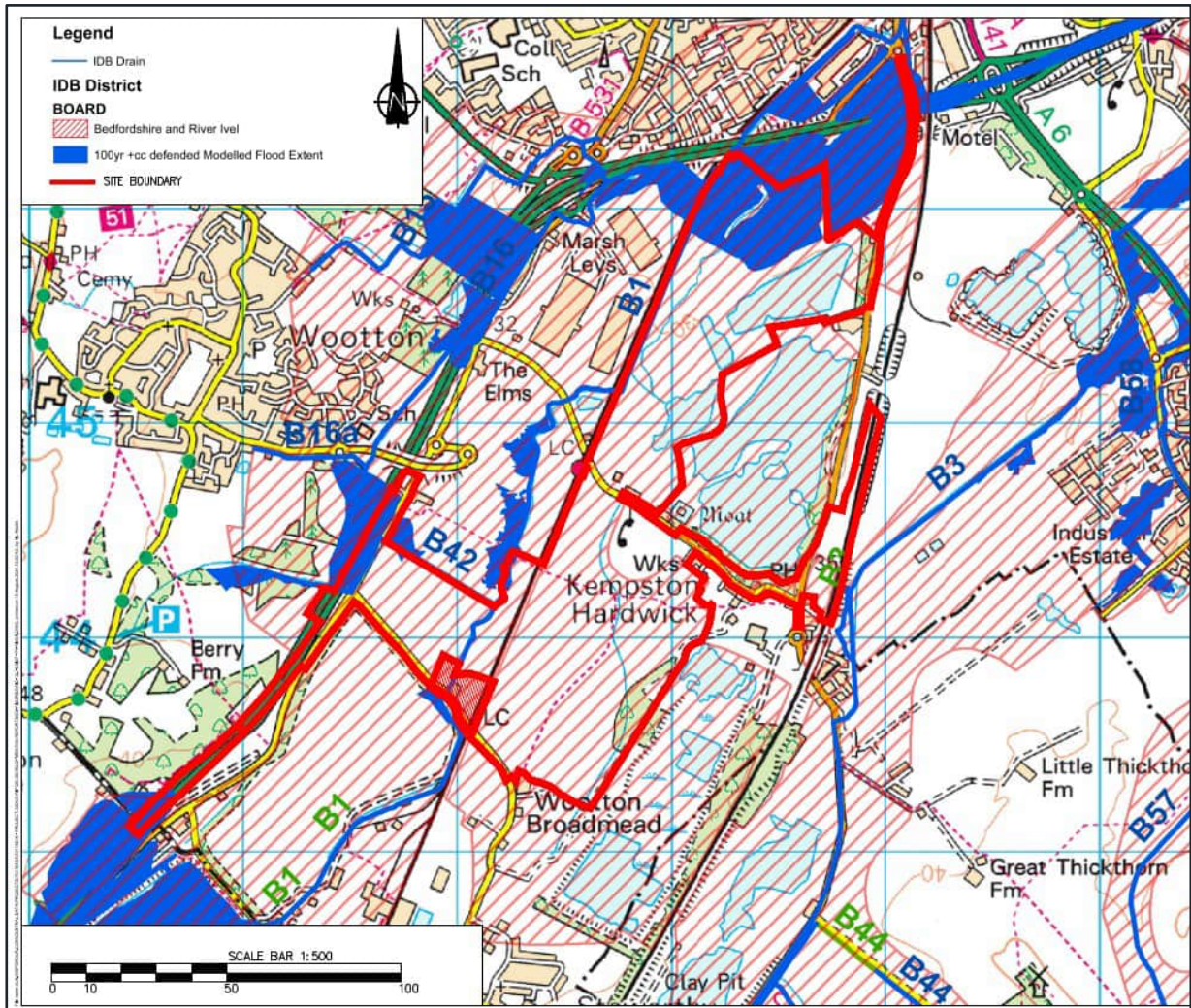
- 5.2.6. The mapping contained with the Bedford BC Level 2 SFRA (2022)⁵ (see **Image 5-2**) is based on EA mapping and adds additional detail, indicating the extents of Flood Zone 3a (up to 1 in 100-year probability flooding extents), Flood Zone 3b (up to 1 in 20-year probability flooding extents - this represents approximately 0.2ha of area within the Site boundary to the north of the Lake Zone, outside of the extents of the Elstow Brook), and an indicative Flood Zone 3b which the report describes as being the entirety of Flood Zone 3 at locations where there are no model outputs for the 1 in 20-year event. The mapping indicates that land within the north of the Lake Zone is located in the indicative Flood Zone 3b.

Image 5-2 - Bedford Borough Council Level 2 SFRA Flood Zone Mapping



- 5.2.7. Detailed mapping from the IDB modelling is shown in **Image 5-3**. This modelling was undertaken by Stantec on behalf of the IDB for the area, to provide a more detailed indication of the fluvial flood risk in their drainage district, the model is understood to have been originally commissioned in 2012 and updated periodically until 2015.

Image 5-3 - Bedford Group of Drainage Boards (IDB) - Flood Extents



- 5.2.8. The IDB modelling shows that the 1 in 100-year probability plus 20% climate change uplift for peak river flow defended Modelled Flood Extent. Flooding within the Site occurs in similar locations to that indicated by the EA's Flood Map for Planning¹² and Bedford BC Level 2 SFRA⁵, with slightly larger flood extents shown in the north of the Lake Zone, and a small area of flooding identified to the north of the West Gateway Zone. The 1 in 100-year probability flood extents can be equated to Flood Zone 3a which is land assessed as having a 1 in 100 or greater annual probability of river flooding.
- 5.2.9. The peak in channel flow figures for the 1 in 100-year plus 20% climate change probability event have been extracted from the model information provided by the IDB/Stantec for the Elstow brook, at the northwestern corner of the Lake Zone, approximate grid reference TL 03235 46176 and are summarised in **Table 5-2** below.

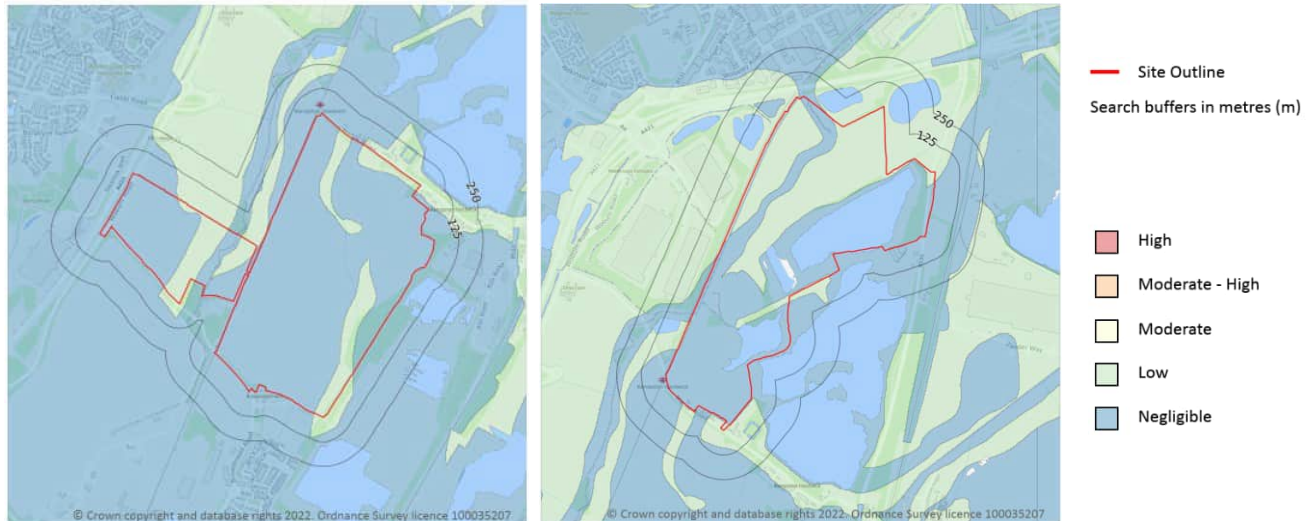
Table 5-2 - IDB Modelled Flood Levels in Elstow Brook

Model Node/Section	Peak Water Level (mAOD)
11000	29.973

- 5.2.10. Based on the available information the majority of the Site is in Flood Zone 1 for both the IDB and EA mapping with isolated areas of flood Zones 2 and 3. The overall risk is therefore classified as Low.

5.3. GROUNDWATER FLOODING

Image 5-4 - Groundsure Groundwater Flooding Probability 1 in 100-year return period event



- 5.3.1. Information commissioned from Groundsure and based on data from Ambient Analytics shows that for the 1 in 100-year return period the risk of groundwater flooding for the Site is negligible to low (see **Image 5-4**). The areas identified as at 'low risk' align with the locations of superficial deposits (around watercourses) identified in BGS mapping and the Ground Investigation found in **Appendix 11.2: Ground Investigation Technical Note (Volume 3)**.
- 5.3.2. Based on a review of the underlying geology, the Site is underlain by primarily a non-aquifer (bedrock) with some scattered superficial deposits of secondary undifferentiated (poor), non-interconnected aquifers, so the capacity for underlying aquifers to cause flooding is considered to be low.
- 5.3.3. As vertical permeability is low through the bedrock, there may however be the potential for the localised emergence of groundwater where there is an accumulation of infiltrating waters within the superficial deposits to the north of the Site and adjacent to watercourse extents, which are not able to escape through the impermeable clay bedrock.
- 5.3.4. As stated previously in Section 4.3, ground and groundwater conditions are described in **Appendix 11.2: Ground Investigation Technical Note (Volume 3)**. Groundwater strikes were generally encountered at depths of approximately 1m to 3m bgl within the superficial Alluvium and Head Deposits. Further long-term groundwater monitoring is to be undertaken at a later stage to confirm conditions as set out in **Appendix 11.4: Outline Land Remediation Strategy (Volume 3)**.
- 5.3.5. The EA 'check your long term flood risk' tool¹³ indicates that postcodes in the area of the Site are not likely to suffer from groundwater flooding.

- 5.3.6. The Bedford BC Level 2 SFRA⁵ map, shows Susceptibility to Groundwater Flooding as provided by the EA AStGWF (areas susceptible to groundwater flooding) data set. The mapping uses a 1km grid and indicates the likely proportion of each grid square that is susceptible to groundwater flood emergence. The Site has varying probability with the highest percentage to the north of the Site at $\geq 75\%$, while the west of West Gateway Zone is the lowest probability of $< 25\%$. The AStGWF dataset is a high level, strategic-scale map showing groundwater flood areas based on a square grid of 1km. It indicates what proportion of each 1km grid square, has geological and hydrogeological conditions that indicate that groundwater might emerge. The likelihood of groundwater flooding occurring is not shown by this dataset. The SFRA Level 2⁵ and engagement with both the LLFA and IDB however do not record any incidents of known groundwater flooding within the proximity of the site.
- 5.3.7. Based on the information available and the assessment undertaken, the probability of groundwater flooding impacting the Site is assessed as Possible.

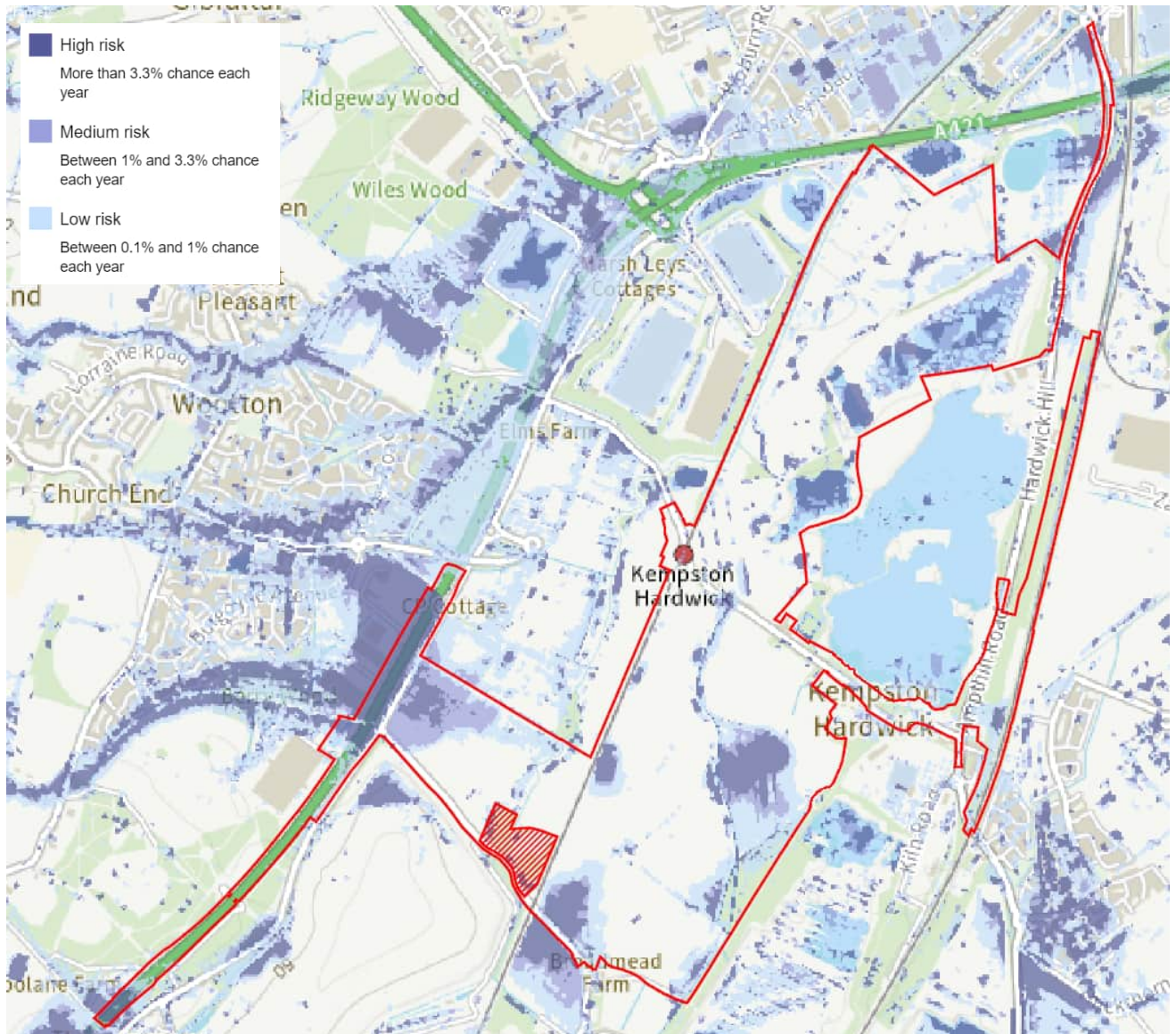
5.4. SEWER FLOODING

- 5.4.1. AW have confirmed in April 2023 (see **Annex 3**) it holds no records of sewer flooding in the vicinity of the Site that can be attributed to capacity limitations in the public sewerage system.
- 5.4.2. Bedford BC highways (see **Annex 3**) have also indicated that they hold no records of historic flooding for the Site.
- 5.4.3. There is also the potential of flooding from the adjacent highway network/private sewer network within the vicinity of the site, but review of available information and the existing topography indicates there is unlikely to be a significant risk to the Site.
- 5.4.4. Based on the information available the probability of sewer flooding impacting the Site can be assessed as negligible.

5.5. SURFACE WATER FLOOD RISK

It is understood that the most relevant flood mapping for surface water is the online EA Long Term Flood Risk map¹³ and the Bedford BC Level 2 SFRA⁵ Mapping, which identify that there is a very low risk of surface water flooding across the majority of the Site. There are various areas of low risk (between a 1 in 100 and 1 in 1000 annual probability) across the Site: notable areas are to the north of the Lake Zone, east and southwest of the Core Zone and west of the West Gateway Zone. Notable areas of medium risk (between a 1 in 30 and 1 in 100 annual probability) are to the north of the Lake Zone and east of the Core Zone. High risk areas (greater than a 1 in 30 annual probability) mainly follow the Elstow Brook and its tributary in the Core Zone, as well as to the south of the East Gateway Zone. Refer to **Image 5-5** for the EA mapping, more detailed description of the risk within each zone can be found below.

Image 5-5 - Environment Agency Map - Surface Water Flooding



- 5.5.1. The Bedford BC Level 2 SFRA⁵ identifies the Kempston Hardwick area as a Surface Water Flooding Hotspot. The area has then been taken forward for catchment-level analysis in Appendix B of the SFRA. The catchment level analysis for both the Elstow Brook and the Harrowden Brook (Figure 3-1 and Figure 3-2 of Appendix B of the SFRA) does not identify any of the historic flooding hotspots as having occurred within, or adjacent to, the Site boundary. These maps can be found in **Annex 5**.

EAST GATEWAY ZONE

- 5.5.2. The area of surface water flood risk for the East Gateway Zone is to the south, in two distinct areas to the east and west of the Sheffield to London St Pancras Midland Main Railway Line, linked by a culvert present beneath the rail line. Both areas have extents at high, medium and low risk. The surface water flood extents appear to be reflective of a scenario prior to the construction of the adjacent Harrowden Green development and the associated diversion of the Harrowden Brook, with flooding in the low area adjacent to the flow path of the brook and partially backing up through the culvert beneath the rail line to the west.

WEST GATEWAY ZONE

- 5.5.3. The West Gateway Zone has some small pockets of low, medium and high surface water flood risk in isolated, unlinked areas which align to low points in the topographic data and also within the channels of the Elstow Brook and west-east tributary. In the low risk return period, a larger area of flooding on the southwest boundary of the Zone can be seen, which appears in part to be related to surface water flooding on the western side of Woburn Road and the A421, which follows the historic route of the watercourse. This does not appear to be reflective of the new development at Bedford Commercial Park which has taken place to the West of the A421 adjacent to the Site.

CORE ZONE

- 5.5.4. The Core Zone has several areas shown to be at risk of surface water flooding; There are two isolated pockets of low, medium and high risk to the west of the Zone, adjacent to the Marston Vale Railway Line, which are ponding and align with low points in the topographic data and are not linked to any flow path. There are a further number of areas at majority low risk adjacent to the existing IDB watercourse, which also align with topographic low points but are thought to be at least partially attributed to the watercourse and are likely to be fluvial flooding from the small local catchment of the watercourse. As stated in the site summary within the SFRA Level 2⁵ the flooding shown on and adjacent to Manor Road in the Core Zone is likely to be exaggerated as the existing culvert is not currently modelled. A further area of majority low risk can be seen to the southwest corner of the Site, a low area of the Site as per topographic data and appears to be at least partially associated with off-Site flows conveying along Broadmead Road, which appear to then discharge off-Site to the Elstow brook to the west.

LAKE ZONE

- 5.5.5. The Lake Zone has a few isolated pockets at risk of surface water flooding, which are ponding and align with low points identified in the topographic data. The areas within the Elstow Brook, associated tributaries and within the Clay Pits are also indicated as at risk. There is a small area in the north-west of the Site adjacent to the Elstow Brook which is at low risk and is associated with flows in the watercourse.

