

ENVIRONMENT

Redrow Homes Ltd (Harrow Estates Division)
Land East of the Common
Barwell
Flood Risk Assessment

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EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance. It has been produced on behalf of Redrow Homes Limited in respect of a planning application for proposed residential use at Land East of The Common, Barwell.

This report demonstrates that the proposed development is not at significant flood risk, subject to the recommended flood mitigation strategies being implemented.

The Site is located entirely within Flood Zone 1 and is not considered to be at risk from Main Rivers. There is an unnamed ordinary watercourse to the west and south of the Site; however, topography and surface water mapping indicates that water would be expected to flow away from the Site.

Whilst the Site is largely at a very low risk of surface water flooding, there are several small areas at low risk of surface water flooding associated with ditches throughout the Site. However, the pluvial depths in these areas are indicated to be below 150mm, suggesting that they will pose a low risk to the Site. Within the south-western part of the Site, there is a flow path of low risk running in a southerly direction to an area of surface water ponding outside of the Site's boundary. However, the catchment area contributing to the flow route originates largely within the site boundary and will, therefore, be managed by the Site drainage strategy.

The proposed development will increase the area of impermeable surfaces at the Site which will increase rates and volumes of surface water runoff. This will be mitigated via surface water attenuation and storage, detailed in a separate SDS (ref LCB-BWB-ZZ-XX-RP-CD-0001_SDS).

The planned development Site has been assessed across a further range of potential flood risk sources; these include canals, groundwater, reservoirs and large waterbodies, and sewers. None of these sources were found to present a potential barrier to development.

It is recommended that finished floor levels are raised a minimum of 150mm above adjacent ground levels to reduce the residual risk of flooding from pluvial and groundwater sources. No dwellings should be located within topographical depressions, and ground levels should be profiled to encourage pluvial runoff and overland flows away from vulnerable infrastructure and towards the nearest drainage point.

In compliance with the requirements of NPPF, and subject to the mitigation measures proposed, the development could proceed without being subject to significant flood risk. Moreover, the development will not increase flood risk to the wider catchment area as a result of suitable management of surface water runoff discharging from the Site.

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1. INTRODUCTION

- 1.1 This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance. The FRA has been produced on behalf of Redrow Homes Limited in respect of a planning application for a residential development on the land east of The Common, Barwell.
- 1.2 This FRA is intended to support an outline planning application, the level of detail included is commensurate and subject to the nature of the proposals at the planning stage. Summary information is included as **Table 1.1**.

Table 1.1: Site Summary

Site Name	Land East of the Common
Location	Barwell
NGR (approx.)	SP450965
Application Site Area (ha)	10.9 (approx.)
Development Type	Residential
Flood Zone Classification	Flood Zone 1
NPPF Vulnerability	More Vulnerable
Anticipated Development Lifetime	100+ years
Environment Agency Office	East Midlands
Lead Local Flood Authority	Leicestershire County Council
Local Planning Authority	Hinckley and Bosworth Borough Council

Sources of Data

- i. Topographical Survey by Geomatics Surveys Ltd, reference 02663/Topo
- ii. OS Explorer Series Mapping
- iii. Environment Agency Consultation
- iv. Environment Agency Risk of Flooding from Surface Water Data
- v. Leicestershire and Leicester City Level 1 Strategic Flood Risk Assessment
- vi. Hinckley and Bosworth Borough Council Level 1 Strategic Flood Risk Assessment
- vii. Leicestershire County Council Preliminary Flood Risk Assessment
- viii. Leicestershire County Council Local Flood Risk Management Strategy

- ix. Humber River Basin District Flood Risk Management Plan
- x. Leicestershire County Council Section 19 Reports
- xi. Site Visit Undertaken by BWB Consulting Ltd (September 1st, 2021)
- xii. Severn Trent Sewer Records
- xiii. Severn Trent Water Pre- Development Enquiry
- xiv. Premium Environmental Services CCTV Survey and Drainage Survey Report
- xv. British Geological Survey (BGS) Drift & Geology Maps

Existing Site

- 1.3 The existing Site is greenfield, composed of agricultural land. The Site is bound to the north by Dawson's Lane, to the east by existing fields, to the south by the A47, and to the west by The Common. The Site is made up of various parcels of greenfield land, separated by hedgerows and trees. The Site is currently used for agriculture and paddock, with a few outbuildings located in the north.
- 1.4 The Site's location is illustrated within **Figure 1.1**.

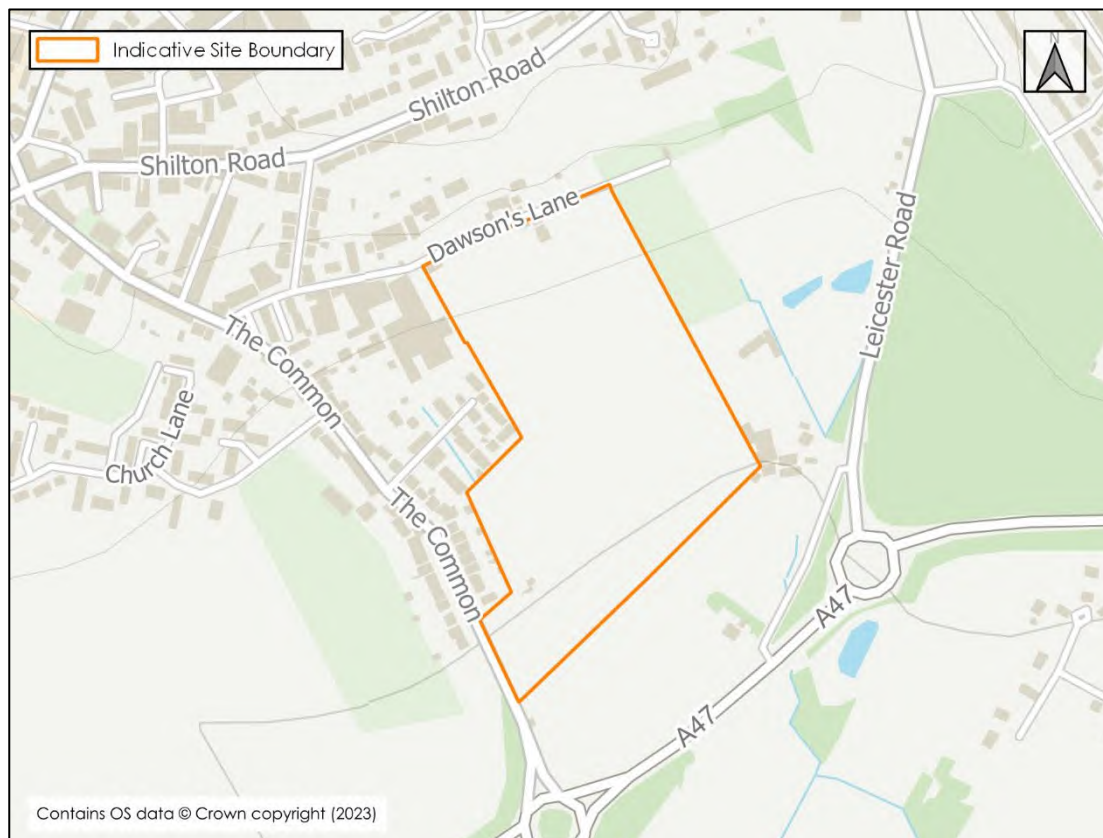


Figure 1.1: Site Location

- 1.5 A review of the topographical survey (**Appendix 1**) alongside Environment Agency (EA) 2022 1m resolution Light Detection and Ranging (LiDAR) data (shown in **Figure 1.2**) indicates that the Site falls in a south-easterly direction, with levels ranging from

approximately 116 metres Above Ordnance Datum (m AOD) in the north to 98m AOD in the south.