SUMMARY

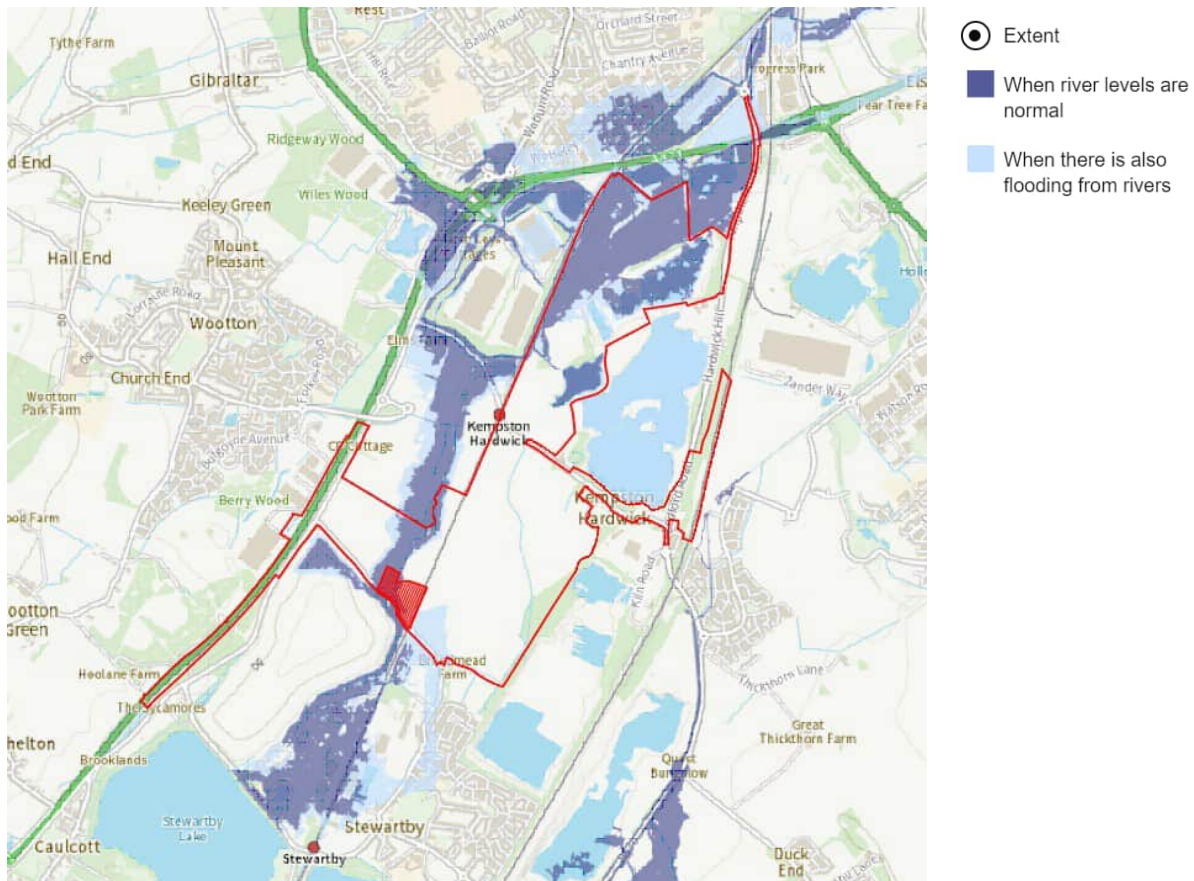
- 5.5.6. Based upon a review of the topographic information it can be seen that the areas at risk of surface water flooding mostly relate to the low points of the Site. However, there are several areas of the Site within the Core, West Gateway and East Gateway Zones that experience surface water flooding from off-Site sources.
- 5.5.7. The majority of the Site is shown to be at very low or low risk of surface water flooding.

- 5.5.8. Based on the available information, the flood risk from surface water is considered to be low for the Site.

5.6. ARTIFICIAL SOURCES OF FLOODING

- 5.6.1. The online Long Term Flood Risk Map¹³ as shown in **Image 5-6** indicates the Site falls within the maximum extent of a reservoir flooding zone.

Image 5-6 - Environment Agency Long Term Flood Risk Map - Reservoir Flooding



- 5.6.2. A large area in the north of the Lake Zone and the West Gateway Zone is within the flood extents of a reservoir failure when river levels are normal. The flooding within the Lake Zone appears to accumulate between the Elstow brook and the existing raised northern bank of the watercourse running northeast to the north of the Hardwick Clay Pits (North) - disused pits. The flows then overtop the bank and flow into the disused pits at low points, accumulating in the pit, flows also continue to flow north and east of the Site towards the A421. Flows are also seen to back up the overflow from the artificial lake and accumulate there without overtopping. The Flooding within the West Gateway Zone is mainly on the western side of the Elstow Brook and around the eastern extent of Broadmead Road.
- 5.6.3. A section to the southwest of the Core Zone is within the flood extents of a reservoir failure where there is also flooding from rivers (noting this takes into account additional flow in the downstream watercourse that represents an extreme flood in the present day).

- 5.6.4. The source of mapped reservoir flooding is the Stewartby Lake reservoir located upstream of the West Gateway Zone, approximately 1.5km southwest of the Site, with flood waters from a reservoir failure flowing along the path of the Elstow Brook and accumulating in low lying areas. In these areas of maximum flooding extent, there is a higher risk of being threatened by an uncontrolled release of water from the Stewartby Lake reservoir. The January 2024 Reservoirs Act Section 12 report (**Annex 8**) for the reservoir notes the lake is adequately maintained and in good condition. The IDB have an on-site emergency flood plan that is in place for the event of failure.
- 5.6.5. The Clay pits present in the Lake Zone are considered artificial water sources, however as these features do not hold water above ground level there is no risk of breach and are therefore not considered a source of flood risk in this context.
- 5.6.6. The reservoir flood mapping indicates the likely affected areas should a reservoir failure occur, but do not indicate the likely risk of reservoir failure in terms of probability and consequence. The EA states that flooding from reservoirs is extremely unlikely, however due to the proximity of the Site to the source of flooding and the possibility of rapid inundation, the risk of flooding from artificial sources is considered to be Possible.

5.7. HISTORIC FLOODING EVENTS

- 5.7.1. As noted in Section 5.4 above, AW do not hold any record of sewer flooding for the Site, the IDB have indicated in their correspondence (**Annex 3**) that they do not hold records of any historic flooding extents and the Bedford BC SFRA Level 2⁵ mapping/Site summary does not indicate any historic flooding in the vicinity of the Site.
- 5.7.2. A flooding incident was recorded in September 2024 approximately 1.8km south-west of the site at the Marston Moretaine junction of the A421²⁴. The junction underpass was submerged with an accumulation of water which needed to be pumped away. Traffic was disrupted for several weeks. The source of flooding relates to one months' worth of rainfall occurring in less than 48 hours, and the pumping station not being adequate to cope with the incoming flows. National Highways cleared the flood water using temporary pumps and the road was re-opened in October. National Highways are replacing and relocating the existing pumping station to higher ground to improve flood prevention and to deal with incoming surface water runoff. The planned works started in February 2025 and are expected to conclude July 2025. Based on the successful implementation of existing Highway improvements there is no further flood risk mitigation required in relation to this incident. Should there further flooding in this area in the future, National Highways will be required to undertake further remedial works as the responsible body to ensure the road remains open and is safe for use.

²⁴ National Highways (2024) Update: A421 in Bedfordshire remains closed in both directions due to significant flooding. Available at: <https://nationalhighways.co.uk/press/update-a421-in-bedfordshire-remains-closed-in-both-directions-due-to-significant-flooding/> [Accessed: 14 May 2025].

6. NPPF SEQUENTIAL AND EXCEPTION TEST

6.1. INTRODUCTION

- 6.1.1. The Proposed Development for which planning permission is described in **Chapter 2: Description of the Proposed Development (Volume 1)** of the Environmental Statement.
- 6.1.2. The assessment of flood risk has been undertaken based on available information, reference is made to the most appropriate existing modelled information for each scenario.

6.2. SEQUENTIAL AND EXCEPTION TESTS

- 6.2.1. The NPPF² aims to steer new development to areas at lowest flood risk through the application of the Sequential Test to avoid, where possible, flood risk to people and property. Only following the application of the Sequential Test should the Exception Test be applied, if necessary, to manage any residual risk.
- 6.2.2. This section summarises the application of the Sequential Test and Exception Test to the Site, considering the assessment presented in the sections above setting out the proposed flood mitigation and management measures.

SEQUENTIAL TEST (FOR INFORMATION)

- 6.2.3. Flood Zones in the vicinity of the Site are fluvially driven and associated with Elstow Brook which flows south-north near the western property boundary of the Site.
- 6.2.4. The EA's Flood Map for Planning¹² (**5-1**) shows that the Site has approximately 26.8ha within Flood Zone 2 and 3, to the north of the Lake Zone and through the West Gateway Zone, representing approximately 11% of the 236.6ha Site. Mapping shown in the Bedford Level 2 SFRA⁵ (**Image 5-2**) provides further detail for the extents of Flood Zone 3a and 3b. Flood Zone 3b is located to the north of the Lake Zone, adjacent to the A421, and is confined to the channel of Elstow Brook. The plan area is approximately 0.22ha within the Site which is less than 0.1% of the total Site area.
- 6.2.5. The IDB have undertaken more up-to-date modelling (**Image 5-3**) for Flood Zone 3 (1% AEP) which is inclusive of climate change (+20% - the central peak river flow allowance for the 2080's) and supersedes the EA flood map, however it does not show Flood Zone 2 or delineation between Flood Zone 3a/3b. Therefore, in addition to the EA modelling, the IDB information has been included for assessing the extents of Flood Zone 3a only.
- 6.2.6. Areas at risk of flooding from surface water have also been identified using the EA Long Term Flood Risk Mapping¹³, with a total area of approximately 68.7ha across the Site, representing 29% of the total Site area. There are various areas of low risk (between a 1 in 100 and 1 in 1000 annual probability) across the Site. Low Risk areas are to the north of the Lake Zone, east and southwest of the Core Zone and west of the West Gateway Zone. Medium Risk areas (between a 1 in 30 and 1 in 100 annual probability) are to the north of the Lake Zone and east of the Core Zone. High risk areas (greater than a 1 in 30 annual probability) mainly follow Elstow Brook and its tributary in the Core Zone, as well as to the south of the West Gateway Zone. The Bedford SFRA Level 1⁴ Appendix C User Guide⁴ defines less than 50% of the Site area as Medium level of concern.
- 6.2.7. Proposed Development within the Site has been allocated following a risk-based approach, steering the most vulnerable development away from areas at the highest risk of flooding based on the flood vulnerability classifications under the NPPF² Annex 3 as described in Section 2, **Table 2-2**.

- 6.2.8. The majority of the Site is within Flood Zone 1, the lowest risk from surface water flooding. Proposed Development has been allocated to these areas as a priority, which includes the theme park in the Core Zone solely within fluvial Flood Zone 1. Proposed Development located in the Lake Zone and West Gateway Zone has been arranged prioritising Flood Zone 1, with only Essential Infrastructure (spine roads), More Vulnerable (mixed use/hotels/camping) and Water Compatible (landscaped space) proposed in Flood Zone 2 and 3. The Zonal Plan has been arranged sequentially and in accordance with Table 2-3, More Vulnerable land use is permitted subject to the Exception Test. Flood Zone definitions can be found above in Section 2, **Table 2-1**;
- 6.2.9. Allocation of the More Vulnerable, mixed use development and Essential Infrastructure roads, was required within the Flood Zones as the areas at lower risk were required for specific land uses accordingly:
- The Core Zone was required for the Theme Park as within the Site, it has the optimal position in relation to transport infrastructure, sitting between the key transport infrastructure links the expanded Wixams Station and the A421;
 - The West Gateway Zone was required for the strategic road infrastructure connecting the Site to the A421;
 - Within the Lake Zone the existing water features, artificial lake and Clay Pits North are being retained and enhanced to act as storm water attenuation, rainwater harvesting and provide ecological mitigation and therefore reduce the area of developable land available;
 - The Ecological Enhancement Area is required to deliver habitat mitigation and has been allocated to the Northern Ecology Area because it is Water Compatible;
 - The Utility Compound location to the south of the Lake Zone was required to ensure proximity to the Theme Park, the artificial lake, and Clay Pits north;
 - Therefore, the mixed use and infrastructure road (which provides the access between Manor Road and the B530) are located within the north of the Lake Zone and were allocated to the remaining developable area;
 - The Proposed Development does not include Highly Vulnerable land uses as classified under the NPPF²; and
 - Because it is not possible to wholly locate the Proposed Development within Flood Zone 1, the Sequential Test requires comparison of reasonably available sites appropriate for the Proposed Development which could be at a lower risk of flooding, which is provided below.
- 6.2.10. Consideration has been given to the location of the Site and alternative reasonable available sites appropriate for the Proposed Development that may have a lower risk of flooding. The Proposed Development includes a theme park, car parking, retail, dining, entertainment, visitor accommodation, conference facilities, Ecological Enhancement Areas, transport and rail infrastructure.
- 6.2.11. A comprehensive site selection process began in 2022 to establish whether there were any reasonably available sites appropriate for the Proposed Development. Based on that selection process, three sites were considered:
- The Swanscombe Peninsula Site in Kent, previously considered for the 'London Resort' development;

- The Newport Road Site, east of Milton Keynes; and
- The Kempston Hardwick Site (i.e. the Site subject to this Planning Proposal).

- 6.2.12. The Swanscombe Peninsula Site was previously given consideration for the development of a major theme park (known as the London Resort). That developer submitted a Development consent Order (DCO) application in 2020. The application was withdrawn in 2022 following Natural England's intention to have the site designated as a Site of Special Scientific Interest. This site also included approximately 51% plan area of Flood Zone 2 and 3, which is comparably worse than the Site selected for the Proposed Development (11%).
- 6.2.13. The Newport Road Site is located to the east of Milton Keynes, close to Junction 14 of the M1 and is located within a strategic city extension in the *draft Milton Keynes (MK) City Plan 2050*²⁵, proposed to deliver 16,000 new homes and 40ha of employment land, designed around a new public-transit network. Commercially reasonable terms could not be agreed for this site during the site selection process and in any event, at the date of submission of this Planning Proposal the site is proposed for alternative mixed-use development, in accordance with the policies of the *draft MK City Plan 2050*²⁵. Therefore this site is not available.
- 6.2.14. Based on the selection criteria and process described above, there are no reasonably available sites with a lower flood risk compared to the Kempston Hardwick Site.
- 6.2.15. The Sequential Test has been applied to steer the Proposed Development to areas at lowest flood risk whilst taking other considerations into account. Within the Site, the Proposed Development has also been steered to areas at lowest flood risk and takes the vulnerability of each aspect of the Proposed Development into account.
- 6.2.16. More Vulnerable land use development (mixed use/hotels/camping) and Essential Infrastructure (spine roads) is permitted in Flood Zone 3a based on Table 2-3 Flood Risk Vulnerability and Flood Zone 'incompatibility'. For More Vulnerable land use the Exception Test is required as discussed in the following section.

EXCEPTION TEST

- 6.2.17. Table 2 of the NPPF² and PPG Flood Risk and Coastal Change³ shows flood risk vulnerability and flood zone 'incompatibility' and is reproduced in **Table 2-3** within this appendix. The proposed location of More Vulnerable development (mixed use/hotels/camping) and Essential Infrastructure (spine roads) in Flood Zone 3a requires the Exception Test to be applied. The Proposed Development does not include any components classified as Highly Vulnerable, and only Water Compatible Development is proposed within Flood Zone 3b as mapped in the Bedford Level 2 SFRA⁵.
- 6.2.18. To pass the Exception Test it will be demonstrated that:
- *"the development would provide wider sustainability benefits to the community that outweigh flood risk; and,*
 - *the development will be safe for its lifetime taking account of the vulnerability of users without increasing flood risk elsewhere, and where possible reducing flood risk overall".³*

²⁵ Milton Keynes Council (2024) *Draft Milton Keynes City Plan 2050*. Available at: <https://placemaker.miltonkeynes.urbanintelligence.co.uk/p/document/21> [Accessed: 13 August 2024].

PART 1: SUSTAINABILITY BENEFITS

- 6.2.19. The Proposed Development provides a range of wider sustainability benefits to the community that outweigh flood risk. The purpose of the Proposed Development is to provide a nationally significant entertainment resort complex.
- 6.2.20. The Proposed Development includes regeneration of the brownfield site to the north of Manor Road, the former Kempston Hardwick Brick Works, a large area of concrete hardstanding and existing clay pits. The northern clay pits are to be remediated as part of the proposed drainage strategy and provide multi-functional Sustainable Drainage Systems (SuDS) features. The disused clay pits and the watercourse through the Core Zone will consider ecological requirements including; variable bank slope treatment, dry/wet benches, enhanced planting and landscaping proposals, terrestrial habitat creation and a geomorphology and ecology driven enhanced watercourse channel (with linear top of banks) incorporating a meandering low flow channel within the main channel bed.
- 6.2.21. The proposed drainage strategy for the Proposed Development, **Appendix 12.3: Drainage Strategy (Volume 3)**, includes capture and attenuation of surface water run-off from rainfall over the development area with a release of run-off rates at a maximum controlled rate of the QBAR greenfield run-off rate. This will reduce surface water discharge rates from the Site for return periods greater than QBAR (approximately 1:2-year return period) and reduce potential flood risk downstream associated with the Elstow Brook and downstream networks. Strategic rainwater harvesting is proposed, primarily to meet non-domestic demand (e.g., irrigation, wash down, thematic water features, and water closet flushing, etc.) for the Proposed Development. This provides increased resilience to a water stressed area, by relying less on Anglian Water's domestic potable water supply and utilising rainwater and surface water runoff for re-use.
- 6.2.22. The wider sustainability benefits to the local community are summarised in the Proposed Development **Planning Statement (Document 6.1.0)**, an extract is as follows:
- 1.1 *"The Proposed Development would deliver transformative benefits to the local area and region. This includes the creation of 8,065 direct jobs in the first year of operation, 81% of which are anticipated to be taken by local²⁶ people, with an anticipated 1.5 additional jobs created through the supply chain for every direct job created, and growing over time, with up to 12,475 people employed by 2051. In addition, the Proposed Development would support 5,380 construction jobs at its peak, with continuing construction workforce requirements for the foreseeable future. **Appendix 6 to this Planning Statement (Socio-economic benefits)** anticipates that the Proposed Development could provide an overall contribution of £35 billion net additional GVA (NPV) to the UK economy over a 30-year appraisal period (comprising construction and the first 25-years of operation) which would inject substantial additional spending into Bedford and the surrounding area's economy, together with a significant boost to the tourism industry of Bedford, the region and the UK as a whole.*
- a. *the Proposed Development unlocks key strategic transport infrastructure to enable the delivery of the objectives of the Bedford Local Plan 2040. The draft Local Plan had stalled in*

²⁶ Living within Bedford Borough Council area, Central Bedfordshire, Luton and Milton Keynes

examination, with an outstanding objection from National Highways that the scale of growth identified by Bedford to meet objectively assessed housing and employment needs could not be met without significant investment in the strategic highway network and public transport infrastructure. In addition, Wixams Railway Station was granted planning permission in March 2024, with a commitment by Network Rail and Bedford BC deliver a two-platform station. Construction has commenced with first trains anticipated to enter into service in the second half of 2026.