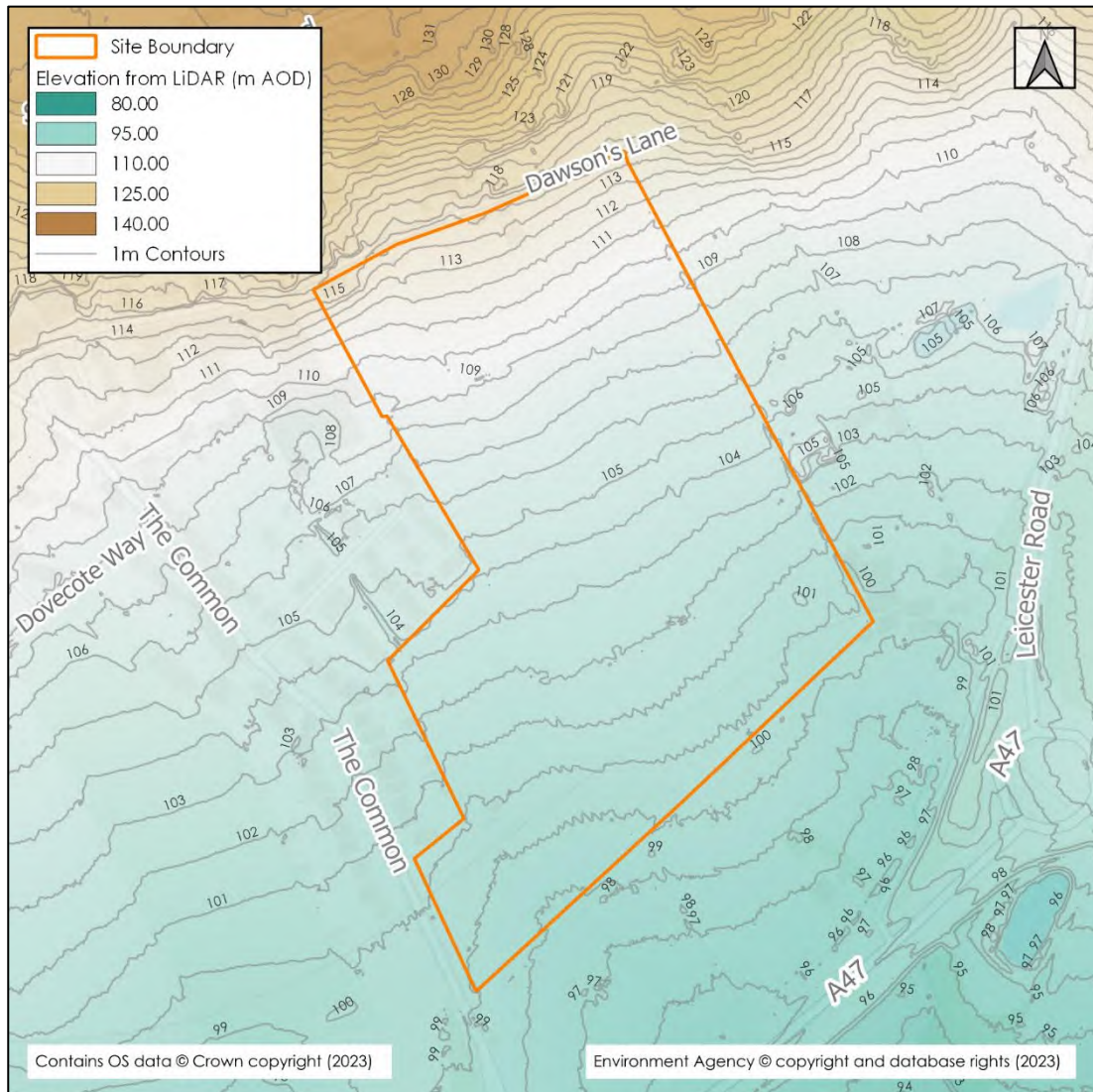


Figure 1.2: Site Topography from EA LiDAR Data

Proposed Development

- 1.6 The application is made in outline with all matters, except for access, reserved. The proposed development comprises the demolition of all buildings on site and development of up to 95 dwellings, together with associated access, open space and landscaping. The application is supported by an Illustrative Masterplan (included as **Appendix 2**) which sets out the Applicant's particular proposals for the site, including strategic landscaping proposals, demonstrating why this proposal should be considered acceptable.

2. FLOOD RISK PLANNING POLICY & GUIDANCE

National Planning Policy Framework

- 2.1 The NPPF¹ sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. Planning Practice Guidance is also available online².
- 2.2 The Planning Practice Guidance sets out the vulnerability to flooding of different land uses. It encourages development to be located in areas of lower flood risk where possible and stresses the importance of preventing increases in flood risk off Site to the wider catchment area.
- 2.3 The Planning Practice Guidance also states that alternative sources of flooding, other than fluvial (river flooding), should be considered when preparing a Flood Risk Assessment.
- 2.4 The Planning Practice Guidance includes a series of tables that define Flood Zones (Table 1), the flood risk vulnerability classification of development land uses (Table 2) and 'compatibility' of development within the defined Flood Zones (Table 3). Table 2 and Table 3 are recreated within **Appendix 3** of this report for reference.
- 2.5 This Flood Risk Assessment is written in accordance with the NPPF and the Planning Practice Guidance.

Flood Map for Planning

- 2.6 With particular reference to planning and development, the Flood Map for Planning identifies Flood Zones in accordance with Table 1 of the Planning Practice Guidance. Further details on the Flood Zone classifications are outlined in **Table 2.1**.

Table 2.1: Flood Zone Classifications

Flood Zone	Description
Flood Zone 1 (Low Probability)	Land having less than a 1 in 1000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability). All land outside of Flood Zone 2 and 3.
Flood Zone 2 (Medium Probability)	Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1% AEP); or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1% AEP).
Flood Zone 3a (High Probability)	Land having a 1 in 100 or greater annual probability of river flooding (>1% AEP); or land having a 1 in 200 or greater annual probability of flooding from the sea (>0.5% AEP). This is represented by "Flood Zone 3" on the Flood Map for Planning.

¹ Revised National Planning Policy Framework, Ministry of Housing, Communities & Local Government, amended 2021

² Planning Practice Guidance: <https://www.gov.uk/government/collections/planning-practice-guidance>

Flood Zone	Description
Flood Zone 3b (The Functional Floodplain)	Flood Zone 3b (The Functional Floodplain) is defined as land where water must flow or be stored in times of flood. This is not identified or separately distinguished from Zone 3a on the Flood Map for Planning.

2.7 The Site is shown to be located entirely within Flood Zone 1, as shown in **Figure 2.1**.

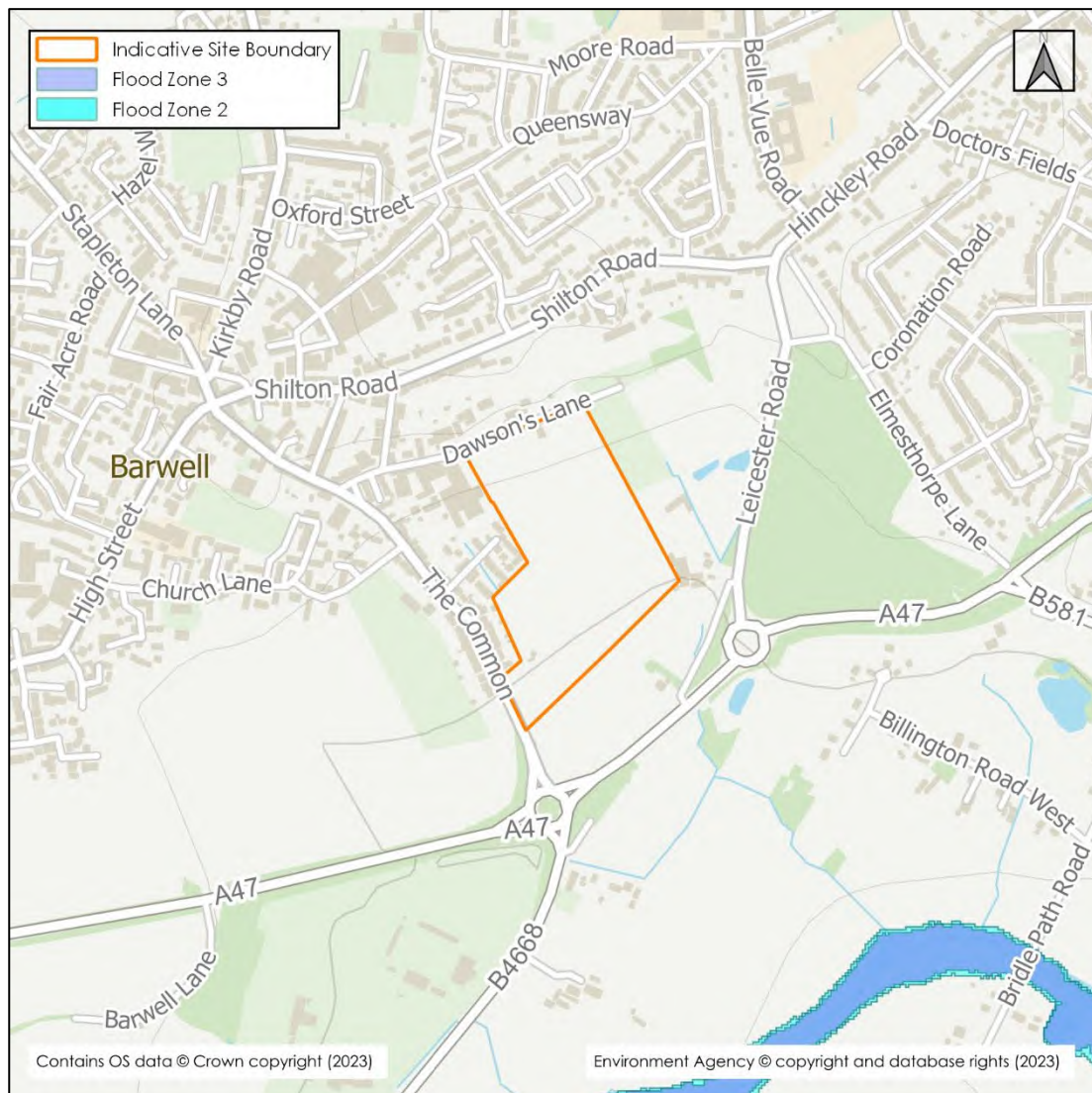


Figure 2.1: Flood Map for Planning

The Design Flood

- 2.8 The Planning Practice Guidance identifies that new developments should be designed to provide adequate flood risk management, mitigation, and resilience against the 'design flood' for their lifetime.
- 2.9 This is a flood event of a given annual flood probability, which is generally taken as fluvial (river) and surface water (pluvial) flooding likely to occur with a 1% annual probability

(a 1 in 100 chance each year), or tidal flooding with a 0.5% annual probability (1 in 200 chance each year), against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.

Climate Change

Peak River Flow

- 2.10 Predicted future changes in peak river flows caused by climate change are provided by the Environment Agency (EA)³, with a range of projections applied to regionalised 'River Basin Districts', which are further subdivided into Management Catchments.
- 2.11 The Site falls within the Soar Management Catchment of the Humber River Basin District. **Table 2.2** identifies the relevant peak river flow climate change allowances from this Management Catchment.

Table 2.2: Peak River Flow Climate Change Allowances for the Soar Management Catchment within the Humber River Basin District

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	28%	35%	60%
Higher Central	18%	21%	37%
Central	14%	16%	28%

- 2.12 When determining the appropriate allowance for use in a Flood Risk Assessment the Flood Zone classification, flood risk vulnerability and the anticipated lifespan of the development should be considered. **Table 2.3** provides a matrix summarising the EA's guidance on determining the appropriate allowance(s).

Table 2.3: Application of Appropriate Peak River Flow Climate Change Allowances

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	Use the central allowance where a location may fall within Flood Zone 2 or 3 in the future.				
2	Use the higher central allowance	Use the central allowance			
3a	Use the higher central allowance	Development should not be permitted	Use the central allowance		

³ Environment Agency, Flood risk assessments: climate change allowances: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>. Last Accessed November 2023.

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
3b	Use the higher central allowance	Development should not be permitted			Use the central allowance
If development is considered appropriate by the local authority when not in accordance with Flood Zone vulnerability categories, then it would be appropriate to use the higher central allowance.					

- 2.13 The Site is located entirely within Flood Zone 1, the proposed development is classified as 'more vulnerable', and it has an anticipated lifespan of 100+ years. Therefore, the Central allowance for the '2080s' epoch will be considered.
- 2.14 However, since the Site is elevated approximately 7m above the nearest Flood Zone extents, it is considered that the Site is unlikely to fall within Flood Zone 2 or 3 in the future. As such, climate change will not be discussed further within this report.

Strategic Flood Risk Assessment

- 2.15 A Strategic Flood Risk Assessment (SFRA) is a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future.
- 2.16 The Leicestershire and Leicester City Level 1 SFRA⁴ has been reviewed in the production of this FRA. Furthermore, the Hinckley and Bosworth Borough Council Level 1 SFRA⁵ has also been assessed. The SFRAs provide information specific to the Site location in the form of fluvial, surface water and groundwater flood risk mapping, as well as records of historical flooding. Information from these sources will be referenced within **Section 3** where applicable.
- 2.17 The Hinckley and Bosworth Borough Council Level 2 SFRA⁶ was produced to facilitate the application of Sequential and Exception Tests to screen allocated development Sites. The proposed application Site is not referenced within the Level 2 SFRA.

Preliminary Flood Risk Assessment

- 2.18 A Preliminary Flood Risk Assessment (PFRA) is an assessment of floods that have taken place in the past and floods that could take place in the future. It generally considers flooding from surface water runoff, groundwater and ordinary watercourses, and is prepared by the Lead Local Flood Authorities (LLFAs).
- 2.19 The Leicestershire County Council PFRA⁷ considers flooding from surface water runoff, groundwater, ordinary watercourses, and canals. It also references the historical river flooding which occurred in the local area in 1998, 2007 and an unknown date. However,

⁴Level 1 Strategic Flood Risk Assessment (JBA Consulting, October 2017)

⁵Level 1 Strategic Flood Risk Assessment (JBA Consulting, July 2019)

⁶Level 2 Strategic Flood Risk Assessment (JBA Consulting, May 2020)

⁷Preliminary Flood Risk Assessment (Leicestershire County Council, June 2011)

no historical instances of flooding at the Site are referenced. Information from the PFRA will be referenced within this report where applicable.

- 2.20 An Addendum⁸ to the Leicestershire County Council PFRA was produced in 2017 to update the council's PFRA published in 2011. This document has been reviewed in relation to the Site's location, but no relevant updates were identified.

Local Flood Risk Management Strategy

- 2.21 A Local Flood Risk Management Strategy (LFRMS) is prepared by an LLFA to help understand and manage flood risk at a local level.
- 2.22 The LFRMS aims to ensure that the knowledge of local flood risk issues is communicated effectively so that they can be better managed. The LFRMS also aims to promote sustainable development and environmental protection.
- 2.23 The Leicestershire County Council LFRMS⁹ has been reviewed and will be referenced within this report where applicable.
- 2.24 An updated draft LFRMS for public consultation¹⁰ has also been reviewed and will be referenced within this report where applicable.

River Basin Flood Risk Management Plan

- 2.25 Flood Risk Management Plans (FRMPs) explain the risk of flooding from rivers, the sea, surface water, groundwater and reservoirs. FRMPs set out how risk management authorities will work with communities to manage flood and coastal risk. Risk management authorities include the Environment Agency, Natural Resources Wales, local councils, internal drainage boards, Highways England and LLFAs.
- 2.26 The first FRMPs were published in March 2016. They described actions to manage flood risk across England between 2015 to 2021. The most recent revisions were published at the end of 2022.
- 2.27 The Site is located within the Humber River Basin District, and the Humber FRMP¹¹ has been reviewed. The relevant Site scale objectives have been considered in **Section 4** of this report.

Section 19 Flood Investigation Reports

- 2.28 Under their duties of the Flood and Water Management Act 2010, LLFAs have a responsibility to publish reports of investigations of flood incidents. A section 19 flood investigation report is a public statement of the circumstances of a historic flood event and what parties have a role in managing the risks. The investigation does not always

⁸ Preliminary Flood Risk Assessment Addendum (Leicestershire County Council, December 2017)

⁹ Local Flood Risk Management Strategy (Leicestershire County Council, March 2015)

¹⁰ Local Flood Risk Management Strategy Draft for Public (Leicestershire County Council, June 2023)

¹¹ Humber River Basin District Flood Risk Management Plans (Environment Agency, December 2022)

give an in-depth analysis of the flood risk or mechanisms, but it can provide a valuable record of past events.

- 2.29 Leicestershire County Council have published 35 Section 19 reports on their website. The reports have been reviewed in relation to the Site's location, but no evidence of flooding at the Site was identified.

Local Plan

- 2.30 The Hinckley and Bosworth Local Plan 2020-2039 Draft¹² outlines the objectives for the growth of the borough up to 2039. The Council are currently working on a new Local Plan which will set out land allocations and planning policies for the period 2020 to 2041. This plan is currently undergoing consultation and is expected to be published shortly.
- 2.31 In the absence of a published updated plan, the Hinckley and Bosworth Local Plan 2020-2039 Draft has been reviewed for policies relating to flood risk, which are included below for reference.

Policy CC02 Flood Risk

- 2.32 Developments in areas at risk of flooding will only be supported where it is demonstrated that:
- I. The Sequential Test has been passed.
 - II. Where required, the Exception Test has been passed.
 - III. The proposed development will not increase the risk of flooding on Site or elsewhere and appropriate floodplain compensation is provided where necessary; and
 - IV. The proposed development, including the access and egress, will be safe and resilient to flooding for its lifetime, taking into account the relevant climate change allowances.
- 2.33 Where development is permitted within flood risk areas, it must demonstrate that, where required, it will reduce fluvial and surface water flood risk and manage residual risk, address the impacts of climate change through appropriate flood mitigation and adaptation measures, including enhancements to existing defences.
- 2.34 All development proposals should, wherever possible, include measures to reduce and manage surface water through appropriate sustainable drainage systems (SuDS) so as to minimise and manage flood risk and improve water quality.

¹² Local Plan (Hinckley and Bosworth Borough Council, June 2021)

Other Relevant Policy and Guidance

- 2.35 This FRA has considered the following documents when assessing sources of flood risk and when recommending mitigation and resilience measures.

Flood Risk to People and New Developments

- 2.36 The Flood Risk to People (FD2321/TR1)¹³ document was prepared as a research project considering flood hazard and factors that affect it.
- 2.37 Flood Risk Assessment Guidance for New Development (FD2320/TR2)¹⁴ provides a framework and guidance for assessing and managing flood risks for new developments and sets flood hazard thresholds.
- 2.38 Hazard ratings are derived using the following equation in line with the above:

$$\text{Hazard Rating} = D * (V+0.5) + DF$$

Where:
D = depth
V = velocity
DF = debris factor

- 2.39 A supplementary note¹⁵ provides clarification of the hazard rating thresholds which should be used for development planning and control use. **Table 2.4** identifies the thresholds of the flood hazard categories.

Table 2.4: Hazard to People¹⁶

Threshold for Flood Hazard Rating	Degree of Flood Hazard	Description
< 0.75	Low	Caution "Flood zone with shallow flowing water or deep standing water"
0.75 - 1.25	Moderate	Danger for some (i.e.: children, the elderly and the infirm) "Danger: Flood Zone with deep or fast flowing water"
1.25 - 2.0	Significant	Danger for most (includes the general public) "Danger: Flood Zone with deep fast flowing water"
2.0 >	Extreme	Danger for all (includes the emergency services) "Extreme Danger: Flood Zone with deep fast flowing water"

¹³ Flood Risk to People Methodology (FD2321/TR1), Defra/Environment Agency, 2006

¹⁴ Flood Risk Assessment Guidance for New Development (FD2320/TR2), Defra/Environment Agency, 2005

¹⁵ Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose – Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1. (http://randd.defra.gov.uk/Document.aspx?Document=FD2321_7400_PR.pdf)

¹⁶ 2008, DEFRA, Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purposes.

Improving the Flood Performance of New Buildings; Flood Resilient Construction

- 2.40 The Flood Resilient Construction¹⁷ document is the outcome of a joint research project between Communities and Local Government and the Environment Agency. A Research and Development Technical Report¹⁸ is also available.
- 2.41 The document provides guidance on flood resilient design and construction and possible techniques and building materials. These documents are referred to in this Flood Risk Assessment and have been considered when recommending mitigation and resilience measures.