PART 2: FLOOD RISK MANAGEMENT

- 6.2.23. The Proposed Development is located partially within Flood Zones 2 and 3 and in areas at low, medium and high risk of surface water flooding.
- 6.2.24. Section 7 of this FRA summarises the proposed mitigation and management measures that are embedded into the surface water strategy as described in **Appendix 12.3: Drainage Strategy (Volume 3)**. Only Water Compatible development which comprises of the Ecological Enhance Area in the north of Lake Zone is proposed within Flood Zone 3b, as identified in the Bedford BC Level 2 SFRA flood mapping⁵.
- 6.2.25. Where development is proposed within Flood Zone 3a, in the north of the Lake Zone, ground levels will be set at least 30.60m AOD (+600mm above the modelled fluvial flood risk level in Elstow Brook of 29.973mAOD, from the IDB Hec-Ras model), to provide protection against fluvial flood risk. To not increase the flood risk both within the Site and elsewhere off-site, existing ground levels in the Northern Ecology Area are proposed to be lowered approximately 300mm over a 6.2ha plan area within the Lake Zone at the northern boundary of the Site (see Section 8 for further details).
- 6.2.26. To ensure that a viable means of egress is provided from the Site during a flood incident, road levels are proposed to be set at a minimum of 600mm above the maximum anticipated flood levels for surface water and fluvial sources in the 1 in 100-year event plus climate change and above the maximum 1 in 1000-year event modelled flood levels. These routes will not impede surface water flow through the Site, as appropriately sized bridges or culverts will be installed where necessary to maintain continuity of flow.
- 6.2.27. The proposed surface water drainage strategy incorporating source control SuDS, as described in **Appendix 12.3: Drainage Strategy (Volume 3)**, ensures that surface water flows arising from the Site will be captured and attenuated for all storm events up to and including the 1 in 100-year storm plus 40% climate change.
- 6.2.28. For areas at risk from surface water flooding originating from off-site, located to the southwest of Core Zone and the western boundary of the West Gateway Zone, proposed ground levels will be engineered to ensure that existing flows are directed to proposed SuDS and existing watercourses within the Site boundary and do not increase flood risk off-site.
- 6.2.29. Section 8 of this FRA demonstrates that the Proposed Development will not increase flood risk to third parties, when compared to the baseline scenario, both for the present day and in the future when climate change is considered.
- 6.2.30. Based on the above, the Proposed Development satisfies both parts of the Exception Test.

7. FLOOD RISK MITIGATION MEASURES

7.1. OVERVIEW

- 7.1.1. This section of the report details the flood risk mitigation measures required to manage the identified risk of flooding from different sources. The development will be allocated on a sequential basis against flood risk, with the most vulnerable land uses allocated to the areas at the lowest risk of flooding from all sources.

7.2. SITE LEVELS

- 7.2.1. Finished Site levels will be designed to provide positive drainage, prevent ponding, and channel flows away from the Proposed Development during exceedance events. The accumulation of standing water would therefore not occur and thus not pose a risk to the development.

7.3. SAFE ACCESS AND EGRESS

- 7.3.1. To ensure that a viable means of egress is provided from the Site during a flood incident, road levels are proposed to be set at a minimum of 600mm above the maximum anticipated flood levels for surface water and fluvial sources in the 1 in 100-year probability event plus climate change and above the maximum 1 in 1,000-year modelled flood level within each Zone. These routes will not impede surface water flow through the Site, as appropriately sized bridges or culverts will be installed where necessary to maintain continuity of flow.
- 7.3.2. For the West Gateway Zone in a flood scenario, access and egress will be possible to the east through the Core Zone and along Manor Road. For the Core Zone in a flood scenario, access/egress will be north towards Manor Road and for the Lake Zone south to Manor Road or North to Amphill Road. For the East Gateway Zone safe access and egress can be made via Amphill Road.

7.4. FLUVIAL FLOOD RISK

- 7.4.1. The Site has been identified as being at risk from fluvial flooding with Flood Zones 2 and 3 present within the Site boundary from the EA flood mapping. More recent flood modelling undertaken by the IDB (dated 2017, and the most recent modelling available) shows the 1 in 100-year plus climate change extents for fluvial flooding (equivalent to Flood Zone 3a). As per modelling notes provided, this was last revised in 2015.
- 7.4.2. Based on information currently available, the development will be allocated on a sequential basis against the modelling that has been undertaken, with the most vulnerable land uses allocated to the areas at lowest risk of flooding. Areas identified as Flood Zone 3b from the SFRA (functional flood plain) are to be developed as a landscaped Ecological Enhancement Area only which will not affect the flood plain or create any increase flood risk.
- 7.4.3. As stated in **Section 6**, the land uses will be allocated sequentially in accordance with the Zonal Plan, with the Most Vulnerable development steered towards the areas at the lowest risk of flooding, in line with **Table 2-3** Flood Risk Vulnerability and Flood Zone 'incompatibility'. Land uses for the development are as described in **Section 2.2**, with the following land uses proposed in each Flood Zone. No Highly Vulnerable land uses are proposed;

- Within Flood Zone 1; All Land Use are permitted including Essential Infrastructure, Water Compatible Development, More Vulnerable and Less Vulnerable.
- Within Flood Zone 2; Land Use permitted includes Essential Infrastructure, Water Compatible Development, More Vulnerable and Less Vulnerable (no Highly Vulnerable proposed).
- Within Flood Zone 3a; Land Use permitted includes Water Compatible Development and Less Vulnerable. Essential Infrastructure and More Vulnerable development as permitted in accordance with the Exception Test shown in Section 6.
- Within Flood Zone 3b; only Water Compatible Development will be allocated, which aligns with the Ecological Enhancement Area located toward the norther part of Lake Zone, as shown on the Zonal Plan.

7.4.4. Where development is proposed within Flood Zone 3a, to the north of the Lake Zone, ground levels will be raised and any floor levels will need to be set at a sufficient height above the peak flood levels to give protection. Public Road B, proposed within the Lake Zone is to be set 600mm above maximum flood levels within the Site boundary to ensure safe access and egress north to Ampthill Road or south to Manor Road. Raising ground levels within an area of Flood Zone 3a will require flood compensation elsewhere within the Site, to ensure there is not an increased risk of flooding off-Site.

7.4.5. This compensation is to be undertaken within the Northern Ecology Area of the Lake Zone, to the north of the proposed road, on a level for level basis, re-profiling the ground to provide storage for flood water volumes up to and including the 1 in 100-year plus climate change event. Based on a high-level analysis the volume to be mitigated is approximately 60,000m³, providing this within the extents identified would result in a required storage depth of approximately 300mm, which can be accommodated on-Site. The flood mapping shows that flood waters continue to flow to the north and east of the Site, levels will be engineered to ensure that these flows are not impeded.

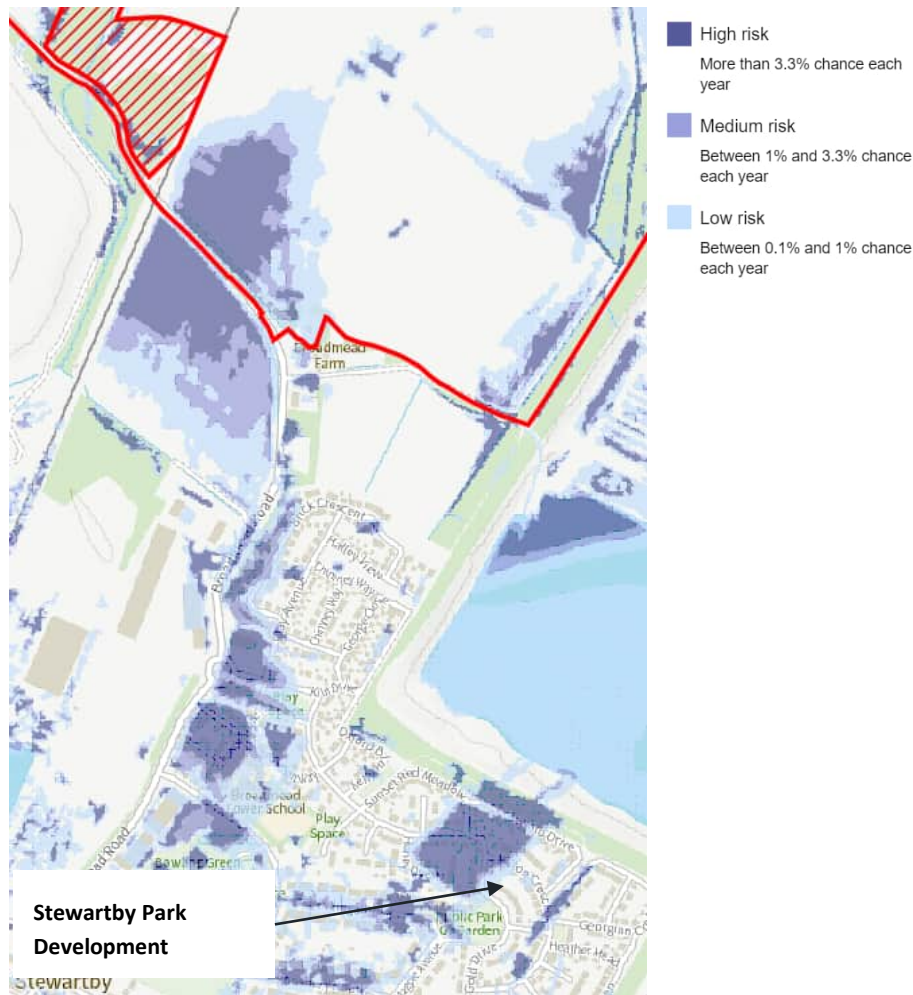
7.4.6. Site specific detailed fluvial flood modelling will be developed post planning consent to inform the detailed design stage. The outputs from the flood modelling will be submitted to and approved by the EA/IDB.

7.5. SURFACE WATER FLOOD RISK

7.5.1. As discussed in Section 5, the Site has been identified as having a potential risk for surface water flooding in isolated areas. Any potential risk linked to surface water run-off generated on-Site is limited through design, with attenuation provided to cater for the 1:100-year + 40% climate change event, as described in **Appendix 12.3: Drainage Strategy (Volume 3)**. Any works required to stabilise existing slopes around the Clay Pits will be designed and implemented to ensure they do not increase flood risk on or off site. Where surface water flooding is shown originating from off-Site sources, sufficient storage to match existing Site capacity (and conveyance to storage with appropriate designed falls/levels) will be provided to reduce increased off-Site flood risk. The areas of flood risk identified as being associated with off-Site flows are detailed below.

CORE ZONE

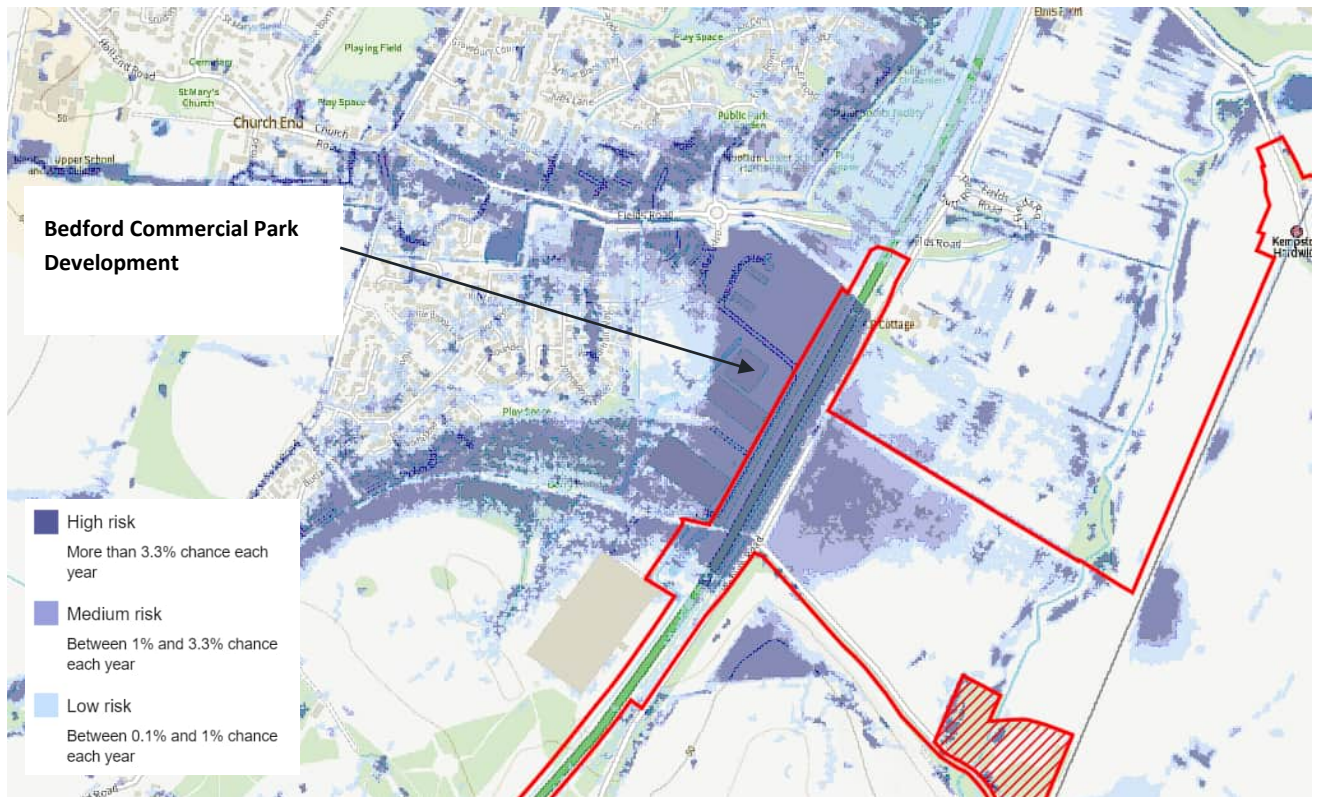
Image 7-1 - Surface Water Flood Risk - Core Zone



- 7.5.2. Maximum flood levels in this area for the 'medium' flood risk (up to 1 in 100-year return period event) are approximately 33.8m AOD and the maximum level for the 'low' flood risk (up to the 1 in 1,000-year event) are approximately 34.1m AOD. As can be seen in **Image 7-1** above, the flood risk map for Surface Water from the EA (the most up to date information available as of May 2025) does not appear to be reflective of the current baseline conditions and does not reflect the developed nature of the Stewartby Park development and the Stewartby Business Park. As explained in Section 5, the flow path seems to be associated with conveyance along the Broadmead road of flows from the catchment to the south including the two developments mentioned. The flows then accumulate in the existing fields north and south of the road where there is a low point in the field boundaries. Levels for the Proposed Development will be engineered such that exceedance surface water flows from off-Site will be directed south, towards the Core Zone relocated watercourse along the east side of the Core Zone and conveyed through the proposed surface water drainage network. The levels strategy will make sure that on-Site storage potential is retained, and flooding is not exacerbated off-site.

WEST GATEWAY ZONE

Image 7-2 - Surface Water Flood Risk - West Gateway Zone



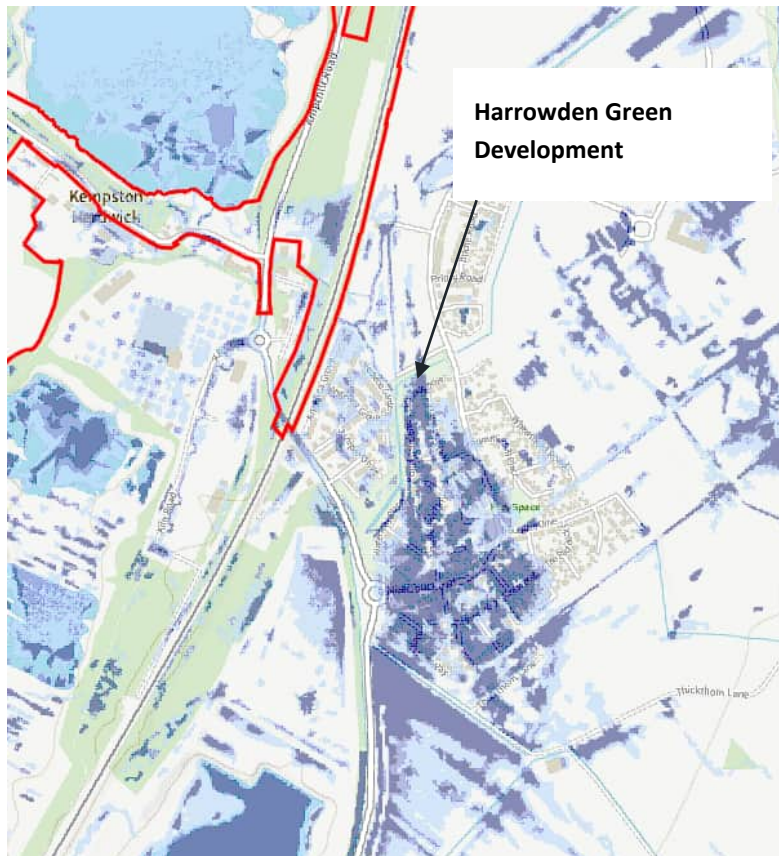
- 7.5.3. The medium and high levels of surface water flood risk in the West Gateway Zone originate from on-Site flows, whilst the low risk appears to be associated both with an accumulation of on-Site flows within a Site low point and an off-Site flow path originating from the southeast which flows through the south of Wooton, routing across the A421 and Woburn Road, accumulating in the West Gateway Zone from a low point in the field boundary adjacent to Woburn Road. Maximum flood levels in this area for the 'low' flood risk (up to the 1 in 1,000-year event) are approximately 33.7m AOD. Levels for the Proposed Development will be engineered such that exceedance surface water flows from off-Site will be directed east and north, towards the proposed road attenuation and the watercourse along the northern boundary of the West Gateway Zone. The grade separated merge/the levels strategy will make sure that on-Site storage potential is retained, and flooding is not exacerbated off-site. As can be seen in **Image 7-2** above, the flood risk map for surface water from the EA does not appear to be reflective of the current baseline conditions, including the new development at Bedford Commercial Park which has taken place to the west of the A421 adjacent to the Site.

EAST GATEWAY ZONE

- 7.5.4. Maximum flood levels in this area for the 'medium' flood risk (up to 1 in 100-year return period event) are approximately 34.5m AOD and the maximum level for the 'low' flood risk (up to the 1 in 1,000-year event) are approximately 34.2m AOD. As can be seen in **Image 7-3** below, the flood risk map for Surface Water from the EA does not appear to be reflective of the current baseline conditions and does not show the diverted route of the Harrowden Brook. Nor is it reflective of the surface water strategy/engineered levels of the adjacent, recently constructed Harrowden Green development, which lies directly to the east and south east of the East Gateway Zone. Existing

surface water flooding extents within the East Gateway Zone appear to be associated both with an accumulation of on-Site flows within the Site low points and the Harrowden Brook flooding and backing up through the culvert beneath the rail line.