Development and Flood Risk – Guidance for the construction industry

- 2.42 The Development and Flood Risk guidance document¹⁹ was prepared to advise on best practice in the assessment and management of flood risk as part of the development process, the document promotes sustainable development in terms of flood risk.
- 2.43 While many of the policies referenced in the document have been superseded, the principles of assessing and managing flood risk sustainably remain the same, and it remains one of the only guidance documents for the implementation of floodplain compensatory storage.

¹⁷ Improving the Flood Performance of New Buildings; Flood Resilient Construction, CLG, May 2007

¹⁸ Flood Resistance and Resilience Solutions; an R&D Scoping Study, Defra/Environment Agency, 2007

¹⁹ C624 Development and Flood Risk – Guidance for the construction industry, CIRIA, 2004

3. POTENTIAL SOURCES OF FLOOD RISK

- 3.1 Flooding can occur from a variety of sources, or combination of sources, which may be natural or artificial. **Table 3.1** below identifies the potential sources of flood risk to the Site in its current condition, and the impacts which the development could have in the wider catchment, prior to mitigation. These are discussed in greater detail in the forthcoming section. The mitigation measures proposed to address flood risk issues and ensure the development is appropriate for its location are discussed within **Section 4.0**.

Table 3.1: Pre-Mitigation Sources of Flood Risk

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Fluvial			X		The Site is located in Flood Zone 1, approximately 670m north of the nearest extents of Flood Zones 2 and 3. Due to the intervening topography, fluvial flood risk is low.
Canals				X	The nearest canal is the Ashby Canal which is located approximately 4.5km west of the Site. Following review of the intervening topography, the Site is located approximately 22m above the nearest canal.
Groundwater			X		The Site is shown to fall within an area predicted to be at a low susceptibility to groundwater flooding.
Reservoirs and waterbodies			X		The Site is shown to fall outside of the area at risk of reservoir failure.
Pluvial runoff			X		The Site is largely at a very low risk of surface water flooding aside from several small areas at low risk associated with ditches and a flow path in the south-western corner. These areas are not expected to pose any significant risk to the development. Furthermore, topographic levels in the surrounding area generally fall away from the Site so any overland flows would likely be routed away from the Site.

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Sewers			X		The nearest public sewer network is located along The Common. Based upon the surrounding topography exceedance flows would be expected to flow away from the Site.
Effect of Development on Wider Catchment		X			The development will increase the area of impermeable surfaces leading to a likely increase in surface water runoff if left unmitigated. The development also has the potential to impede the low-risk surface water flow route in the south-west of the Site.

Fluvial Flood Risk

- 3.2 Flooding from watercourses occurs when flows exceed the capacity of the channel, or where a restrictive structure is encountered, which leads to water overtopping the banks into the floodplain. This process can be exacerbated when debris is mobilised by high flows and accumulates at structures.

Flood Map for Planning

- 3.3 The Site is located in Flood Zone 1, as shown in **Figure 2.1** and is approximately 670m north of the nearest extents of Flood Zones 2 and 3, which are associated with a tributary of the Thurlaston Brook. The Site is elevated approximately 7m above the nearest Flood Zone extents and it is, therefore, considered that the Site is unlikely to fall within Flood Zone 2 or 3 in the future.
- 3.4 The SFRA and PFRA reference no instances of past fluvial flooding at the Site.
- 3.5 A Request for Information was submitted to the EA for any information relating to flood risk at the Site; however, no such data was available due to the Site's location within Flood Zone 1. The EA's response is provided in **Appendix 4** for reference.
- 3.6 The EA Historic Flood Map shows the nearest recorded flood outline to be located approximately 5.8km east of the Site; this is attributed to the Croft Flood in 1993 due to the channel exceeding capacity. This flooding event did not affect the Site.
- 3.7 Overall, the Site is at a low risk of flooding from Main Rivers.

Unnamed Ordinary Watercourses (UOWs)

- 3.8 The Site is located 80m north and 85m west of an unnamed tributary of the Thurlaston Brook. This watercourse is too small to be included within the EA's Flood Map for Planning. However, surface water mapping can be used to provide an indication of the possible flood extents. An extract of the EA's Risk of Flooding from Surface Water (RoFSW) Extent mapping overlain against the UOW is included as **Figure 3.1** below.

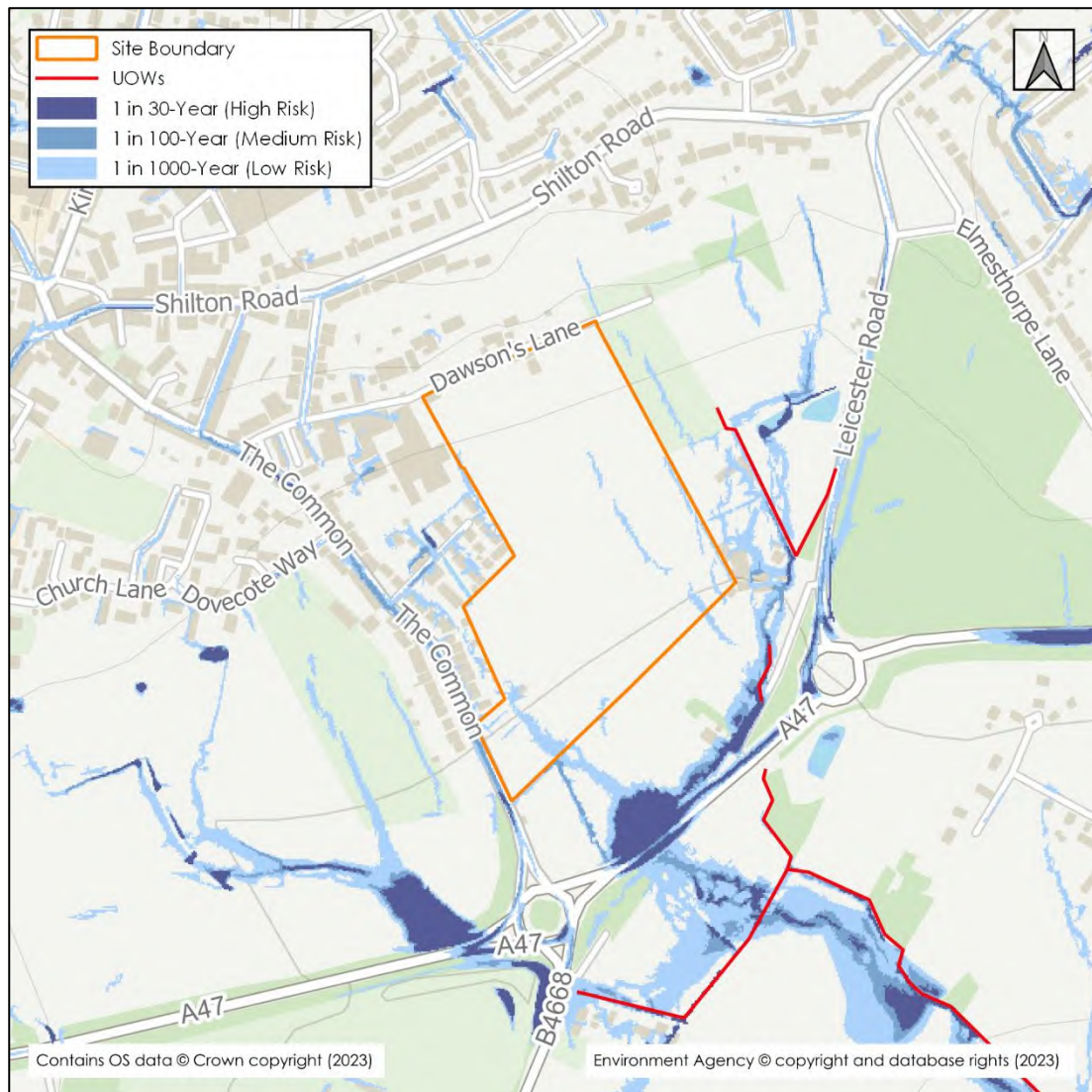


Figure 3.1: Unnamed Ordinary Watercourses

- 3.9 The surface water mapping suggests that flooding from the UOW will not encroach into the Site boundary; as such, the risk of flooding from this source is considered to be low.
- 3.10 Overall, the Site is considered to be at a low risk of flooding from fluvial sources.

Flood Risk from Canals

- 3.11 The Canal and River Trust (CRT) generally maintains canal levels using reservoirs, feeders and boreholes and manages water levels by transferring it within the canal system.

- 3.12 Water in a canal is typically maintained at predetermined levels by control weirs. When rainfall or other water enters the canal, the water level rises and flows out over the weir. If the level continues rising it will reach the level of the storm weirs. The control weirs and storm weirs are normally designed to take the water that legally enters the canal under normal conditions. However, it is possible for unexpected water to enter the canal or for the weirs to become obstructed. In such instances the increased water levels could result in water overtopping the towpath and flowing onto the surrounding land.
- 3.13 Flooding can also occur where a canal is impounded above surrounding ground levels and the retaining structure fails.
- 3.14 The nearest canal is the Ashby Canal located approximately 4.3km north-west of the Site at its nearest point.
- 3.15 The Site is elevated approximately 22m above the canal.
- 3.16 As such, the site is not considered to be at risk from flooding from the Ashby Canal.

Groundwater Flood Risk

- 3.17 Groundwater flooding occurs when the water table rises above ground elevations, or it rises to depths containing basement level development. It is most likely to happen in low lying areas underlain by permeable geology. This is most common on regional scale chalk aquifers, but there may also be a risk on sandstone and limestone aquifers or on thick deposits of sands and gravels underlain by less permeable strata such as that in a river valley.
- 3.18 British Geological Survey (BGS) mapping outlines that the Site is underlain by a mix of Mercia Mudstone and Gunthorpe Mudstone; these are designated by the EA as Secondary B Aquifers. Secondary B Aquifers are defined as predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
- 3.19 Superficial deposits of Bosworth Clay and Silt and Thrusington Diamicton are present at the Site. These are designated as Unproductive and Undifferentiated Secondary Aquifers respectively. Unproductive Aquifers are defined as rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. Undifferentiated Secondary Aquifers are designated in cases where it has not been possible to assign category A or B to a rock type.
- 3.20 No BGS boreholes are located within the Site or within the immediate surrounding area.
- 3.21 Mapping within the Hinckley and Bosworth Borough Council SFRA suggests that the Site is located in a 1km² grid tile whereby <25% of land is considered to be susceptible to groundwater flooding.
- 3.22 The SFRA does not include any evidence to suggest that the Site has previously flooded from groundwater sources.

3.23 Overall, the Site is considered to be at a low risk of groundwater flooding.

Flood Risk from Reservoirs & Large Waterbodies

3.24 Flooding can occur from large waterbodies or reservoirs if they are impounded above the surrounding ground levels or are used to retain water in times of flood. Although unlikely, reservoirs and large waterbodies could overtop or breach leading to rapid inundation of the downstream floodplain.

3.25 To help identify this risk, reservoir failure flood risk mapping has been prepared, this shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. The map displays a worst-case scenario and is only intended as a guide.

3.26 There are two flooding scenarios shown on the reservoir flood maps: a 'dry-day' and a 'wet-day'. The dry-day scenario predicts the flooding that would occur if the dam or reservoir failed when rivers are at normal levels. The wet-day scenario predicts how much worse the flooding might be if a river is already experiencing an extreme flood. Reservoir Failure Mapping is provided in **Figure 3.2** below.

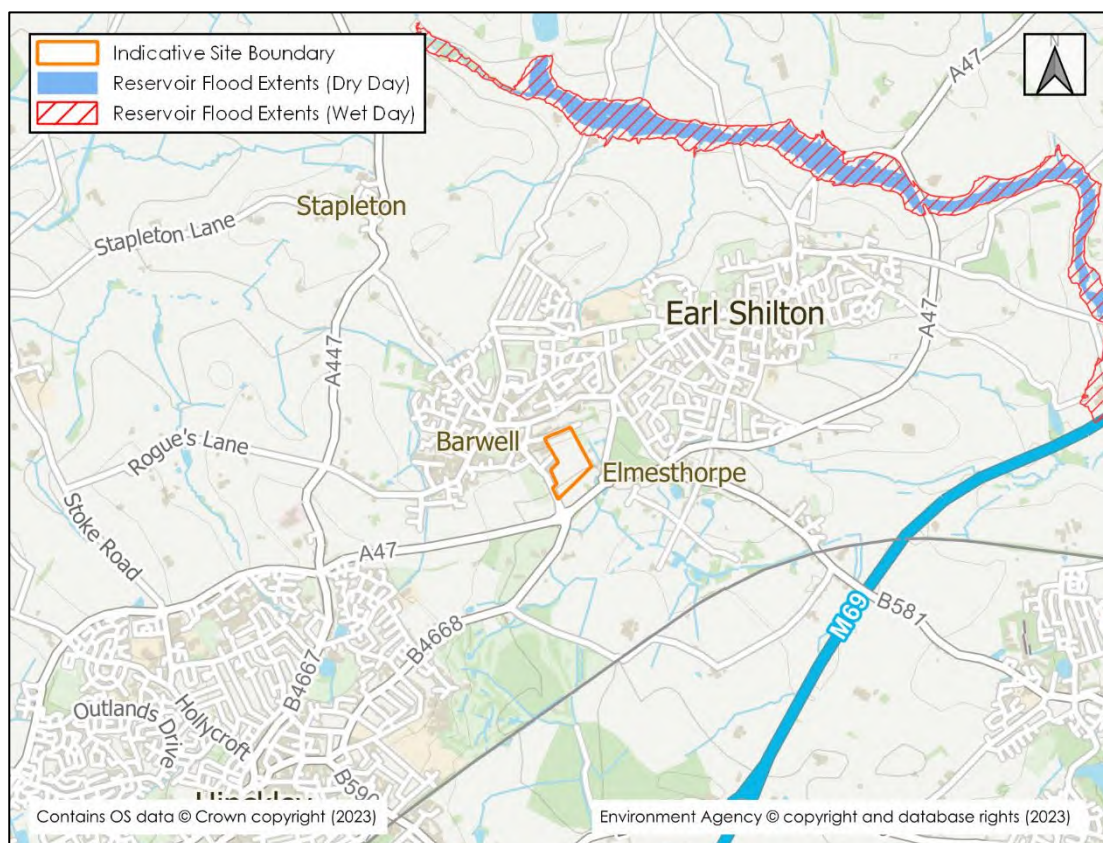


Figure 3.2: Reservoir Failure Extents

3.27 The Site is shown to be located a significant distance (approx. 2.3km) from the nearest reservoir failure extents.

3.28 Therefore, the risk of flooding from this source is considered to be low.

Pluvial Flood Risk

- 3.29 Pluvial flooding can occur during prolonged or intense storm events when the infiltration potential of soils, or the capacity of drainage infrastructure is overwhelmed leading to the accumulation of surface water and the generation of overland flow routes.
- 3.30 Risk of Flooding from Surface Water (RoFSW) mapping has been collated and published by the EA. This shows the potential flooding which could occur when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. An extract from the mapping is included as **Figure 3.3**.

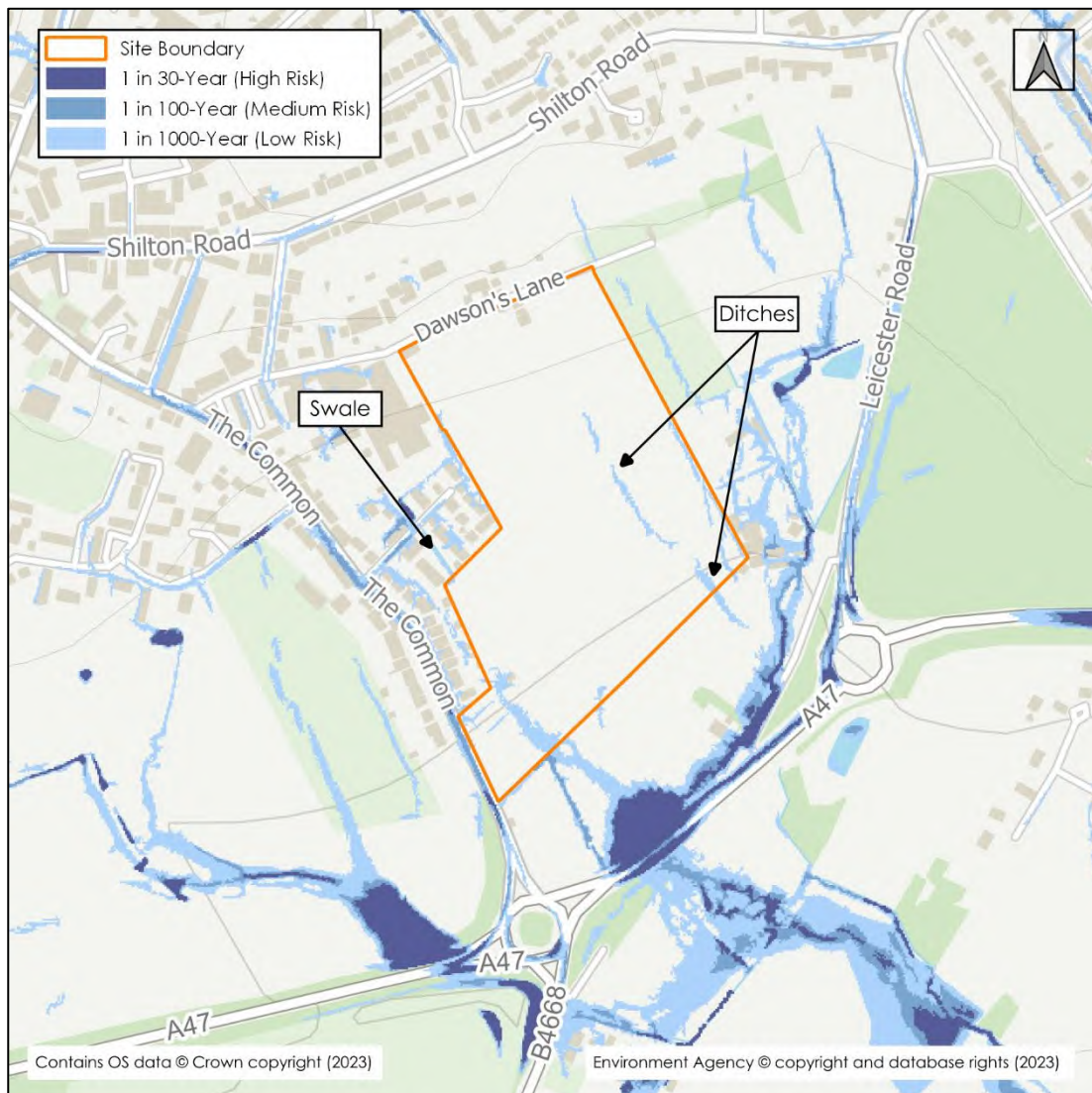


Figure 3.3: Risk of Flooding from Surface Water

- 3.31 The vast majority of the Site is shown to be at a very low risk of surface water flooding.
- 3.32 Within the Site, there are a number of small areas at low (1 in 1000-year) risk of surface water flooding. These are associated with a series of ditches identified across the Site, confirmed following a visual inspection. The pluvial depths in these areas are indicated

to be below 150mm. This, alongside the isolated nature of the ditches, suggest that they will pose a low risk of surface water flooding to the Site.