Image 7-3 - Surface Water Flood Risk - East Gateway Zone



LAKE ZONE

- 7.5.5. As explained in Section 5, the Lake Zone does not appear to be at risk of surface water flooding from off-Site sources, small pockets of flooding associated with the extents of the Elstow Brook will be mitigated by a suitability designed levels strategy and the surface water strategy described in **Appendix 12.3: Drainage Strategy (Volume 3)**.
- 7.5.6. Where development is allocated to areas identified at being at risk of surface water flooding from off-Site sources ground levels will be raised, and any floor levels will be set at least 600mm above the peak surface water flood levels to give protection. Post-planning and additional flood modelling, when more certainty around peak flood levels is possible, this could be reduced to 300mm above peak surface water flood levels in line with EA standing advice¹ Raising ground levels within the floodable area will require flood compensation elsewhere within the Site, to ensure there is not an increased risk of flooding off-site.
- 7.5.7. Site specific detailed flood modelling for surface water will be developed post planning consent to inform the detailed design stage. The outputs from the flood modelling will be submitted to and approved by the EA/IDB.

7.6. GROUNDWATER FLOOD RISK

- 7.6.1. The risk of groundwater flooding for the Site is described in Section 5, with the potential for direct groundwater flooding from aquifers considered to be low due to the unproductive nature of the soils. There is however potential for localised groundwater emergence from an accumulation of surface water in shallow superficial soils that become perched above impermeable bedrock. The development proposals in combination with the implementation of the surface water strategy described in **Appendix 12.3: Drainage Strategy (Volume 3)** will ensure that surface waters on-Site are intercepted and attenuated prior to discharge to receiving watercourses, therefore mitigating the localised risk of an accumulation of surface waters. At times of extreme and prolonged rainfall a residual risk may remain for landscaped areas where there is the potential for infiltration, and flooding will be contained to these areas by the levels strategy and ensure that vulnerable areas are not impacted.

7.7. ARTIFICIAL FLOOD RISK

- 7.7.1. As detailed in Section 5, there are significant areas of the Lake Zone and West Gateway Zone that are identified as being at risk of reservoir flooding from Stewartby Lake in both the scenarios where river levels are normal, or there is river flooding too. A small area to the southwest of the Core Zone is at risk when rivers are flooded only.
- 7.7.2. Where levels are to be raised in the Lake Zone and compensation is provided for the fluvial flood zone, the extents of reservoir flooding from these areas will be diverted to the Lake Zone Attenuation feature via a culvert at the eastern end of the boundary road, the flow path directing flows away from the Site to the northeast will also be maintained to allow the migration of flows and not exacerbate risk off-Site.

8. OFF-SITE EFFECTS

8.1. SURFACE WATER FLOODING

- 8.1.1. As outlined in Section 7.6, where the EA Long Term Flood Risk Mapping¹³ shows surface water flooding originating from off-site, levels will be engineered to direct flows towards SuDS features and watercourses, retaining the natural storage volume of the land and ensuring that levels do not direct exceedance flows off-site.
- 8.1.2. **Appendix 12.3: Drainage Strategy (Volume 3)** demonstrates that the drainage network at the Site is designed to accommodate run-off during the critical storm event (including climate change) and will discharge at the greenfield rate, therefore preventing potential exceedance flows off-Site.

8.2. FLUVIAL EFFECTS

- 8.2.1. As described in Section 6, land use is being applied on a sequential basis, allocating the most sensitive land uses to areas at lowest risk of flooding. Flood compensation is to be provided for the loss of flood Zone 3 within the Site boundary on a level for level basis and therefore no off-Site flooding will be exacerbated.

9. RESIDUAL FLOOD RISK – FOR INFORMATION

- 9.1.1. The risk of flooding from the Proposed Development is considered as low and as discussed in the previous sections, the proposed design solutions detailed in **Appendix 12.3: Drainage Strategy (Volume 3)** and Section 7.6 minimise any residual risk linked to potential extreme rainfall events.
- 9.1.2. The Site's external levels will remain elevated compared to the surrounding roads to reduce risk of surface water flow paths in the surrounding roads entering the site.
- 9.1.3. **Appendix 12.3: Drainage Strategy (Volume 3)** demonstrates that the drainage network at the Site is designed to accommodate run-off during all events up to and including the 100-year plus 40% climate change scenario, preventing potential exceedance flows off-Site. Drainage exceedance routes have also been considered and allowed for as part of the development of parameters to make sure that any surface water run-off exceeding the drainage network capacity would naturally flow away.
- 9.1.4. In accordance with best practice all buildings within the development will have raised thresholds above the external levels, to help mitigate against surface water flooding.

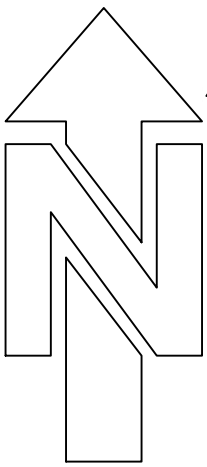
10. CONCLUSIONS – FOR INFORMATION

- 10.1.1. This FRA has been prepared in support of the planning proposal for the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)** of the Environmental Statement.
- 10.1.2. Fluvial flood mapping from the IDB, EA and LLFA identifies that the majority of the Site is located in Flood Zone 1 with areas to the north and west in Flood Zone 2 and 3. Land uses are being allocated on a sequential basis with the most vulnerable land uses being allocated to areas at the lowest risk of flooding - only land uses identified as More Vulnerable and Essential Infrastructure are proposed within Flood Zone 3a, with only Water Compatible development (landscaping and ecological enhancement) in Flood Zone 3b. Flood Zone compensation is proposed on a level for level basis where levels are to be raised within Flood Zone 3. Safe routes of access and egress from the Site are to be set at 600mm above maximum flood levels.
- 10.1.3. Surface water could be a source of flood risk due to the localised low points identified on the Long Term Flood Risk Maps¹³ and the presence of several flow paths on the peripheries of the Site. Any remaining risk is to be mitigated by the proposed drainage strategy in **Appendix 12.3: Drainage Strategy (Volume 3)** which demonstrates the ability to accommodate surface water run-off during all events up to and including the 100-year plus 40% climate change allowance scenario, to prevent potential exceedance flows off-site. Levels will be engineered to prevent ponding, direct surface water flows towards the drainage system and mitigation provided to prevent increased off-Site flooding. As such the Proposed Development will reduce the probability of surface water flooding at the Site and in the surroundings.
- 10.1.4. The potential for groundwater emergence has been identified due to the presence of an impermeable bed rock with isolated shallow deposits of alluvium and head. This will be mitigated by the **Appendix 12.3: Drainage Strategy (Volume 3)** intercepting surface water run-off and attenuating flows prior to discharge.
- 10.1.5. The Site also lies within the extents of any potential flooding from the Stewartby Lake, where development is proposed within this maximum extent level raising is proposed, with exceedance routing to be provided on-Site steering flows to the low points of the proposed attenuation where flows can safely accumulate, existing off-Site flow paths will also be maintained to make sure there is continuity and not increase flood risk off-site.
- 10.1.6. Other potential sources of flooding have been investigated and are deemed to be low.
- 10.1.7. It is concluded that, in terms of flood risk, the Proposed Development is sustainable.

Annex 1

TOPOGRAPHICAL SURVEY

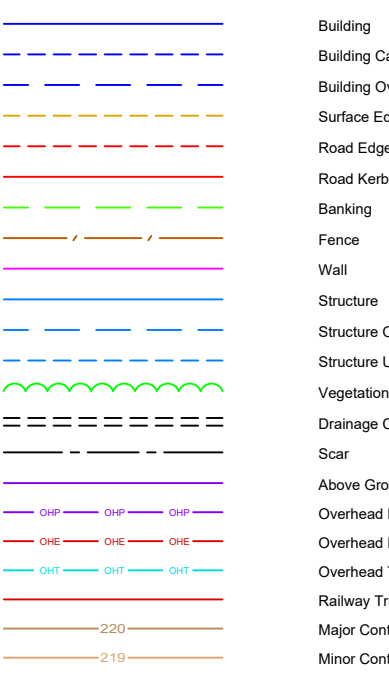
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SHEET LAYOUT



TOPOGRAPHIC LEGEND



*Warning: Linetypes do not display when represented by 3D Polylines in AutoCAD.
To view or plot linetypes use 2D CAD file.

ABBREVIATIONS

[illegible]

NOTES

IV.	DRONE SURVEY AREA EXTENDED	NC	08/2020
	DETAILS	BY	0A/2020

ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS	DATUM ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATION BY GPS OBSERVATIONS
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ENT:



PROJECT TITLE: DLR COMPOUND
NORTHSTOWE

TOPOGRAPHIC & DESKTOP SURVEY

DESIGNED BY: BC/KG	DRAWN BY: BC/NC	APPROVED BY: LP
DATE: 1:200 @ A0	SURVEY DATE: 03/2023	
ISSUING NUMBER: 2850_P Rev A		
ET NUMBER: 2 of 117 A0		REV:

SHEET LAYOUT

TOPOGRAPHIC LEGEND

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NOTES

IV.	DRONE SURVEY AREA EXTENDED	NC	09/23
	DETAILS	BY	DATE

ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS	DATUM
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LEEDS RUGBY LONDON
0113 291 8700 0113 261 8700 01752 340686
E-Mail: info@80seven.com Web site: www.80seven.com



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NORTHSTOWE

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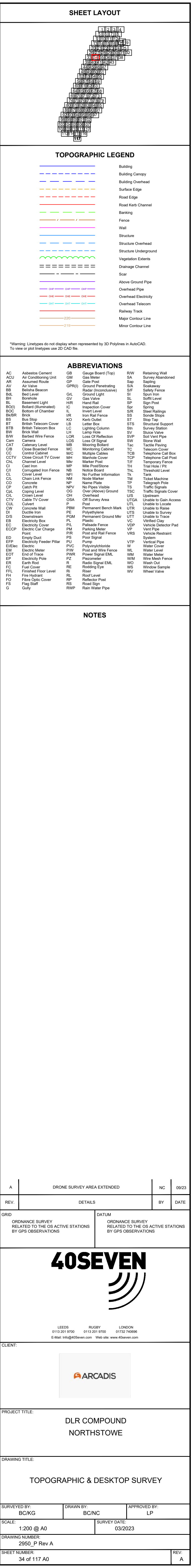
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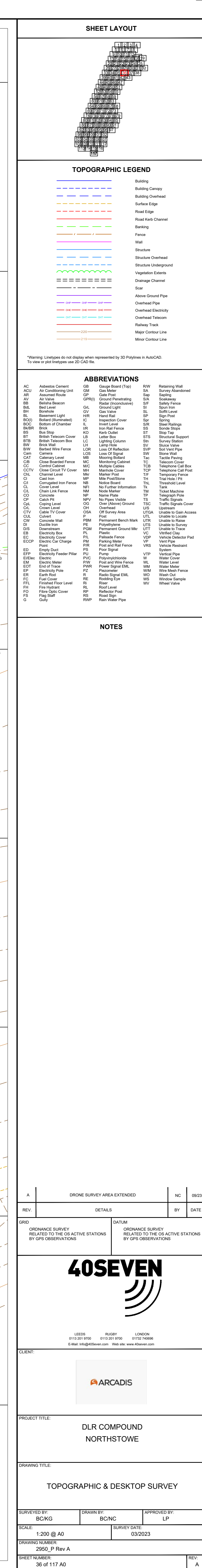
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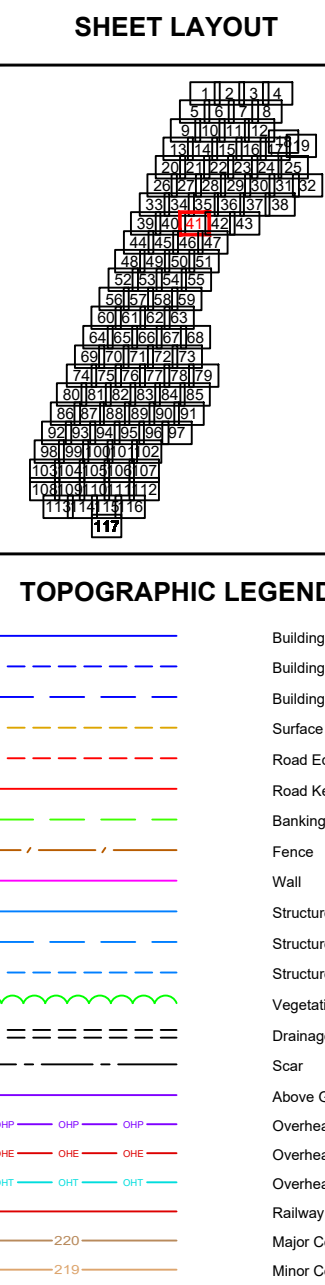
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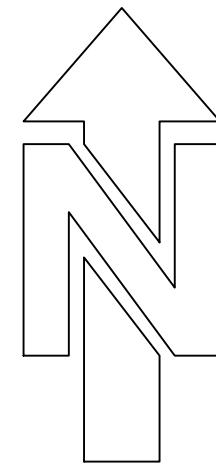




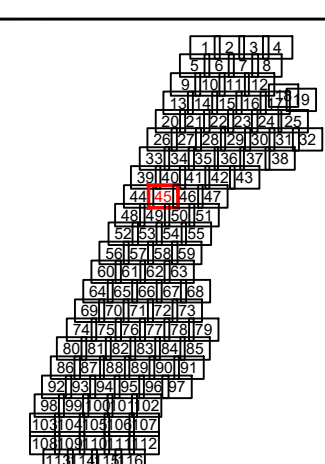
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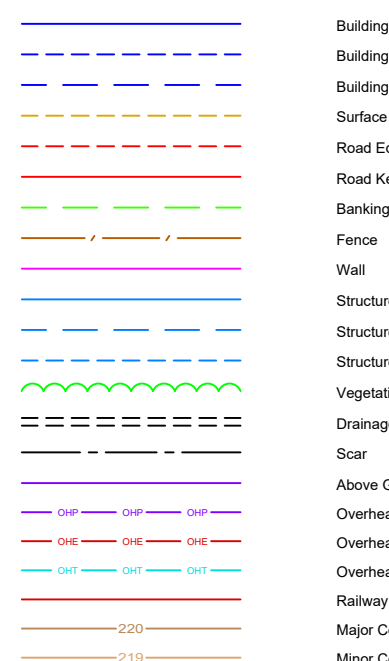
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DLR COMPOUND NORTHSTOWE			
DRAWING TITLE			
TOPOGRAPHIC & DESKTOP SURVEY			
SURVEYED BY: ECRG		DRAWN BY: BNC	
SCALE 1:200 @ A0		APPROVED BY: LP	
DRAWING NUMBER 2500_P_Rev A		SHEET DATE 03/02/23	
SHEET NUMBER 45 of 137 A0		REV. A	



SHEET LAYOUT



TOPOGRAPHIC LEGEND



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ABBREVIATION

AC	Acoustic	AD	Adaptive	AE	Aerial	AF	Air Force	AG	Aggravation	AH	Allegation	AI	Artificial	AL	Allegation	AM	Amplification	AN	Antenna	AO	Antenna	AP	Antenna	AR	Antenna	AS	Antenna	AT	Antenna	AV	Antenna	AW	Antenna	AX	Antenna	AY	Antenna	AZ	Antenna	BA	Antenna	BB	Antenna	BC	Antenna	BD	Antenna	BE	Antenna	BF	Antenna	BG	Antenna	BH	Antenna	BI	Antenna	BJ	Antenna	BK	Antenna	BL	Antenna	BM	Antenna	BN	Antenna	BO	Antenna	BP	Antenna	BQ	Antenna	BR	Antenna	BS	Antenna	BT	Antenna	BV	Antenna	BW	Antenna	BX	Antenna	BY	Antenna	BZ	Antenna	CA	Antenna	CB	Antenna	CC	Antenna	CD	Antenna	CE	Antenna	CF	Antenna	CG	Antenna	CH	Antenna	CI	Antenna	CJ	Antenna	CK	Antenna	CL	Antenna	CM	Antenna	CN	Antenna	CO	Antenna	CP	Antenna	CQ	Antenna	CR	Antenna	CS	Antenna	CT	Antenna	CU	Antenna	CV	Antenna	CW	Antenna	CX	Antenna	CY	Antenna	CZ	Antenna	DA	Antenna	DB	Antenna	DC	Antenna	DD	Antenna	DE	Antenna	DF	Antenna	DG	Antenna	DH	Antenna	DI	Antenna	DJ	Antenna	DK	Antenna	DL	Antenna	DM	Antenna	DN	Antenna	DO	Antenna	DP	Antenna	DQ	Antenna	DR	Antenna	DS	Antenna	DT	Antenna	DV	Antenna	DW	Antenna	DX	Antenna	DY	Antenna	DZ	Antenna	EA	Antenna	EB	Antenna	EC	Antenna	ED	Antenna	EE	Antenna	EF	Antenna	EG	Antenna	EH	Antenna	EI	Antenna	EJ	Antenna	EK	Antenna	EL	Antenna	EM	Antenna	EN	Antenna	EO	Antenna	EP	Antenna	EQ	Antenna	ER	Antenna	ES	Antenna	ET	Antenna	EU	Antenna	EV	Antenna	EW	Antenna	EX	Antenna	EY	Antenna	EZ	Antenna	FA	Antenna	FB	Antenna	FC	Antenna	FD	Antenna	FE	Antenna	FF	Antenna	FG	Antenna	FH	Antenna	FI	Antenna	FJ	Antenna	FK	Antenna	FL	Antenna	FM	Antenna	FN	Antenna	FO	Antenna	FP	Antenna	FQ	Antenna	FR	Antenna	FS	Antenna	FT	Antenna	FV	Antenna	FW	Antenna	FX	Antenna	FY	Antenna	FZ	Antenna	GA	Antenna	GB	Antenna	GC	Antenna	GD	Antenna	GE	Antenna	GF	Antenna	GG	Antenna	GH	Antenna	GI	Antenna	GJ	Antenna	GK	Antenna	GL	Antenna	GM	Antenna	GN	Antenna	GO	Antenna	GP	Antenna	GQ	Antenna	GR	Antenna	GS	Antenna	GT	Antenna	GV	Antenna	GW	Antenna	GX	Antenna	GY	Antenna	GZ	Antenna	HA	Antenna	HB	Antenna	HC	Antenna	HD	Antenna	HE	Antenna	HF	Antenna	HG	Antenna	HH	Antenna	HI	Antenna	HJ	Antenna	HK	Antenna	HL	Antenna	HM	Antenna	HN	Antenna	HO	Antenna	HP	Antenna	HQ	Antenna	HR	Antenna	HS	Antenna	HT	Antenna	HV	Antenna	HW	Antenna	HX	Antenna	HY	Antenna	HZ	Antenna	IA	Antenna	IB	Antenna	IC	Antenna	ID	Antenna	IE	Antenna	IF	Antenna	IG	Antenna	IH	Antenna	II	Antenna	IJ	Antenna	IK	Antenna	IL	Antenna	IM	Antenna	IN	Antenna	IO	Antenna	IP	Antenna	IQ	Antenna	IR	Antenna	IS	Antenna	IT	Antenna	IV	Antenna	IW	Antenna	IX	Antenna	IY	Antenna	IZ	Antenna	JA	Antenna	JB	Antenna	JC	Antenna	JD	Antenna	JE	Antenna	JF	Antenna	JG	Antenna	JH	Antenna	JI	Antenna	JJ	Antenna	JK	Antenna	JL	Antenna	JM	Antenna	JN	Antenna	JO	Antenna	JP	Antenna	jq	Antenna	JR	Antenna	JS	Antenna	JT	Antenna	JV	Antenna	JW	Antenna	JX	Antenna	JY	Antenna	JZ	Antenna	KA	Antenna	KB	Antenna	KC	Antenna	KD	Antenna	KE	Antenna	KF	Antenna	KG	Antenna	KH	Antenna	KI	Antenna	KJ	Antenna	KK	Antenna	KL	Antenna	KM	Antenna	KN	Antenna	KO	Antenna	KP	Antenna	KQ	Antenna	KR	Antenna	KS	Antenna	KT	Antenna	KV	Antenna	KW	Antenna	KX	Antenna	KY	Antenna	KZ	Antenna	LA	Antenna	LB	Antenna	LC	Antenna	LD	Antenna	LE	Antenna	LF	Antenna	LG	Antenna	LH	Antenna	LI	Antenna	LJ	Antenna	LK	Antenna	LL	Antenna	LM	Antenna	LN	Antenna	LO	Antenna	LP	Antenna	LQ	Antenna	LR	Antenna	LS	Antenna	LT	Antenna	LV	Antenna	LW	Antenna	LX	Antenna	LY	Antenna	LZ	Antenna	MA	Antenna	MB	Antenna	MC	Antenna	MD	Antenna	ME	Antenna	MF	Antenna	MG	Antenna	MH	Antenna	MI	Antenna	MJ	Antenna	MK	Antenna	ML	Antenna	MM	Antenna	MN	Antenna	MO	Antenna	MP	Antenna	MQ	Antenna	MR	Antenna	MS	Antenna	MT	Antenna	MV	Antenna	MW	Antenna	MX	Antenna	MY	Antenna	MZ	Antenna	NA	Antenna	NB	Antenna	NC	Antenna	ND	Antenna	NE	Antenna	NF	Antenna	NG	Antenna	NH	Antenna	NI	Antenna	NJ	Antenna	NK	Antenna	NL	Antenna	NM	Antenna	NO	Antenna	NP	Antenna	NQ	Antenna	NR	Antenna	NS	Antenna	NT	Antenna	NV	Antenna	NW	Antenna	NX	Antenna	NY	Antenna	NZ	Antenna	OA	Antenna	OB	Antenna	OC	Antenna	OD	Antenna	OE	Antenna	OF	Antenna	OG	Antenna	OH	Antenna	OI	Antenna	OJ	Antenna	OK	Antenna	OL	Antenna	OM	Antenna	ON	Antenna	OO	Antenna	OP	Antenna	OQ	Antenna	OR	Antenna	OS	Antenna	OT	Antenna	OV	Antenna	OW	Antenna	OX	Antenna	OY	Antenna	OZ	Antenna	PA	Antenna	PB	Antenna	PC	Antenna	PD	Antenna	PE	Antenna	PF	Antenna	PG	Antenna	PH	Antenna	PI	Antenna	PJ	Antenna	PK	Antenna	PL	Antenna	PM	Antenna	PN	Antenna	PO	Antenna	PP	Antenna	PQ	Antenna	PR	Antenna	PS	Antenna	PT	Antenna	PV	Antenna	PW	Antenna	PX	Antenna	PY	Antenna	PZ	Antenna	QA	Antenna	QB	Antenna	QC	Antenna	QD	Antenna	QE	Antenna	QF	Antenna	QG	Antenna	QH	Antenna	QI	Antenna	QJ	Antenna	QK	Antenna	QL	Antenna	QM	Antenna	QN	Antenna	QO	Antenna	QP	Antenna	QQ	Antenna	QR	Antenna	QS	Antenna	QT	Antenna	QV	Antenna	QW	Antenna	QX	Antenna	QY	Antenna	QZ	Antenna	RA	Antenna	RB	Antenna	RC	Antenna	RD	Antenna	RE	Antenna	RF	Antenna	RG	Antenna	RH	Antenna	RI	Antenna	RJ	Antenna	RK	Antenna	RL	Antenna	RM	Antenna	RN	Antenna	RO	Antenna	RP	Antenna	RQ	Antenna	RR	Antenna	RS	Antenna	RT	Antenna	RV	Antenna	RW	Antenna	RX	Antenna	RY	Antenna	RZ	Antenna	SA	Antenna	SB	Antenna	SC	Antenna	SD	Antenna	SE	Antenna	SF	Antenna	SG	Antenna	SH	Antenna	SI	Antenna	SJ	Antenna	SK	Antenna	SL	Antenna	SM	Antenna	SN	Antenna	SO	Antenna	SP	Antenna	SQ	Antenna	SR	Antenna	SS	Antenna	ST	Antenna	SV	Antenna	SW	Antenna	SX	Antenna	SY	Antenna	SZ	Antenna	TA	Antenna	TB	Antenna	TC	Antenna	TD	Antenna	TE	Antenna	TF	Antenna	TG	Antenna	TH	Antenna	TI	Antenna	TJ	Antenna	TK	Antenna	TL	Antenna	TM	Antenna	TN	Antenna	TO	Antenna	TP	Antenna	TQ	Antenna	TR	Antenna	TS	Antenna	TV	Antenna	TW	Antenna	TX	Antenna	TY	Antenna	TZ	Antenna	UA	Antenna	UB	Antenna	UC	Antenna	UD	Antenna	UE	Antenna	UF	Antenna	UG	Antenna	UH	Antenna	UI	Antenna	UJ	Antenna	UK	Antenna	UL	Antenna	UM	Antenna	UN	Antenna	UO	Antenna	UP	Antenna	UQ	Antenna	UR	Antenna	US	Antenna	UT	Antenna	UV	Antenna	UW	Antenna	UX	Antenna	UY	Antenna	UZ	Antenna	VA	Antenna	VB	Antenna	VC	Antenna	VD	Antenna	VE	Antenna	VF	Antenna	VG	Antenna	VH	Antenna	VI	Antenna	VJ	Antenna	VK	Antenna	VL	Antenna	VM	Antenna	VN	Antenna	VO	Antenna	VP	Antenna	VQ	Antenna	VR	Antenna	VS	Antenna	VT	Antenna	VV	Antenna	VW	Antenna	VX	Antenna	VY	Antenna	VZ	Antenna	WA	Antenna	WB	Antenna	WC	Antenna	WD	Antenna	WE	Antenna	WF	Antenna	WG	Antenna	WH	Antenna	WI	Antenna	WJ	Antenna	WK	Antenna	WL	Antenna	WM	Antenna	WN	Antenna	WO	Antenna	WP	Antenna	WQ	Antenna	WR	Antenna	WS	Antenna	WT	Antenna	WV	Antenna	WW	Antenna	WX	Antenna	WY	Antenna	WZ	Antenna	XA	Antenna	XB	Antenna	XC	Antenna	XD	Antenna	XE	Antenna	XF	Antenna	XG	Antenna	XH	Antenna	XI	Antenna	XJ	Antenna	XK	Antenna	XL	Antenna	XM	Antenna	XN	Antenna	XO	Antenna	XP	Antenna	XQ	Antenna	XR	Antenna	XS	Antenna	XT	Antenna	XV	Antenna	XW	Antenna	XX	Antenna	XY	Antenna	XZ	Antenna	YA	Antenna	YB	Antenna	YC	Antenna	YD	Antenna	YE	Antenna	YF	Antenna	YG	Antenna	YH	Antenna	YI	Antenna	YJ	Antenna	YK	Antenna	YL	Antenna	YM	Antenna	YN	Antenna	YO	Antenna	YP	Antenna	YQ	Antenna	YR	Antenna	YS	Antenna	YT	Antenna	YV	Antenna	YW	Antenna	YX	Antenna	YZ	Antenna	ZA	Antenna	ZB	Antenna	ZC	Antenna	ZD	Antenna	ZE	Antenna	ZF	Antenna	ZG	Antenna	ZH	Antenna	ZI	Antenna	ZJ	Antenna	ZK	Antenna	ZL	Antenna	ZM	Antenna	ZN	Antenna	ZO	Antenna	ZP	Antenna	ZQ	Antenna	ZR	Antenna	ZS	Antenna	ZT	Antenna	ZV	Antenna	ZW	Antenna	ZX	Antenna	ZY	Antenna	ZZ	Antenna
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NOTE

A	DRONE SURVEY AREA EXTENDED	NC	05/22
REV.	DETAILS	BY	DATE

GRID	DATUM
ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS	ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS



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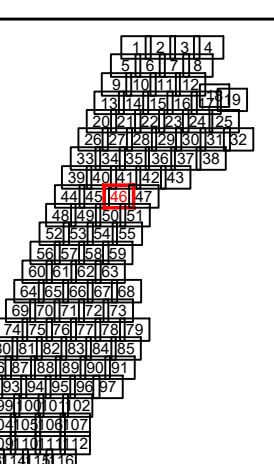
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NORTHSTOWE

DRAWING TITLE:

TOPOGRAPHIC & DESKTOP SURVEY

SURVEYED BY: BC/KG	DRAWN BY: BC/NC	APPROVED BY: LP
SCALE: 1:200 @ A0		SURVEY DATE: 03/2023

DRAWING NUMBER: 2950_P Rev A	
SHEET NUMBER: 45 of 117 A0	REV: A



 Building
 Building Canopy

	Building Overhead
	Surface Edge
	Road Edge
	Road Kerb Channel
	Banking
	Fence
	Wall
	Structure
	Structure Overhead
	Structure Underground
	Vegetation Extents
	Drainage Channel
	Scar
	Above Ground Pipe
	Overhead Pipe
	Overhead Electricity
	Overhead Telecom
	Railway Track
	Major Control Line
	Minor Control Line

*Warning: Linetypes do not display when represented by 3D Polylines in AutoCAD. To view or plot linetypes use 2D CAD file.

CB	Cause Based (Top)	ROW	Retaining Wall
GM	Gas Meter	SA	Survey Area
GP	Gate Post	Sap	Sapling
GPR	Ground Penetrating	SA	Sidewalk

[illegible]

A.	DRONE SURVEY AREA EXTENDED	N
EV.	DETAILS	BY

ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS	DATUM ORDNANCE SURVEY RELATED TO THE OS ACTIVE BY GPS OBSERVATIONS
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LEEDS RUGBY LONDON
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SUBJECT TITLE: DLR COMPOUND
NORTHOTOXE

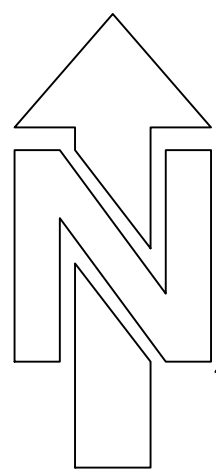
TOPOGRAPHIC & DESKTOP SURVEY

TESTED BY: BC/KG	DRAWN BY: BC/NC	APPROVED BY: LP
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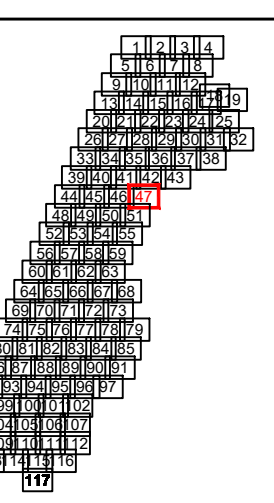
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1:200 @ A0	03/2023

WING NUMBER:
2050_P Rev A

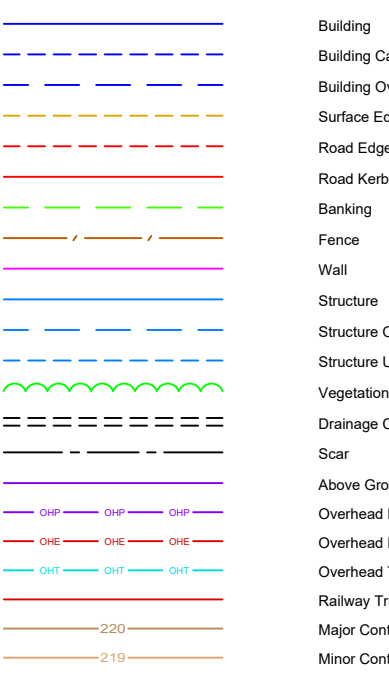
ET NUMBER:
46 of 117 A0



SHEET LAYOUT



TOPOGRAPHIC LEGEND



Warning: Linetypes do not display when represented by 3D Polylines in AutoCAD.
To view or plot linetypes use 2D CAD file.

ABBREVIATIONS

[illegible]

NOTES

A	DRONE SURVEY AREA EXTENDED	NC	09/23
REV.	DETAILS	BY	DATE

GRID	DATUM
ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS	ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS



LEEDS RUGBY LONDON
0201 9300 0113 261 5700 01732 346686
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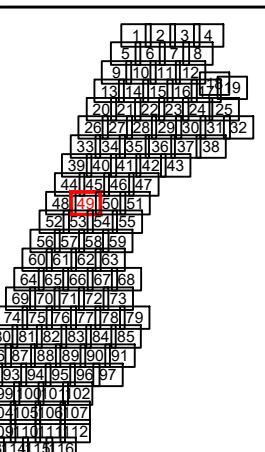
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SURVEYED BY: BC/KG	DRAWN BY: BC/NC	APPROVED BY: LP
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SCALE: 1:200 @ A0	SURVEY DATE: 03/2023
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SHEET NUMBER:
47 of 117 A0