- 3.33 Within the south-western part of the Site, there is a flow path of low risk running in a southerly direction to an area of surface water ponding outside of the Site's boundary. This flow path is not expected to exceed depths of 300mm.
- 3.34 A CCTV Survey undertaken by Premium Environment Services shows that there is a swale to the west of the Site which enters a culvert at the Site's north-western boundary. This culvert then flows south along The Common before outfalling to a ditch along the southwest boundary of the Site. The ditch is shown to be at a low to high risk of surface water flooding. However, it is expected that any exceedance flows from the ditch would flow south away from the Site given the topography of the area.
- 3.35 The masterplan illustrates that access to the Site is to be achieved via The Common. This road is shown to be at a low to high risk of surface water flooding. The vast majority of the road demonstrates a medium (1 in 100-year) risk with maximum depths of approximately 300mm. Surface water hazard mapping indicates that The Common is at a low degree of flood hazard, defined as a "flood zone with shallow flowing water or deep standing water". Therefore, access is unlikely to be affected to any significant degree.
- 3.36 Overall, surface water flooding is considered to pose a low risk to the Site.

Flood Risk from Sewers

- 3.37 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or as a result of a reduction in capacity due to collapse or blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flows.
- 3.38 The local sewerage undertaker is Severn Trent Water. A copy of their sewer records is included as **Appendix 5**. The nearest public sewer network is located along The Common adjacent to the Site's south-west boundary. This is comprised of a mix between surface water, foul water, and combined sewers.
- 3.39 There has been no information provided pertaining to the depths of these sewer networks.
- 3.40 The topography of the area suggests that any exceedance flows will likely flow southwards, away from the Site.
- 3.41 Overall, the Site is considered to be at a low risk of flooding from this source.

Effect of Development on Wider Catchment

Impedance of Flood Flows

- 3.42 The development has the potential to impede the low-risk surface water flow route in the south-west of the Site. Appropriate mitigation strategies will be discussed in **Section 4**.

Development Land Use/Drainage Considerations

- 3.43 The Site is currently in a greenfield condition; therefore, the proposed development will increase the area of impermeable surfaces on the Site. This has the potential to increase rates and volumes of surface water runoff which, unless managed appropriately, could increase flood risk to the wider area. Appropriate surface water management is discussed in **Section 4**.

4. FLOOD RISK MITIGATION

- 4.1 **Section 3.0** has identified the sources of flooding which could potentially pose a risk to the Site and the proposed development. This section of the FRA sets out the mitigation measures which are to be incorporated within the proposed development to address and reduce the risk of flooding to within acceptable levels.

Sequential Arrangement

- 4.2 The proposed development is sequentially located in Flood Zone 1 and is considered to be at low risk of fluvial flooding.
- 4.3 The Site has been sequentially arranged so that the 'More Vulnerable' uses are located in the areas identified to be at very low pluvial risk and the 'Less Vulnerable' land uses, such as open space, are partially located within the surface water flood extents.
- 4.4 A 'More Vulnerable' area is proposed in part of the area covered by the low-risk surface water flow route to the south-west of the Site. However, the catchment area contributing to the flow route originates largely within the site boundary and will, therefore, be managed by the Site drainage strategy, which is detailed within a separate Sustainable Drainage Statement (SDS) (ref: LCB-BWB-ZZ-XX-RP-CD-0001_SDS).
- 4.5 Development should be set back with an appropriate easement from the top of bank of the drainage ditches. Within this easement, there should be no erection of temporary or permanent buildings, structures or fences, as well as planting of trees/obstructive vegetation.

Development Levels

- 4.6 It is recommended that finished floor levels should be raised a minimum of 150mm above adjacent ground levels to reduce the residual risk of flooding from pluvial and groundwater sources.
- 4.7 No dwellings should be located within topographical depressions.
- 4.8 Ground levels should be profiled to encourage pluvial runoff and overland flows away from vulnerable infrastructure and towards the nearest drainage point.

Safe Access and Egress

- 4.9 The proposed access route along The Common has a medium risk of surface water flooding. However, due to the depths predominantly being less than 150mm the flood hazard is considered low, and access is likely to still be possible.

Surface Water Drainage

- 4.10 To mitigate the development's impact on the current runoff regime it is proposed to incorporate surface water attenuation and storage as part of the development proposals.

- 4.11 Further information on the drainage approach is provided within the accompanying Sustainable Drainage Statement, reference LCB-BWB-ZZ-XX-RP-CD-0001_SDS.

Foul Water Drainage

- 4.12 It is proposed to drain used water from the development separately to surface water.
- 4.13 Further information on the drainage approach is provided within the accompanying Sustainable Drainage Statement, reference LCB-BWB-ZZ-XX-RP-CD-0001_SDS.

5. CONCLUSIONS AND RECOMMENDATIONS

- 5.1 This FRA has been prepared in accordance with requirements set out in the NPPF and the associated Planning Practice Guidance. The FRA has been produced on behalf of Redrow Homes Limited in respect of a planning application for the residential development on land east of The Common, Barwell. This FRA refers to Phase 1 of the proposed development.
- 5.2 This FRA is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.
- 5.3 This report demonstrates that the proposed development is at not at significant flood risk, subject to the recommended flood mitigation strategies being implemented. The identified risks and mitigation measures are summarised within **Table 5.1**:

Table 5.1: Summary of Flood Risk Assessment

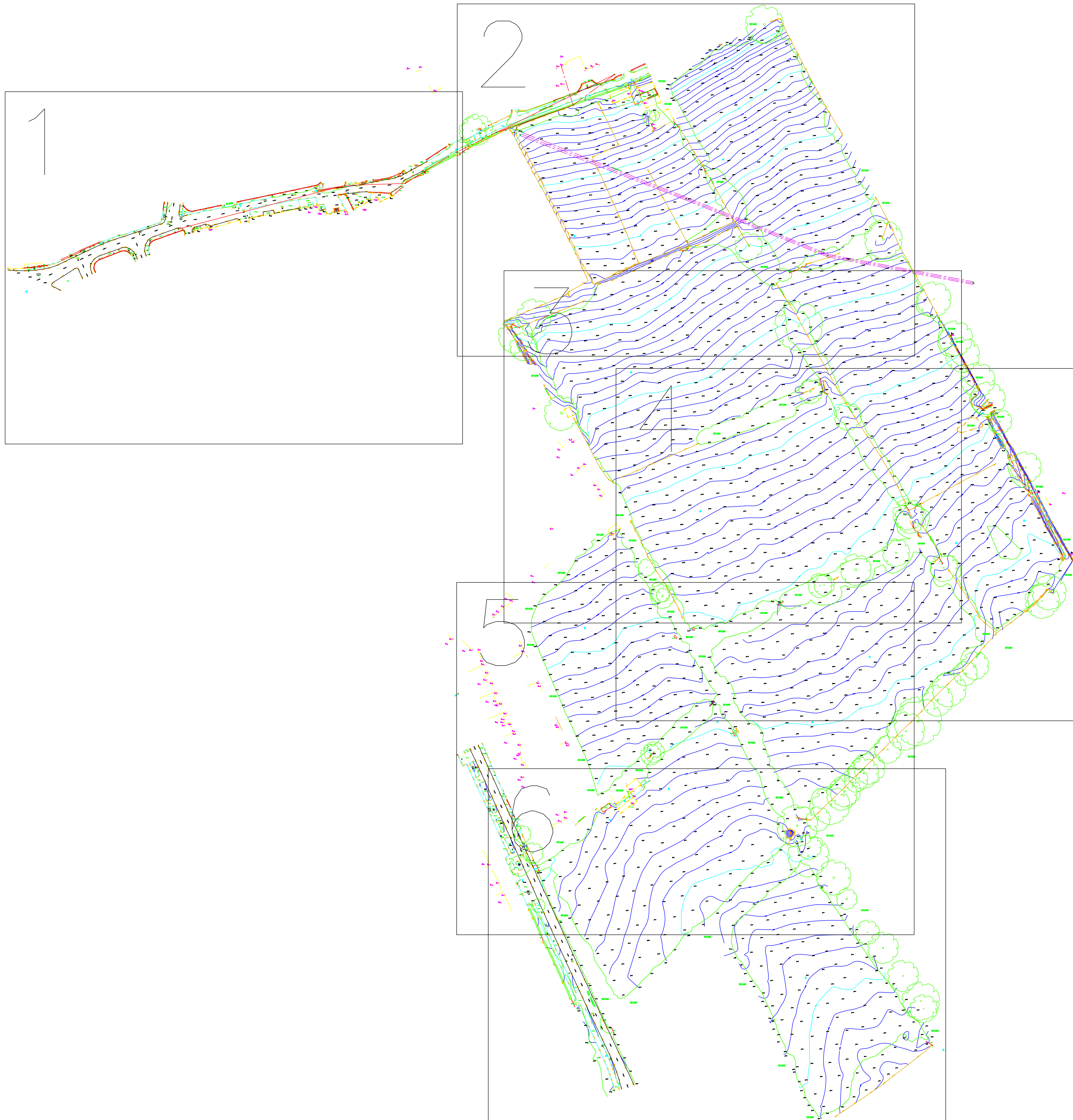
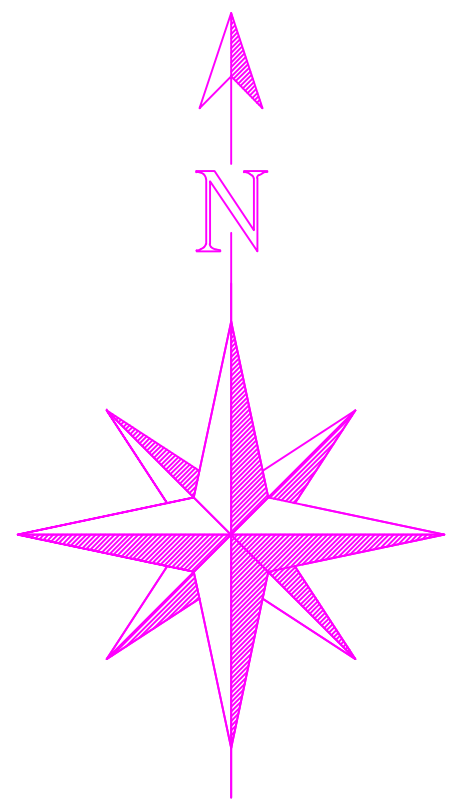
Flood Source	Risk & Proposed Mitigation Measures
Fluvial	The Site is located entirely within Flood Zone 1 and is not considered to be at risk from Main Rivers. There is an UOW to the west and south of the Site; however, topography and surface water mapping indicates flows are expected to flow away from the Site.
Pluvial Runoff	Whilst the Site is largely at a very low risk of surface water flooding, there are several small areas at low risk of surface water flooding associated with ditches throughout the Site. However, the pluvial depths in these areas are indicated to be below 150mm, suggesting that they will pose a low risk to the Site. Furthermore, the Site has been sequentially arranged so that the 'More Vulnerable' uses are located in the areas identified to be at very low pluvial risk and the 'Less Vulnerable' land uses are located within the surface water flood extents. Within the south-western part of the Site, there is a flow path of low risk running in a southerly direction to an area of surface water ponding outside of the Site's boundary. However, the catchment area contributing to the flow route originates largely within the site boundary and will, therefore, be managed by the Site drainage strategy. Finished floor levels should be raised 150mm above adjacent ground levels to reduce the residual risk of flooding from pluvial sources. In addition, no dwellings should be located within topographical depressions and ground levels should be profiled to encourage pluvial runoff and overland flows away from vulnerable infrastructure and towards the nearest drainage point.
Impact of the Development	The development has the potential to impede the low-risk surface water flow route in the south-west of the Site. However, the catchment area contributing to the flow route originates largely within the site boundary and will, therefore, be managed by the Site drainage strategy. The proposed development will increase the area of impermeable surfaces at the Site which will increase rates and volumes of surface water runoff. This will be mitigated via surface water attenuation and storage, detailed in a separate SDS (ref LCB-BWB-ZZ-XX-RP-CD-0001_SDS).