ABBREVIATIONS					
AC	Advanced Control	GB	Glue Ball	HW	Heavy
AD	Adhesive	GC	Ground Cable	IB	Iron Ball
AE	Anti-Electrostatic	GP	Ground Plane	IC	Insulation
AL	Aluminum	GR	Grounding Rod	IP	Insulation Pad
ALV	Aluminum Veneer	GRG	Grounding Rod Ground	IR	Insulation Resistance
AN	Anti-Normal	GRG	Grounding Rod Ground	IS	Insulation Surface
AP	Anti-Pollution	GRG	Grounding Rod Ground	IS	Insulation Surface
AR	Anti-Radiation	GRG	Grounding Rod Ground	IS	Insulation Surface
AS	Anti-Shock	GRG	Grounding Rod Ground	IS	Insulation Surface
AT	Anti-Thermal	GRG	Grounding Rod Ground	IS	Insulation Surface
AV	Anti-Vibration	GRG	Grounding Rod Ground	IS	Insulation Surface
AW	Anti-Water	GRG	Grounding Rod Ground	IS	Insulation Surface
AX	Anti-X-Ray	GRG	Grounding Rod Ground	IS	Insulation Surface
AY	Anti-Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
B	Battery	GRG	Grounding Rod Ground	IS	Insulation Surface
BC	Battery Cell	GRG	Grounding Rod Ground	IS	Insulation Surface
BD	Battery Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
BE	Battery Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
BF	Battery Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
BH	Battery Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
BI	Battery Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
BJ	Battery Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
BK	Battery Key	GRG	Grounding Rod Ground	IS	Insulation Surface
BL	Battery Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
BM	Battery Mount	GRG	Grounding Rod Ground	IS	Insulation Surface
BN	Battery Noise	GRG	Grounding Rod Ground	IS	Insulation Surface
BO	Battery Output	GRG	Grounding Rod Ground	IS	Insulation Surface
BP	Battery Power	GRG	Grounding Rod Ground	IS	Insulation Surface
BQ	Battery Quality	GRG	Grounding Rod Ground	IS	Insulation Surface
BR	Battery Resistance	GRG	Grounding Rod Ground	IS	Insulation Surface
BS	Battery Safety	GRG	Grounding Rod Ground	IS	Insulation Surface
BT	Battery Temperature	GRG	Grounding Rod Ground	IS	Insulation Surface
BV	Battery Voltage	GRG	Grounding Rod Ground	IS	Insulation Surface
BW	Battery Weight	GRG	Grounding Rod Ground	IS	Insulation Surface
BY	Battery Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
C	Cable	GRG	Grounding Rod Ground	IS	Insulation Surface
CA	Cable Assembly	GRG	Grounding Rod Ground	IS	Insulation Surface
CB	Cable Bundle	GRG	Grounding Rod Ground	IS	Insulation Surface
CC	Cable Connector	GRG	Grounding Rod Ground	IS	Insulation Surface
CD	Cable Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
CE	Cable Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
CF	Cable Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
CG	Cable Grounding	GRG	Grounding Rod Ground	IS	Insulation Surface
CH	Cable Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
CI	Cable Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
CJ	Cable Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
CK	Cable Key	GRG	Grounding Rod Ground	IS	Insulation Surface
CL	Cable Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
CM	Cable Mount	GRG	Grounding Rod Ground	IS	Insulation Surface
CN	Cable Noise	GRG	Grounding Rod Ground	IS	Insulation Surface
CO	Cable Output	GRG	Grounding Rod Ground	IS	Insulation Surface
CP	Cable Power	GRG	Grounding Rod Ground	IS	Insulation Surface
CQ	Cable Quality	GRG	Grounding Rod Ground	IS	Insulation Surface
CR	Cable Resistance	GRG	Grounding Rod Ground	IS	Insulation Surface
CS	Cable Safety	GRG	Grounding Rod Ground	IS	Insulation Surface
CT	Cable Temperature	GRG	Grounding Rod Ground	IS	Insulation Surface
CV	Cable Voltage	GRG	Grounding Rod Ground	IS	Insulation Surface
CW	Cable Weight	GRG	Grounding Rod Ground	IS	Insulation Surface
CY	Cable Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
D	Device	GRG	Grounding Rod Ground	IS	Insulation Surface
DA	Device Assembly	GRG	Grounding Rod Ground	IS	Insulation Surface
DB	Device Bundle	GRG	Grounding Rod Ground	IS	Insulation Surface
DC	Device Connector	GRG	Grounding Rod Ground	IS	Insulation Surface
DD	Device Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
DE	Device Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
DF	Device Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
DG	Device Grounding	GRG	Grounding Rod Ground	IS	Insulation Surface
DH	Device Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
DI	Device Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
DJ	Device Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
DK	Device Key	GRG	Grounding Rod Ground	IS	Insulation Surface
DL	Device Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
DM	Device Mount	GRG	Grounding Rod Ground	IS	Insulation Surface
DN	Device Noise	GRG	Grounding Rod Ground	IS	Insulation Surface
DO	Device Output	GRG	Grounding Rod Ground	IS	Insulation Surface
DP	Device Power	GRG	Grounding Rod Ground	IS	Insulation Surface
DQ	Device Quality	GRG	Grounding Rod Ground	IS	Insulation Surface
DR	Device Resistance	GRG	Grounding Rod Ground	IS	Insulation Surface
DS	Device Safety	GRG	Grounding Rod Ground	IS	Insulation Surface
DT	Device Temperature	GRG	Grounding Rod Ground	IS	Insulation Surface
DV	Device Voltage	GRG	Grounding Rod Ground	IS	Insulation Surface
DW	Device Weight	GRG	Grounding Rod Ground	IS	Insulation Surface
DY	Device Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
E	Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
EA	Electrode Assembly	GRG	Grounding Rod Ground	IS	Insulation Surface
EB	Electrode Bundle	GRG	Grounding Rod Ground	IS	Insulation Surface
EC	Electrode Connector	GRG	Grounding Rod Ground	IS	Insulation Surface
ED	Electrode Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
EE	Electrode Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
EF	Electrode Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
EG	Electrode Grounding	GRG	Grounding Rod Ground	IS	Insulation Surface
EH	Electrode Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
EI	Electrode Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
EJ	Electrode Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
EK	Electrode Key	GRG	Grounding Rod Ground	IS	Insulation Surface
EL	Electrode Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
EM	Electrode Mount	GRG	Grounding Rod Ground	IS	Insulation Surface
EN	Electrode Noise	GRG	Grounding Rod Ground	IS	Insulation Surface
EO	Electrode Output	GRG	Grounding Rod Ground	IS	Insulation Surface
EP	Electrode Power	GRG	Grounding Rod Ground	IS	Insulation Surface
EQ	Electrode Quality	GRG	Grounding Rod Ground	IS	Insulation Surface
ER	Electrode Resistance	GRG	Grounding Rod Ground	IS	Insulation Surface
ES	Electrode Safety	GRG	Grounding Rod Ground	IS	Insulation Surface
ET	Electrode Temperature	GRG	Grounding Rod Ground	IS	Insulation Surface
EV	Electrode Voltage	GRG	Grounding Rod Ground	IS	Insulation Surface
EW	Electrode Weight	GRG	Grounding Rod Ground	IS	Insulation Surface
EY	Electrode Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
F	Fiber	GRG	Grounding Rod Ground	IS	Insulation Surface
FA	Fiber Assembly	GRG	Grounding Rod Ground	IS	Insulation Surface
FB	Fiber Bundle	GRG	Grounding Rod Ground	IS	Insulation Surface
FC	Fiber Connector	GRG	Grounding Rod Ground	IS	Insulation Surface
FD	Fiber Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
FE	Fiber Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
FF	Fiber Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
FG	Fiber Grounding	GRG	Grounding Rod Ground	IS	Insulation Surface
FH	Fiber Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
FI	Fiber Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
FJ	Fiber Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
FK	Fiber Key	GRG	Grounding Rod Ground	IS	Insulation Surface
FL	Fiber Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
FM	Fiber Mount	GRG	Grounding Rod Ground	IS	Insulation Surface
FN	Fiber Noise	GRG	Grounding Rod Ground	IS	Insulation Surface
FO	Fiber Output	GRG	Grounding Rod Ground	IS	Insulation Surface
FP	Fiber Power	GRG	Grounding Rod Ground	IS	Insulation Surface
FQ	Fiber Quality	GRG	Grounding Rod Ground	IS	Insulation Surface
FR	Fiber Resistance	GRG	Grounding Rod Ground	IS	Insulation Surface
FS	Fiber Safety	GRG	Grounding Rod Ground	IS	Insulation Surface
FT	Fiber Temperature	GRG	Grounding Rod Ground	IS	Insulation Surface
FV	Fiber Voltage	GRG	Grounding Rod Ground	IS	Insulation Surface
FW	Fiber Weight	GRG	Grounding Rod Ground	IS	Insulation Surface
FY	Fiber Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
G	Ground	GRG	Grounding Rod Ground	IS	Insulation Surface
GA	Ground Assembly	GRG	Grounding Rod Ground	IS	Insulation Surface
GB	Ground Bundle	GRG	Grounding Rod Ground	IS	Insulation Surface
GC	Ground Connector	GRG	Grounding Rod Ground	IS	Insulation Surface
GD	Ground Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
GE	Ground Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
GF	Ground Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
GG	Ground Grounding	GRG	Grounding Rod Ground	IS	Insulation Surface
GH	Ground Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
GI	Ground Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
GJ	Ground Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
GK	Ground Key	GRG	Grounding Rod Ground	IS	Insulation Surface
GL	Ground Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
GM	Ground Mount	GRG	Grounding Rod Ground	IS	Insulation Surface
GN	Ground Noise	GRG	Grounding Rod Ground	IS	Insulation Surface
GO	Ground Output	GRG	Grounding Rod Ground	IS	Insulation Surface
GP	Ground Power	GRG	Grounding Rod Ground	IS	Insulation Surface
GQ	Ground Quality	GRG	Grounding Rod Ground	IS	Insulation Surface
GR	Ground Resistance	GRG	Grounding Rod Ground	IS	Insulation Surface
GS	Ground Safety	GRG	Grounding Rod Ground	IS	Insulation Surface
GT	Ground Temperature	GRG	Grounding Rod Ground	IS	Insulation Surface
GV	Ground Voltage	GRG	Grounding Rod Ground	IS	Insulation Surface
GW	Ground Weight	GRG	Grounding Rod Ground	IS	Insulation Surface
GY	Ground Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
H	Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
HA	Housing Assembly	GRG	Grounding Rod Ground	IS	Insulation Surface
HB	Housing Bundle	GRG	Grounding Rod Ground	IS	Insulation Surface
HC	Housing Connector	GRG	Grounding Rod Ground	IS	Insulation Surface
HD	Housing Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
HE	Housing Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
HF	Housing Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
HG	Housing Grounding	GRG	Grounding Rod Ground	IS	Insulation Surface
HH	Housing Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
HI	Housing Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
HJ	Housing Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
HK	Housing Key	GRG	Grounding Rod Ground	IS	Insulation Surface
HL	Housing Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
HM	Housing Mount	GRG	Grounding Rod Ground	IS	Insulation Surface
HN	Housing Noise	GRG	Grounding Rod Ground	IS	Insulation Surface
HO	Housing Output	GRG	Grounding Rod Ground	IS	Insulation Surface
HP	Housing Power	GRG	Grounding Rod Ground	IS	Insulation Surface
HQ	Housing Quality	GRG	Grounding Rod Ground	IS	Insulation Surface
HR	Housing Resistance	GRG	Grounding Rod Ground	IS	Insulation Surface
HS	Housing Safety	GRG	Grounding Rod Ground	IS	Insulation Surface
HT	Housing Temperature	GRG	Grounding Rod Ground	IS	Insulation Surface
HV	Housing Voltage	GRG	Grounding Rod Ground	IS	Insulation Surface
HW	Housing Weight	GRG	Grounding Rod Ground	IS	Insulation Surface
HY	Housing Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
I	Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
IA	Insulation Assembly	GRG	Grounding Rod Ground	IS	Insulation Surface
IB	Insulation Bundle	GRG	Grounding Rod Ground	IS	Insulation Surface
IC	Insulation Connector	GRG	Grounding Rod Ground	IS	Insulation Surface
ID	Insulation Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
IE	Insulation Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
IF	Insulation Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
IG	Insulation Grounding	GRG	Grounding Rod Ground	IS	Insulation Surface
IH	Insulation Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
II	Insulation Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
IJ	Insulation Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
IK	Insulation Key	GRG	Grounding Rod Ground	IS	Insulation Surface
IL	Insulation Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
IM	Insulation Mount	GRG	Grounding Rod Ground	IS	Insulation Surface
IN	Insulation Noise	GRG	Grounding Rod Ground	IS	Insulation Surface
IO	Insulation Output	GRG	Grounding Rod Ground	IS	Insulation Surface
IP	Insulation Power	GRG	Grounding Rod Ground	IS	Insulation Surface
IQ	Insulation Quality	GRG	Grounding Rod Ground	IS	Insulation Surface
IR	Insulation Resistance	GRG	Grounding Rod Ground	IS	Insulation Surface
IS	Insulation Safety	GRG	Grounding Rod Ground	IS	Insulation Surface
IT	Insulation Temperature	GRG	Grounding Rod Ground	IS	Insulation Surface
IV	Insulation Voltage	GRG	Grounding Rod Ground	IS	Insulation Surface
IW	Insulation Weight	GRG	Grounding Rod Ground	IS	Insulation Surface
IY	Insulation Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
J	Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
JA	Junction Assembly	GRG	Grounding Rod Ground	IS	Insulation Surface
JB	Junction Bundle	GRG	Grounding Rod Ground	IS	Insulation Surface
JC	Junction Connector	GRG	Grounding Rod Ground	IS	Insulation Surface
JD	Junction Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
JE	Junction Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
JF	Junction Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
JG	Junction Grounding	GRG	Grounding Rod Ground	IS	Insulation Surface
JH	Junction Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
JI	Junction Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
JJ	Junction Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
JK	Junction Key	GRG	Grounding Rod Ground	IS	Insulation Surface
JL	Junction Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
JM	Junction Mount	GRG	Grounding Rod Ground	IS	Insulation Surface
JN	Junction Noise	GRG	Grounding Rod Ground	IS	Insulation Surface
JO	Junction Output	GRG	Grounding Rod Ground	IS	Insulation Surface
JP	Junction Power	GRG	Grounding Rod Ground	IS	Insulation Surface
JQ	Junction Quality	GRG	Grounding Rod Ground	IS	Insulation Surface
JR	Junction Resistance	GRG	Grounding Rod Ground	IS	Insulation Surface
JS	Junction Safety	GRG	Grounding Rod Ground	IS	Insulation Surface
JT	Junction Temperature	GRG	Grounding Rod Ground	IS	Insulation Surface
JV	Junction Voltage	GRG	Grounding Rod Ground	IS	Insulation Surface
JW	Junction Weight	GRG	Grounding Rod Ground	IS	Insulation Surface
JY	Junction Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
K	Key	GRG	Grounding Rod Ground	IS	Insulation Surface
KA	Key Assembly	GRG	Grounding Rod Ground	IS	Insulation Surface
KB	Key Bundle	GRG	Grounding Rod Ground	IS	Insulation Surface
KC	Key Connector	GRG	Grounding Rod Ground	IS	Insulation Surface
KD	Key Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
KE	Key Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
KF	Key Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
KG	Key Grounding	GRG	Grounding Rod Ground	IS	Insulation Surface
KH	Key Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
KI	Key Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface
KJ	Key Junction	GRG	Grounding Rod Ground	IS	Insulation Surface
KK	Key Key	GRG	Grounding Rod Ground	IS	Insulation Surface
KL	Key Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
KM	Key Mount	GRG	Grounding Rod Ground	IS	Insulation Surface
KN	Key Noise	GRG	Grounding Rod Ground	IS	Insulation Surface
KO	Key Output	GRG	Grounding Rod Ground	IS	Insulation Surface
KP	Key Power	GRG	Grounding Rod Ground	IS	Insulation Surface
KQ	Key Quality	GRG	Grounding Rod Ground	IS	Insulation Surface
KR	Key Resistance	GRG	Grounding Rod Ground	IS	Insulation Surface
KS	Key Safety	GRG	Grounding Rod Ground	IS	Insulation Surface
KT	Key Temperature	GRG	Grounding Rod Ground	IS	Insulation Surface
KV	Key Voltage	GRG	Grounding Rod Ground	IS	Insulation Surface
KW	Key Weight	GRG	Grounding Rod Ground	IS	Insulation Surface
KY	Key Yield	GRG	Grounding Rod Ground	IS	Insulation Surface
L	Lead	GRG	Grounding Rod Ground	IS	Insulation Surface
LA	Lead Assembly	GRG	Grounding Rod Ground	IS	Insulation Surface
LB	Lead Bundle	GRG	Grounding Rod Ground	IS	Insulation Surface
LC	Lead Connector	GRG	Grounding Rod Ground	IS	Insulation Surface
LD	Lead Discharge	GRG	Grounding Rod Ground	IS	Insulation Surface
LE	Lead Electrode	GRG	Grounding Rod Ground	IS	Insulation Surface
LF	Lead Fuel	GRG	Grounding Rod Ground	IS	Insulation Surface
LG	Lead Grounding	GRG	Grounding Rod Ground	IS	Insulation Surface
LH	Lead Housing	GRG	Grounding Rod Ground	IS	Insulation Surface
LI	Lead Insulation	GRG	Grounding Rod Ground	IS	Insulation Surface

NOTES

A	DRONE SURVEY AREA EXTENDED	NC	06/23
REV.	DETAILS	BY	DATE

GRID	DATUM
ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS	ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS

40SEVEN



LEEDS RUGBY LONDON
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CURRENT:



PROJECT TITLE:

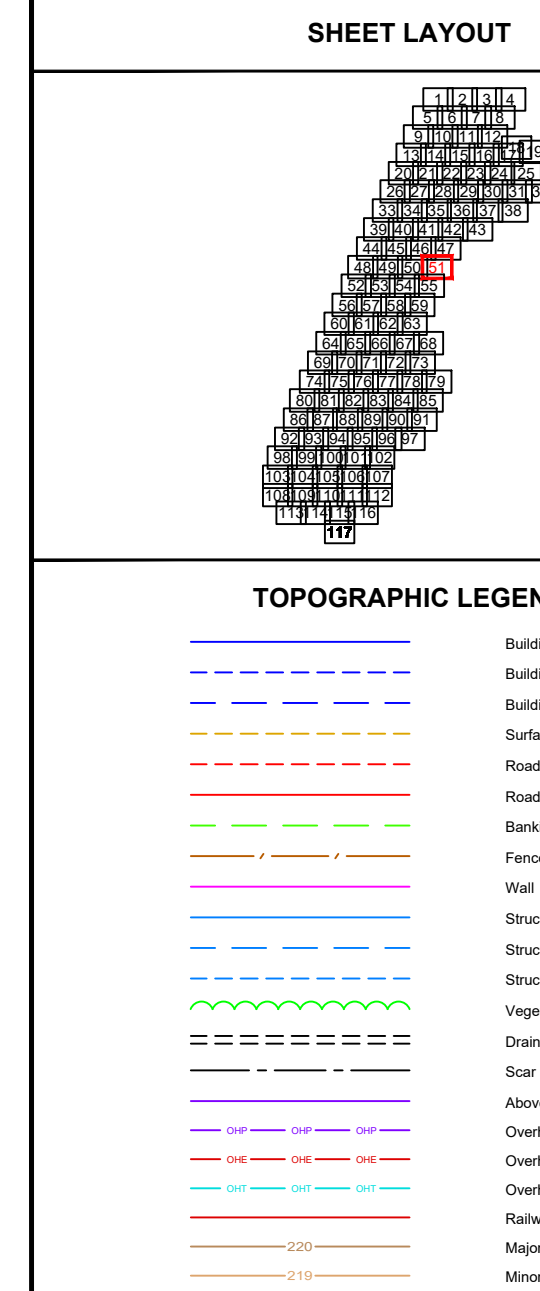
DLR COMPOUND
NORTHSTOWE

DRAWING TITLE:

TOPOGRAPHIC & DESKTOP SURVEY

SURVEYED BY: BC/KG	DRAWN BY: BC/NC	APPROVED BY: LP
SCALE: 1:200 @ A0		SURVEY DATE: 03/2023

DRAWING NUMBER: 2950_P Rev A	
SHEET NUMBER: 49 of 117 A0	REV: A

[illegible]

NOTES

A	DRONE SURVEY AREA EXTENDED	NC
REV.	DETAILS	BY

GRID	DATUM
ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS	ORDNANCE SURVEY RELATED TO THE OS ACTIVE STA BY GPS OBSERVATIONS



LEEDS RUZEH LONDON
0113 291 9790 0113 261 9790 01732 746696



PROJECT TITLE: DLR COMPOUND

DRAWING TITLE:

TOPOGRAPHIC & DESKTOP SURVEY

SURVEYED BY: BC/KG	DRAWN BY: BC/NC	APPROVED BY: LP
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SCALE: 1:200 @ A0	SURVEY DATE: 03/2023
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SHEET NUMBER:
51 of 117 A0

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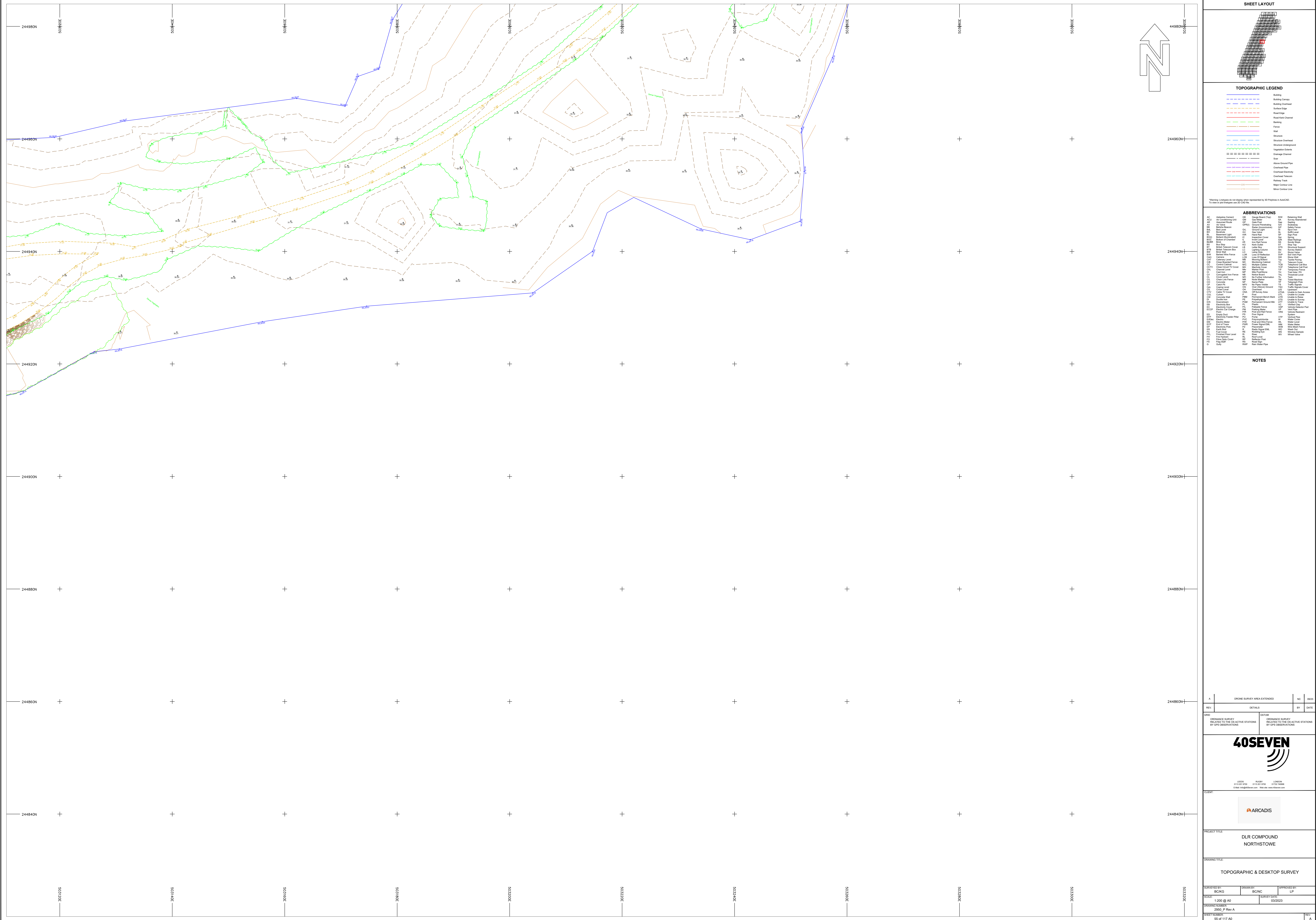




Figure 1 is a schematic representation of the experimental design. It shows a vertical timeline of a 220-minute session. The timeline is divided into several horizontal segments, each representing a different experimental condition. The segments are color-coded: red for 'Olf' (olfaction), blue for 'ChE' (cholinergic stimulation), green for 'Olf', and yellow for 'ChE'. The segments are arranged in a sequence that repeats several times. A horizontal bar at the bottom indicates the total duration of 220 minutes.

*Warning: Linetypes do not display when represented by 3D Polylines in AutoCAD. To view or plot linetypes use 2D CAD file.

ACU	Air Conditioning Unit	GA	Gas Meter	SA	Shower Arm
AD	Alarm	GB	Gas Burner	SB	Shower Base
AV	Air Valve	GP	Gas Pressure	SC	Shower Control
B	Bath	GR	Gas Register	SD	Shower Drain
BAL	Balloon	GS	Gas Sizing	SE	Shower Enclosure
BAS	Bath	GT	Gas Test	SF	Shower Floor
BAT	Bath	GU	Gas Unit	SG	Shower Gasket
BATH	Bath	GV	Gas Valve	SH	Shower Head
BATN	Bath	GW	Gas Work	SI	Shower Inlet
BATV	Bath	GX	Gas X-ray	SJ	Shower Jet
BBS	Bath	GY	Gas Yoke	SK	Shower Kit
BBSL	Bath	HA	Hand	SL	Shower Liner
BBSL	Bath	HB	Hand	SM	Shower Mat
BBSL	Bath	HC	Hand	SN	Shower Nozzle
BBSL	Bath	HD	Hand	SO	Shower Outlet
BBSL	Bath	HE	Hand	SP	Shower Pan
BBSL	Bath	HF	Hand	SR	Shower Rack
BBSL	Bath	HG	Hand	SS	Shower Screen
BBSL	Bath	HH	Hand	ST	Shower Tank
BBSL	Bath	HI	Hand	SV	Shower Valve
BBSL	Bath	HJ	Hand	SW	Shower Wall
BBSL	Bath	HK	Hand	SY	Shower Yoke
BBSL	Bath	HL	Hand	TA	Shower Tray
BBSL	Bath	HM	Hand	TB	Shower Tub
BBSL	Bath	HN	Hand	TC	Shower Tub
BBSL	Bath	HO	Hand	TD	Shower Tub
BBSL	Bath	HP	Hand	TE	Shower Tub
BBSL	Bath	HQ	Hand	TF	Shower Tub
BBSL	Bath	HR	Hand	TH	Shower Tub
BBSL	Bath	HS	Hand	TI	Shower Tub
BBSL	Bath	HT	Hand	TJ	Shower Tub
BBSL	Bath	HU	Hand	TK	Shower Tub
BBSL	Bath	HV	Hand	TL	Shower Tub
BBSL	Bath	HW	Hand	TM	Shower Tub
BBSL	Bath	HX	Hand	TO	Shower Tub
BBSL	Bath	HY	Hand	TP	Shower Tub
BBSL	Bath	IZ	Hand	TR	Shower Tub
BBSL	Bath	IA	Hand	TS	Shower Tub
BBSL	Bath	IB	Hand	TT	Shower Tub
BBSL	Bath	IC	Hand	TU	Shower Tub
BBSL	Bath	ID	Hand	TV	Shower Tub
BBSL	Bath	IE	Hand	TV	Shower Tub
BBSL	Bath	IF	Hand	TV	Shower Tub
BBSL	Bath	IG	Hand	TV	Shower Tub
BBSL	Bath	IH	Hand	TV	Shower Tub
BBSL	Bath	II	Hand	TV	Shower Tub
BBSL	Bath	IJ	Hand	TV	Shower Tub
BBSL	Bath	IK	Hand	TV	Shower Tub
BBSL	Bath	IL	Hand	TV	Shower Tub
BBSL	Bath	IM	Hand	TV	Shower Tub
BBSL	Bath	IN	Hand	TV	Shower Tub
BBSL	Bath	IO	Hand	TV	Shower Tub
BBSL	Bath	IP	Hand	TV	Shower Tub
BBSL	Bath	IQ	Hand	TV	Shower Tub
BBSL	Bath	IR	Hand	TV	Shower Tub
BBSL	Bath	IS	Hand	TV	Shower Tub
BBSL	Bath	IT	Hand	TV	Shower Tub
BBSL	Bath	IU	Hand	TV	Shower Tub
BBSL	Bath	IV	Hand	TV	Shower Tub
BBSL	Bath	IW	Hand	TV	Shower Tub
BBSL	Bath	IX	Hand	TV	Shower Tub
BBSL	Bath	IY	Hand	TV	Shower Tub
BBSL	Bath	IZ	Hand	TV	Shower Tub
BBSL	Bath	JA	Hand	TV	Shower Tub
BBSL	Bath	JB	Hand	TV	Shower Tub
BBSL	Bath	JC	Hand	TV	Shower Tub
BBSL	Bath	JD	Hand	TV	Shower Tub
BBSL	Bath	JE	Hand	TV	Shower Tub
BBSL	Bath	JF	Hand	TV	Shower Tub
BBSL	Bath	JG	Hand	TV	Shower Tub
BBSL	Bath	JH	Hand	TV	Shower Tub
BBSL	Bath	JI	Hand	TV	Shower Tub
BBSL	Bath	JJ	Hand	TV	Shower Tub
BBSL	Bath	JK	Hand	TV	Shower Tub
BBSL	Bath	JL	Hand	TV	Shower Tub
BBSL	Bath	JM	Hand	TV	Shower Tub
BBSL	Bath	JN	Hand	TV	Shower Tub
BBSL	Bath	JO	Hand	TV	Shower Tub
BBSL	Bath	JP	Hand	TV	Shower Tub
BBSL	Bath	JQ	Hand	TV	Shower Tub
BBSL	Bath	JR	Hand	TV	Shower Tub
BBSL	Bath	JS	Hand	TV	Shower Tub
BBSL	Bath	JT	Hand	TV	Shower Tub
BBSL	Bath	JU	Hand	TV	Shower Tub
BBSL	Bath	JV	Hand	TV	Shower Tub
BBSL	Bath	JW	Hand	TV	Shower Tub
BBSL	Bath	JX	Hand	TV	Shower Tub
BBSL	Bath	JY	Hand	TV	Shower Tub
BBSL	Bath	JZ	Hand	TV	Shower Tub
BBSL	Bath	KA	Hand	TV	Shower Tub
BBSL	Bath	KB	Hand	TV	Shower Tub
BBSL	Bath	KC	Hand	TV	Shower Tub
BBSL	Bath	KD	Hand	TV	Shower Tub
BBSL	Bath	KE	Hand	TV	Shower Tub
BBSL	Bath	KF	Hand	TV	Shower Tub
BBSL	Bath	KG	Hand	TV	Shower Tub
BBSL	Bath	KH	Hand	TV	Shower Tub
BBSL	Bath	KI	Hand	TV	Shower Tub
BBSL	Bath	KJ	Hand	TV	Shower Tub
BBSL	Bath	KK	Hand	TV	Shower Tub
BBSL	Bath	KL	Hand	TV	Shower Tub
BBSL	Bath	KM	Hand	TV	Shower Tub
BBSL	Bath	KN	Hand	TV	Shower Tub
BBSL	Bath	KO	Hand	TV	Shower Tub
BBSL	Bath	KP	Hand	TV	Shower Tub
BBSL	Bath	KQ	Hand	TV	Shower Tub
BBSL	Bath	KR	Hand	TV	Shower Tub
BBSL	Bath	KS	Hand	TV	Shower Tub
BBSL	Bath	KT	Hand	TV	Shower Tub
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BBSL	Bath	KW	Hand	TV	Shower Tub
BBSL	Bath	KX	Hand	TV	Shower Tub
BBSL	Bath	KY	Hand	TV	Shower Tub
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BBSL	Bath	LC	Hand	TV	Shower Tub
BBSL	Bath	LD	Hand	TV	Shower Tub
BBSL	Bath	LE	Hand	TV	Shower Tub
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BBSL	Bath	LG	Hand	TV	Shower Tub
BBSL	Bath	LH	Hand	TV	Shower Tub
BBSL	Bath	LI	Hand	TV	Shower Tub
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BBSL	Bath	LL	Hand	TV	Shower Tub
BBSL	Bath	LM	Hand	TV	Shower Tub
BBSL	Bath	LN	Hand	TV	Shower Tub
BBSL	Bath	LO	Hand	TV	Shower Tub
BBSL	Bath	LP	Hand	TV	Shower Tub
BBSL	Bath	LP	Hand	TV	Shower Tub

A	DRONE SURVEY AREA EXTENDED	NC	09/23
REV.	DETAILS	BY	DATE

ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS	DATUM ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS
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LEEDS 0113 261 8730 RUGBY 0113 261 8730 LONDON 01732 746695



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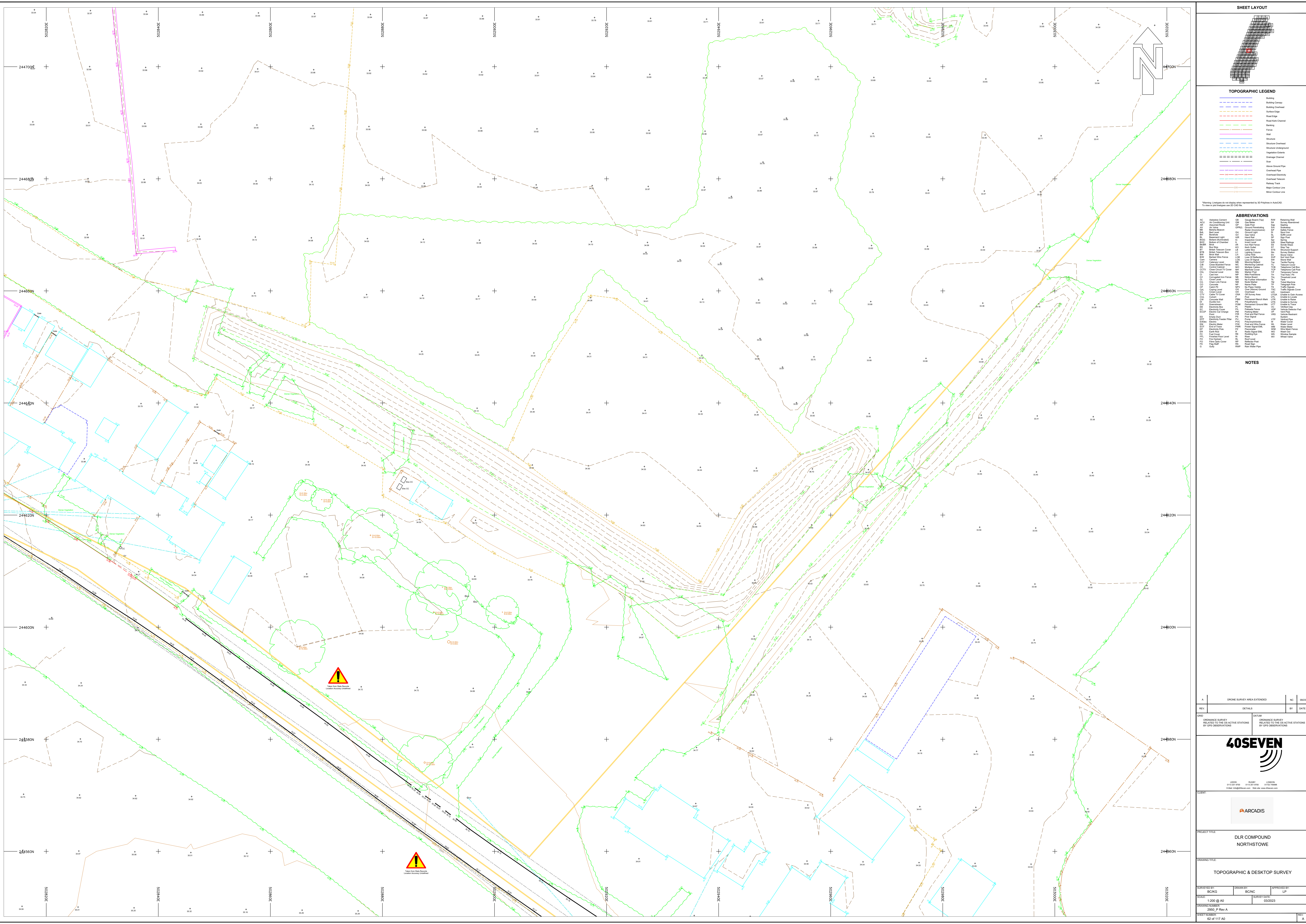
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SCALE:		SURVEY DATE:

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DRAWING NUMBER:	

2850_P Rev A

SHEET NUMBER:	REV:
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SHEET LAYOUT

TOPOGRAPHIC LEGEND

ABBREVIATIONS

NOTES

A

ORION SURVEY AREA EXTENDED

1C

0021

REV

DETAILS

BY

DATE

GRID

ORION SURVEY AREA EXTENDED

ORION SURVEY AREA EXTENDED

DATUM

ORION SURVEY AREA EXTENDED

40SEVEN

LEADS

RUGBY

LONDON

0113 231 1000

0113 231 1000

0113 231 1000

CLIENT

PROJECT TITLE

DLR COMPOUND NORTHSTOWE

DRAWING TITLE

TOPOGRAPHIC & DESKTOP SURVEY

SURVEYED BY

BCNG

APPROVED BY

LP

SCALE

1:200 @ A0

SURVEY DATE

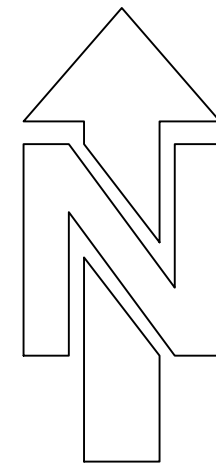
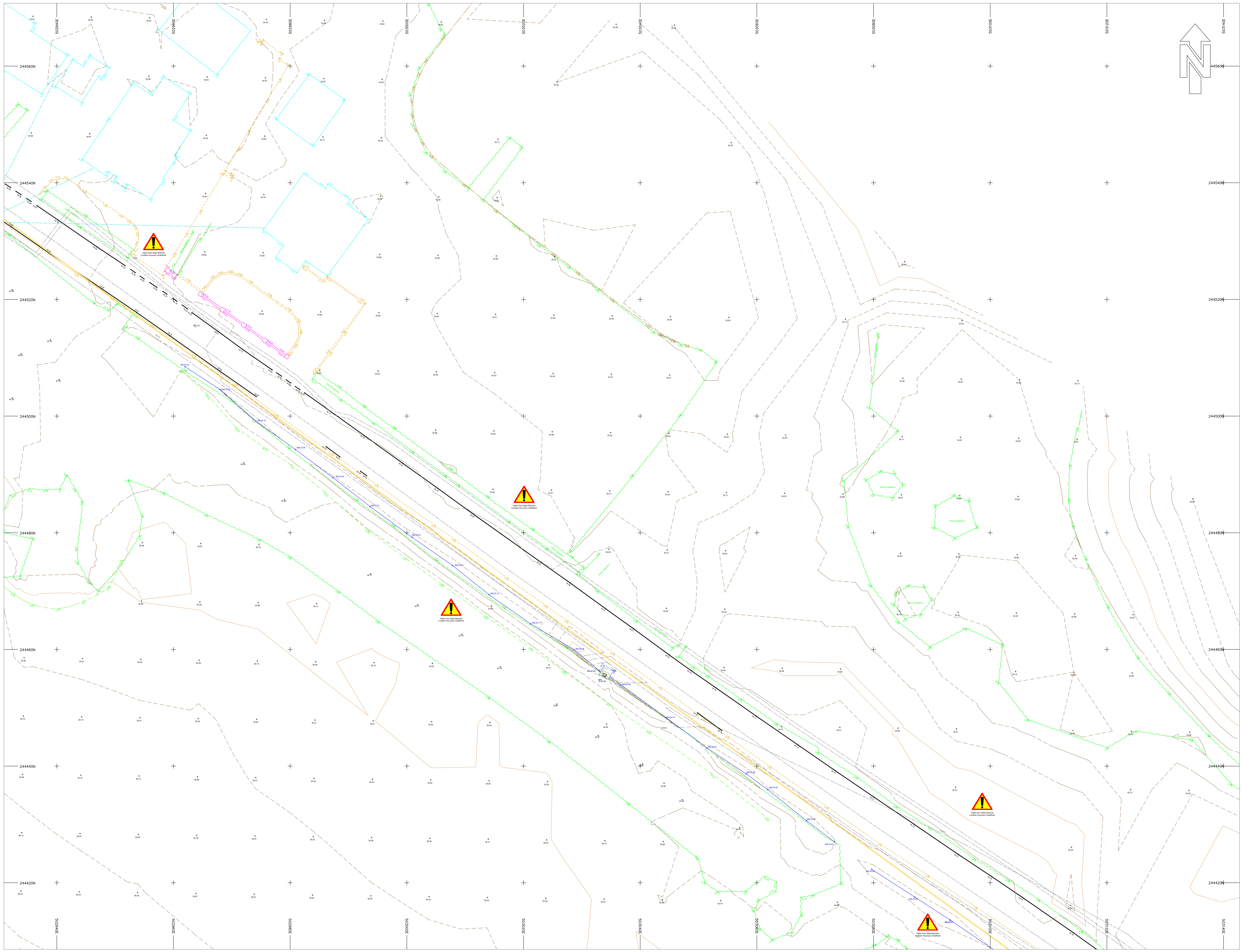
03/2023

DRAWING NUMBER

2000_P Rev A

SHEET NUMBER

62 of 117 A0



SHEET LAYOUT



TOPOGRAPHIC LEGEND

- Building Contour
- Building Footprint
- Building Edge
- Road Edge
- Road Kerb Channel
- Roadway
- Fence
- Wall
- Structure
- Structure Overhead
- Structure Underpass
- Vegetation Extent
- Drainage Channel
- Drain
- Overhead Pipe
- Overhead Electricity
- Overhead Telecom
- Railway Track
- Major Contour Line
- Minor Contour Line

*Warning: Linework is not display when represented by 3D Polygons in AutoCAD
To view or plot linework use 2D CAD file