This summary should be read in conjunction with BWB's full report. It reflects an assessment of the Site based on information received by BWB at the time of production.

- 5.4 In compliance with the requirements of NPPF, and subject to the mitigation measures proposed, the development could proceed without being subject to significant flood risk. Moreover, the development will not increase flood risk to the wider catchment area as a result of suitable management of surface water runoff discharging from the Site.

APPENDICES

Appendix 1: Topographical Survey



SURVEY CONTROL STATIONS			
STN	EASTING	NORTHING	HEIGHT
2001	444963.494	296512.274	102.497
2002	444991.686	296527.427	106.509
2003	444991.686	296527.427	106.509
2004	444991.686	296527.427	106.509
2005	444919.445	296796.827	114.792
2006	445043.094	296779.500	110.763
2007	445127.272	296650.454	104.822
2008	445176.209	296560.499	100.757
2009	445094.620	296458.830	100.072
2010	445086.433	296392.223	98.480
2011	445090.802	296313.768	96.253
2012	445013.076	296430.986	99.396
2013	444936.734	296375.272	100.200
2015	444842.574	296729.570	125.413
2016	444991.686	296729.570	96.411
2017	444920.153	296368.464	100.239
2019	444980.310	296402.950	99.509
2020	445040.719	296429.068	100.148
2021	444991.686	296416.075	98.500
2022	444988.188	296413.798	99.471
2023	444991.686	296411.075	114.108
2024	444991.686	296419.787	114.729
2025	445191.335	296454.477	102.503
2026	445214.816	296573.304	100.147
2027	445212.122	296492.862	100.849
2028	445184.913	296712.712	95.361
2030	444892.474	296783.216	115.365
2031	444988.188	296714.536	114.510
2032	444991.686	296822.909	112.069
2033	444991.686	296750.092	114.495
2034	444756.667	296740.768	114.271
2035	444756.667	296740.768	114.271
2036	444756.667	296740.768	114.271
2037	444640.509	296703.295	113.902
2038	444640.509	296703.295	113.902

LEGEND

- CONTROL STATIONS
- MANHOLE
- BUSH
- TREE
- DROP KERB
- EMBANKMENT
- OVERHEAD ELECTRICITY LINE
- OVERHEAD TELEPHONE LINE
- FOOTPATH
- FENCE
- HEDGE
- FOLIAGE
- DITCH
- VERGE
- EXISTING BUILDING
- MAIN CONTOUR
- CONTOUR
- SW SEWER
- FW SEWER

- AV Air Valve
- BH Benchhole
- BS Box Stop
- BM Bench Mark
- BT BT Inspection Chamber
- BT Level
- CATV Cable TV Cover
- C/L Chain Link Fence
- CPS Concrete Paving Slab
- CSB Electricity Control Box
- EH Building Eaves Level
- ER Earthing Rod
- FB Flower Bed
- FL Floor Level
- GR Grate
- GR Gully
- GV Gas Valve
- IC Inspection Chamber
- IL Invert Level
- KD Kerb Ditch
- JB Junction Box
- LM Lamp Post
- MH Man Hole
- MP Marker Post
- MS Misc Stone Marker
- NP Street Name Plate
- O/H Overhead
- PB Post Box
- PI Pit
- PM Parking Meter
- P/R Post & Rail Fence
- P/W Post & Wire Fence
- PL Electricity Pylon
- RE Roadside Eye
- RSJ Reinforced Steel Joist
- R/W Reinforced Pipe
- SPS Stone Paving Slabs
- SL Soft Level
- SP Sign Post
- SV Stop Valve
- ST Stop Top
- SY Stay Wire
- TC Tactile Crossing
- TOW Top Of Wall Level
- TH Tree Hole
- TL Traffic Light
- TP Drainage Point
- UL Under Lift
- WM Water Meter
- WH Building Valley Level

Disclaimer
Main Entry to sewers has not been undertaken. Depths, Pipe sizes etc are measured from the ground. All sewers and inverts to be checked prior to any works commencing on site. Geomatic Surveys Limited are not responsible for manholes, services, information not surveyed which may have an impact on site development.
Boundaries shown are physical and may not represent legally conveyed ownership.
Tree species have only been identified using basic identification techniques. For precise tree species identification, it is recommended that a qualified arboriculturist is used prior to tree removal.

REV	DATE	DESCRIPTION	BY	APP.
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Sheet Layout

Sheet 1

Survey Information
The Survey has been orientated to Ordnance Survey National Grid and datum using one central control station. No Scale Factor has been applied to the coordinates meaning that the survey is arbitrary and not true Ordnance Survey Coordinates.

Geomatic Surveys Ltd
LAND SURVEYORS AND CONSULTING ENGINEERS
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Client
REDROW HOMES LTD
(HARROW ESTATES DIVISION)