ABBREVIATIONS

- AC Air Conditioning Unit
- AD Air Duct
- AE Air Exhaust
- AF Air Filter
- AG Air Gas
- AL Air Line
- AM Air Manifold
- AN Air Nozzle
- AO Air Outlet
- AP Air Pipe
- AR Air Register
- AS Air Supply
- AT Air Terminal
- AV Air Valve
- AW Air Way
- AX Air X
- AY Air Y
- AZ Air Z
- BA Back
- BB Back
- BC Back
- BD Back
- BE Back
- BF Back
- BG Back
- BH Back
- BI Back
- BJ Back
- BK Back
- BL Back
- BM Back
- BN Back
- BO Back
- BP Back
- BQ Back
- BR Back
- BS Back
- BT Back
- BV Back
- BW Back
- BX Back
- BY Back
- BZ Back
- CA Cable
- CB Cable
- CC Cable
- CD Cable
- CE Cable
- CF Cable
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- CK Cable
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- CO Cable
- CP Cable
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- CV Cable
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- CZ Cable
- DA Dam
- DB Dam
- DC Dam
- DD Dam
- DE Dam
- DF Dam
- DG Dam
- DH Dam
- DI Dam
- DJ Dam
- DK Dam
- DL Dam
- DM Dam
- DN Dam
- DO Dam
- DP Dam
- DQ Dam
- DR Dam
- DS Dam
- DT Dam
- DV Dam
- DW Dam
- DX Dam
- DY Dam
- DZ Dam
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- EC East
- ED East
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- EG East
- EH East
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- EJ East
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- EL East
- EM East
- EN East
- EO East
- EP East
- EQ East
- ER East
- ES East
- ET East
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- EW East
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- FT Fall
- FU Fall
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- GR Gas
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- GX Gas
- GY Gas
- GZ Gas
- HA Heat
- HB Heat
- HC Heat
- HD Heat
- HE Heat
- HF Heat
- HG Heat
- HH Heat
- HI Heat
- HJ Heat
- HK Heat
- HL Heat
- HM Heat
- HN Heat
- HO Heat
- HP Heat
- HQ Heat
- HR Heat
- HS Heat
- HT Heat
- HV Heat
- HW Heat
- HX Heat
- HY Heat
- HZ Heat
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- IB Ice
- IC Ice
- ID Ice
- IE Ice
- IF Ice
- IG Ice
- IH Ice
- II Ice
- IJ Ice
- IK Ice
- IL Ice
- IM Ice
- IN Ice
- IO Ice
- IP Ice
- IQ Ice
- IR Ice
- IS Ice
- IT Ice
- IV Ice
- IW Ice
- IX Ice
- IY Ice
- IZ Ice
- JA Jet
- JB Jet
- JC Jet
- JD Jet
- JE Jet
- JF Jet
- JG Jet
- JH Jet
- JI Jet
- IJ Jet
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- LP Jet
- LQ Jet
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- LT Jet
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- ME Man
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- NP North
- NQ North
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- NT North
- NV North
- NW North
- NX North
- NY North
- NZ North
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- OB Oil
- OC Oil
- OD Oil
- OE Oil
- OF Oil
- OG Oil
- OH Oil
- OI Oil
- OJ Oil
- OK Oil
- OL Oil
- OM Oil
- ON Oil
- OO Oil
- OP Oil
- OQ Oil
- OR Oil
- OS Oil
- OT Oil
- OV Oil
- OW Oil
- OX Oil
- OY Oil
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- ZV Z
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- ZX Z
- ZY Z
- ZZ Z

NOTES

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- 2. The survey was carried out in accordance with the requirements of the British Standard BS 5400-7:1993.
- 3. The survey was carried out in accordance with the requirements of the British Standard BS 5400-8:1993.
- 4. The survey was carried out in accordance with the requirements of the British Standard BS 5400-9:1993.
- 5. The survey was carried out in accordance with the requirements of the British Standard BS 5400-10:1993.
- 6. The survey was carried out in accordance with the requirements of the British Standard BS 5400-11:1993.
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- 62. The survey was carried out in accordance with the requirements of the British Standard BS 5400-67:1993.
- 63. The survey was carried out in accordance with the requirements of the British Standard BS 5400-68:1993.
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- 93. The survey was carried out in accordance with the requirements of the British Standard BS 5400-98:1993.
- 94. The survey was carried out in accordance with the requirements of the British Standard BS 5400-99:1993.
- 95. The survey was carried out in accordance with the requirements of the British Standard BS 5400-100:1993.

A	CRONE SURVEY AREA EXTENDED	YC	0025
REV	DETAILS	BY	DATE

GRID	CRONE SURVEY AREA EXTENDED	DATUM	0025
CRONE SURVEY AREA EXTENDED	CRONE SURVEY AREA EXTENDED	CRONE SURVEY AREA EXTENDED	CRONE SURVEY AREA EXTENDED



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www.40seven.co.uk www.40seven.co.uk www.40seven.co.uk



PROJECT TITLE
DLR COMPOUND
NORTHSTOWE

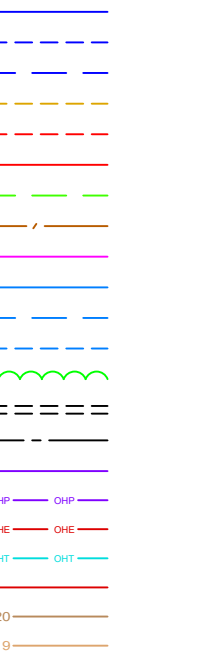
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TOPOGRAPHIC & DESKTOP SURVEY

SURVEYED BY: BCNG DRAWN BY: BCNG APPROVED BY: LP

SCALE: 1:200 @ A0 SURVEY DATE: 03/2023
DRAWING NUMBER: 2800_P Rev A
SHEET NUMBER: 67 of 117 A0



TOPOGRAPHIC LEGEND



*Warning: Linetypes do not display when represented by 3D Polylines in AutoCAD.
To view or plot linetypes use 2D CAD file.

ABBREVIATION

[illegible]

NOTE

IV.	DRONE SURVEY AREA EXTENDED	NC	08/2024
	DETAILS	BY	08/2024

ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS	DATUM ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATION BY GPS OBSERVATIONS
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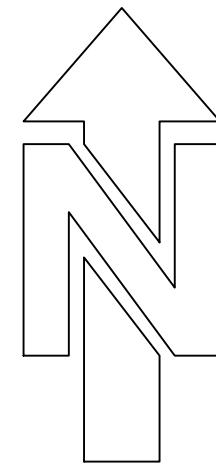
DLR COMPOUND
NORTHSTOWE



GRAPHIC & DESKTOP SURF

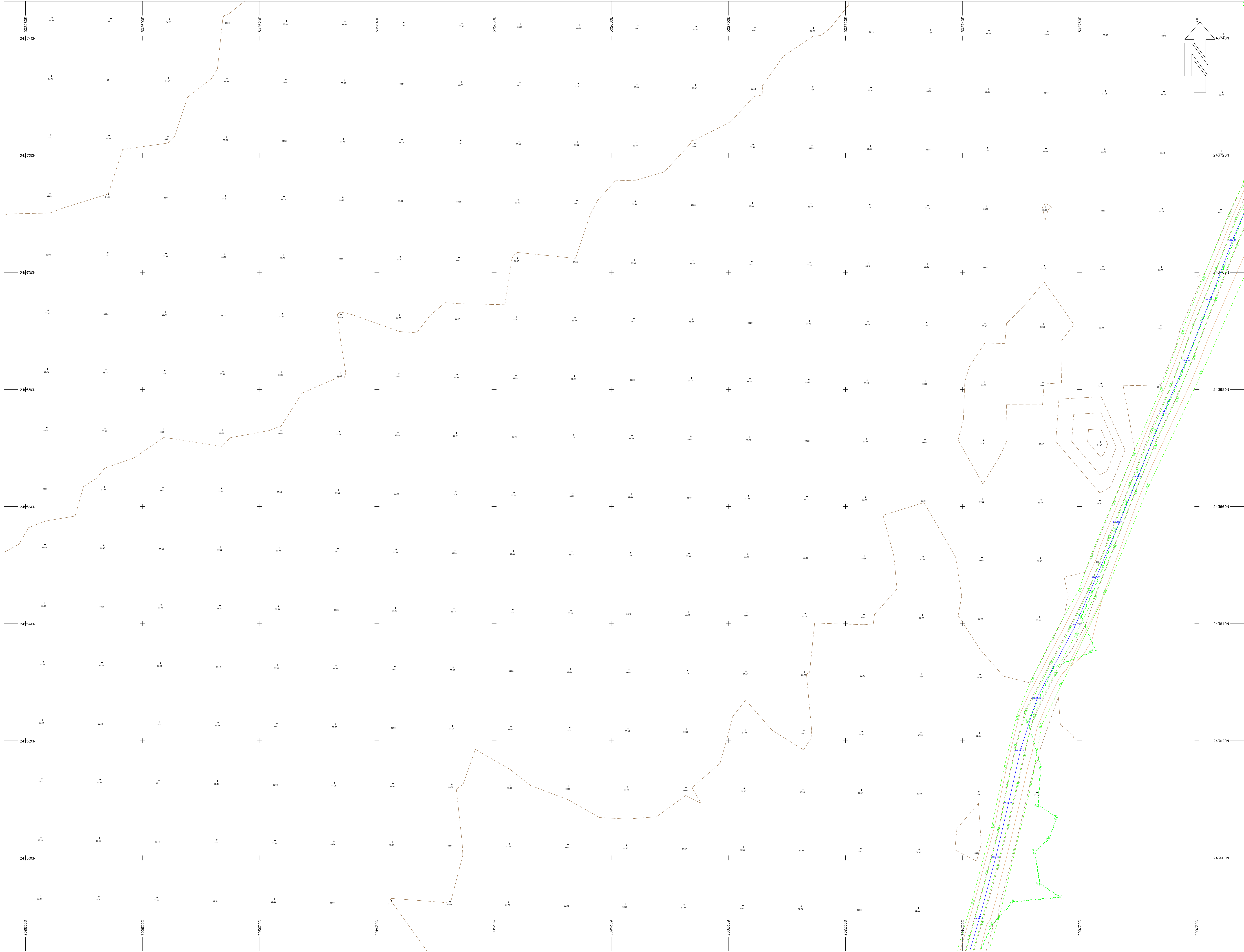
DRAWN BY: BC/MC	APPROV
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SURVEY DATE:

	03/2023
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REV	DETAILS			BY	DATE
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0175 231 8776		0193 231 8776		07742 168466	
01662 418426		01662 418426		01662 418426	
CLIENT:					
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PROJECT TITLE					
DLR COMPOUND NORTHSTOWE					
DRAWING TITLE					
TOPOGRAPHIC & DESKTOP SURVEY					
SURVEYED BY BCNC		DRAWN BY BCNC		APPROVED BY LP	
SCALE 1:200 @ A0		SURVEY DATE 03/2023			
DRAWING NUMBER 2950_P Rev A					
SHEET NUMBER 99 of 117 A0					REV



SHEET LAYOUT

TOPOGRAPHIC LEGEND

---	Building Contour
---	Building Contour
---	Building Edge
---	Road Edge
---	Road Kerb Channel
---	Road
---	Structure
---	Structure Overhead
---	Structure Underpass
---	Vegetation Extents
---	Drainage Channel
---	Drain
---	Along Road Pipe
---	Overhead Pipe
---	Overhead Electricity
---	Overhead Telecom
---	Railway Track
---	Major Contour Line
---	Minor Contour Line

ABBREVIATIONS

AC	Asbestos Contaminant	AD	Asbestos Deposit	ADN	Asbestos Deposit
ACU	Air Conditioning Unit	ADP	Air Duct Penetration	ADP	Air Duct Penetration
AD	Asbestos Deposit	ADP	Air Duct Penetration	ADP	Air Duct Penetration
ADP	Air Duct Penetration	ADP	Air Duct Penetration	ADP	Air Duct Penetration
ADP	Air Duct Penetration	ADP	Air Duct Penetration	ADP	Air Duct Penetration
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ADP	Air Duct Penetration	ADP	Air Duct Penetration	ADP	Air Duct Penetration

NOTES

A	CRIME SURVEY AREA EXTENDED	1C	0001
REV	DETAILS	BY	DATE

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CLIENT:

PROJECT TITLE:

DLR COMPOUND NORTHSTOWE

DRAWING TITLE:

TOPOGRAPHIC & DESKTOP SURVEY

SURVEYED BY:

BCNG

APPROVED BY:

LP

SCALE:

1:200 @ A0

SHEET DATE:

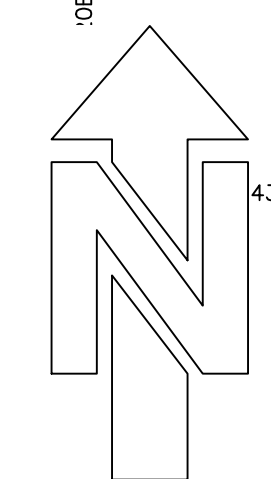
03/2023

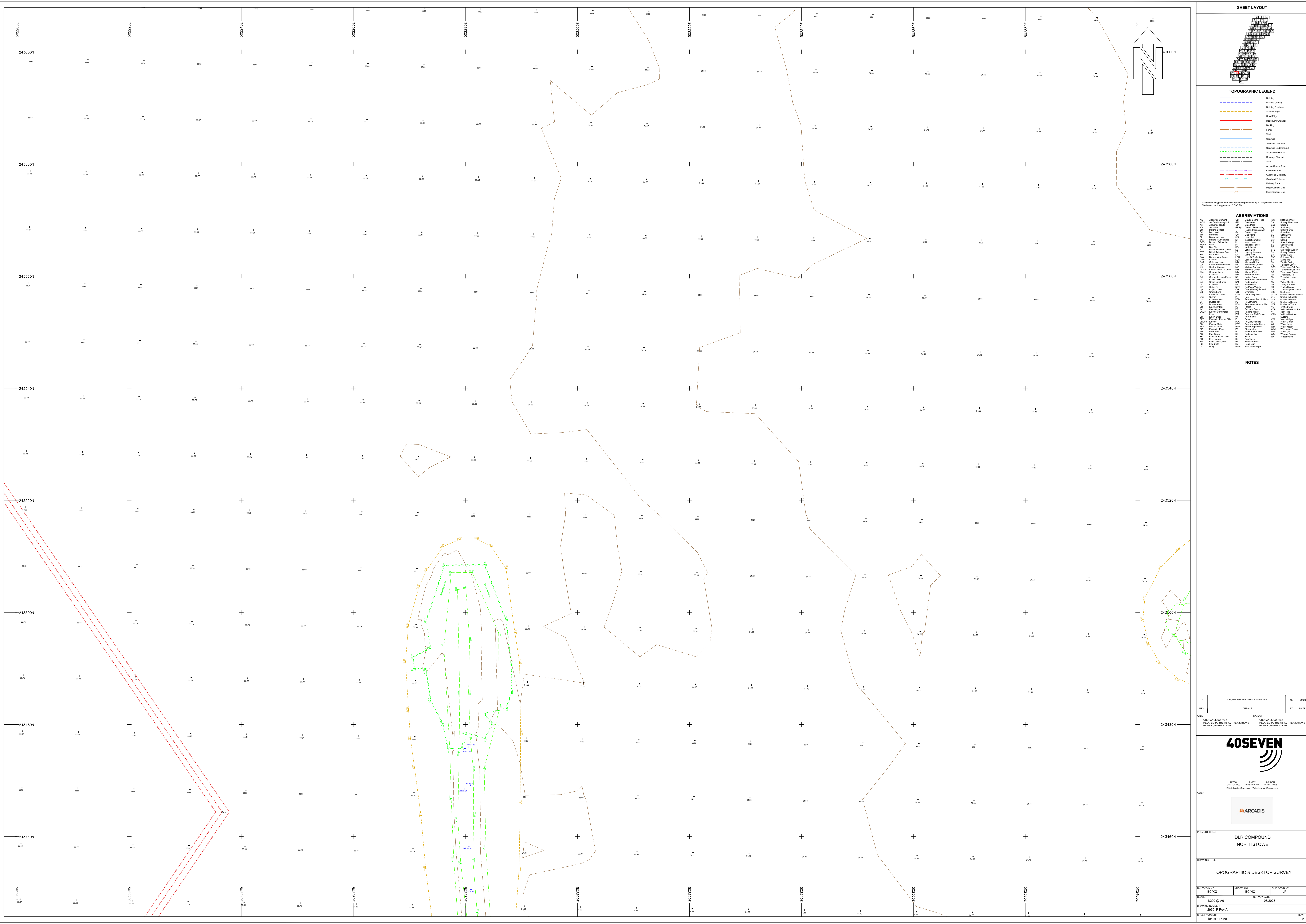
DRAWING NUMBER:

2500_P Rev A

SHEET NUMBER:

101 of 117 A0

[illegible]



SHEET LAYOUT

TOPOGRAPHIC LEGEND

ABBREVIATIONS

NOTES

Warning: Linetypes do not display when represented by 3D Plotlines in AutoCAD.
To view all plot linetypes use 2D CAD Plot.

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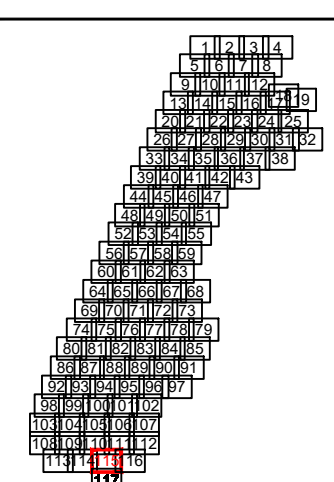
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SHEET LAYOUT



TOPOGRAPHIC LEGEND

	Building
	Building Canopy
	Building Overhead
	Surface Edge
	Road Edge
	Road Kerb Channel
	Banking
	Fence
	Wall
	Structure
	Structure Overhead
	Structure Underlay
	Vegetative Extension
	Drainage Channel
	Solar
	Above Ground Pipe
	Overhead Pipe
	Overhead Electrode
	Overhead Telecommunications
	Railway Track
	Major Corridor Line
	Minor Corridor Line

*Warning: Linetypes do not display when represented by 3D Polylines in AutoCAD. To view or plot linetypes use 2D CAD file.

ABBREVIATION

[illegible]

NOTE

A	DRONE SURVEY AREA EXTENDED	NC	06/23
REV.	DETAILS	BY	DATE

GRID	DATUM
ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS	ORDNANCE SURVEY RELATED TO THE OS ACTIVE STATIONS BY GPS OBSERVATIONS



LEEDS 0113 291 9700 RUGBY 0113 291 9700 LONDON 01732 34000

CUEN



PROJECT TITLE: DLR COMPOUND
NORTHSTOWE

DRAWING TITLE:

TOPOGRAPHIC & DESKTOP SURVEY

SURVEYED BY: BC/KG		DRAWN BY: BC/NC		APPROVED BY: LP	
SCALE: 1:200 @ A0			SURVEY DATE: 03/2023		
DRAWING NUMBER: 2950_P Rev A					
SHEET NUMBER: 115 of 117 A0					REV: A