Project Title
THE COMMON
BARWELL
LEICESTERSHIRE

Drawing Title
PLOT SHEET LAYOUT

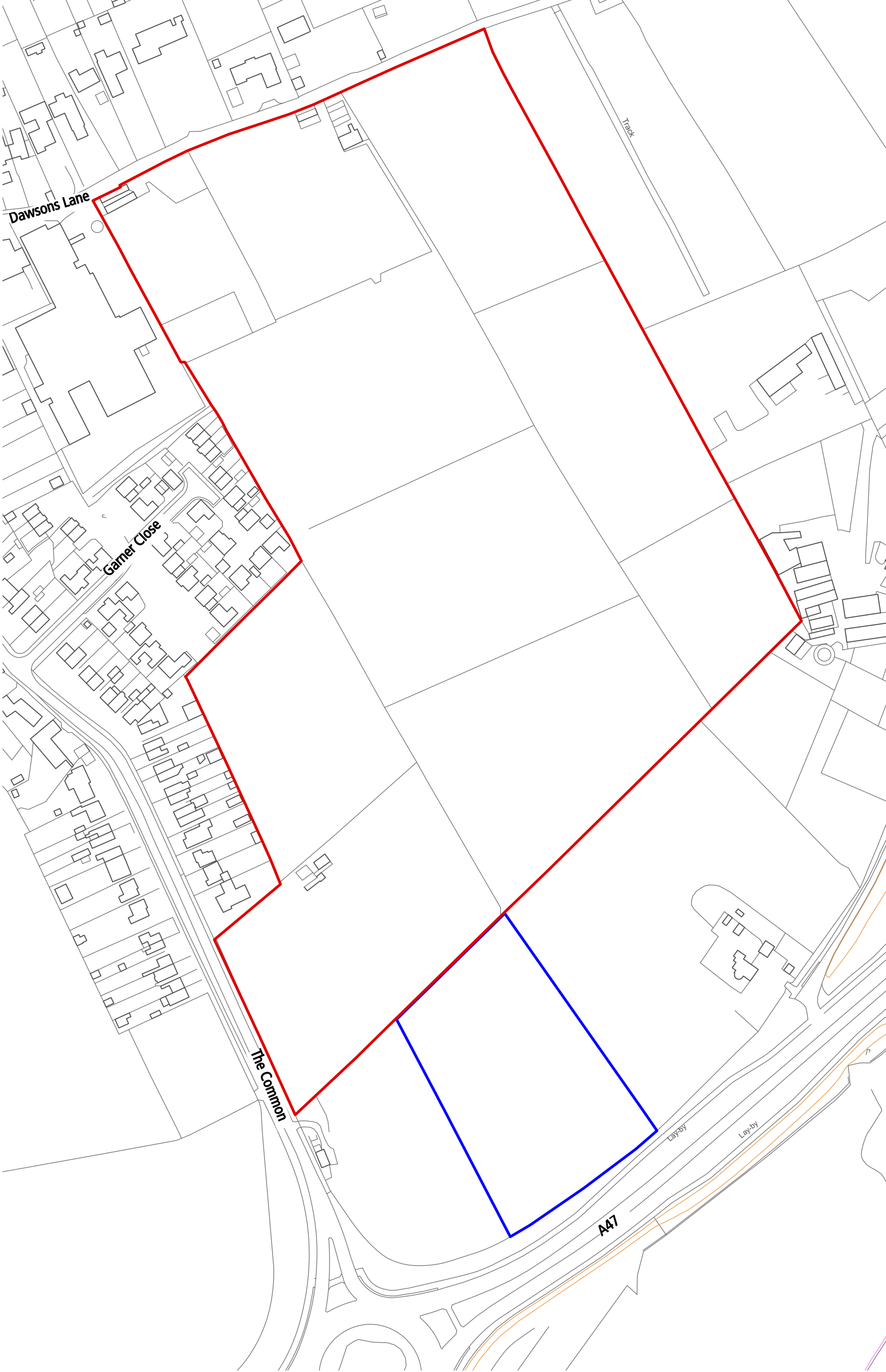
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Date	14/07/2021	Scale	1:1000 @ AD	Sheet No.	SHEET 1 OF 1
Dwg. No.	02663/Topo	Rev			

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Appendix 2: Illustrative Masterplan

Site boundary

Land also under the control of the applicant



client:
Harrow Estates

project:
Land East of The Common, Barwell

drawing title:
Site Boundary Plan

job number:
HAR102

scale
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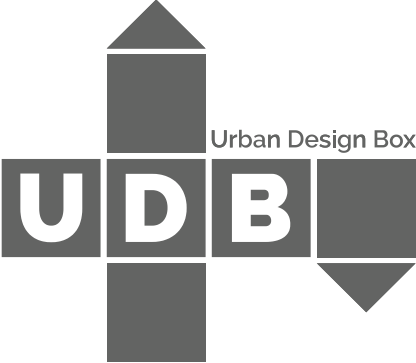
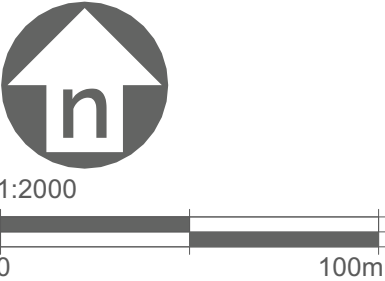
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November 2023

drawing number:
1001D

drawn
AJ

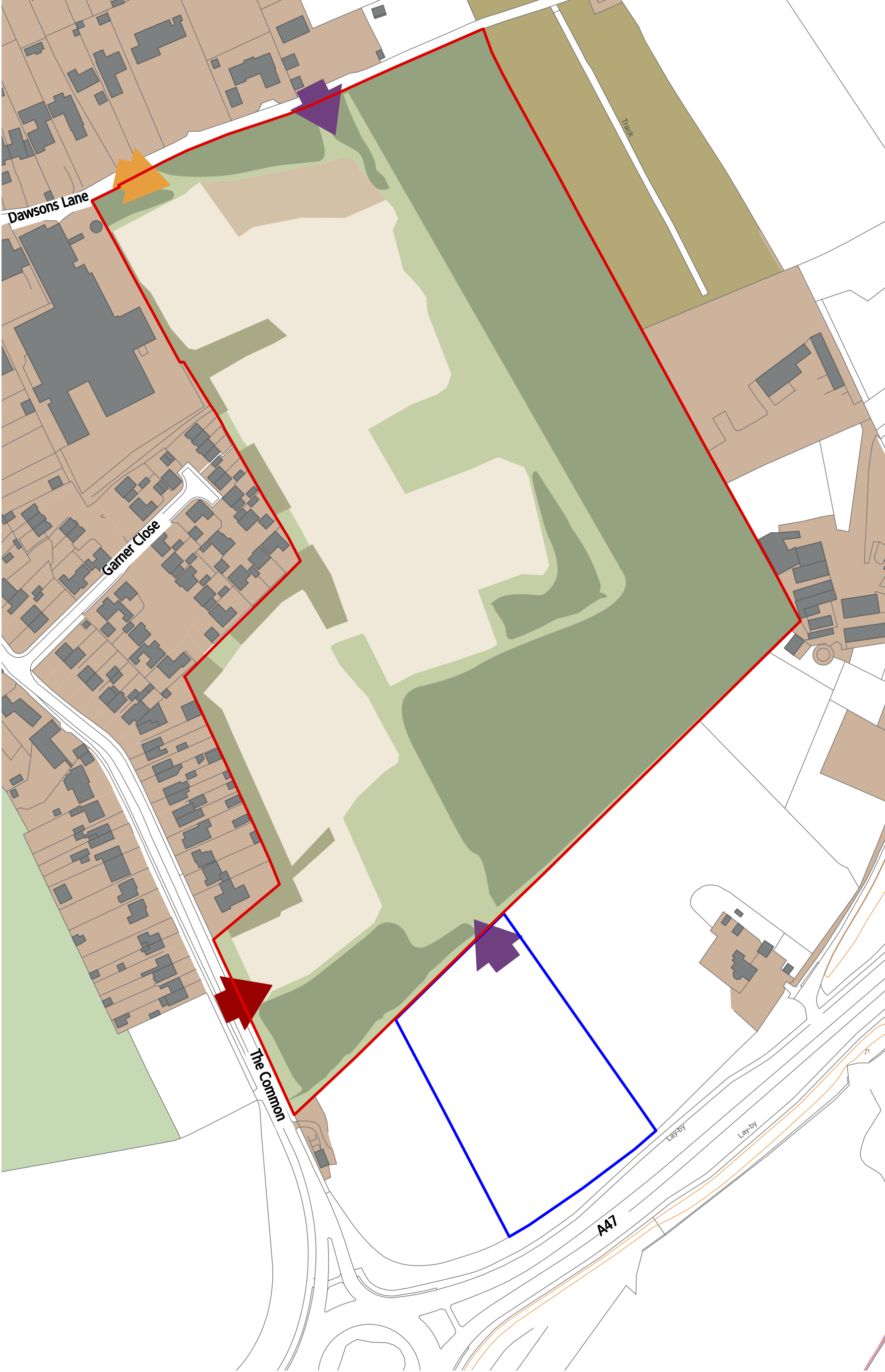
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Preliminary

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- Site boundary
- Land also under the control of the applicant
- Proposed all modes access
- Proposed pedestrian and cycle access
- Proposed pedestrian access
- Residential development and access roads
- Self build development and access roads
- Public open space
- Meadow grassland with mown paths and attenuation area
- Maintenance area

NOTE
A limited deviation of +/- 5m should be allowed to area boundaries to give flexibility of the detailed street design at Reserved Matters stage, whist balancing the overall quantum.



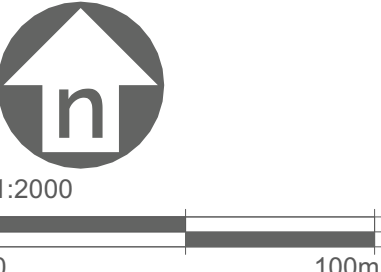
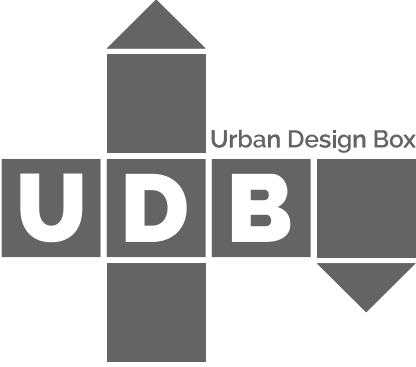
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Harrow Estates

project:
Land East of The Common, Barwell

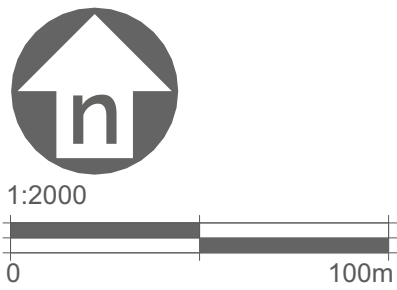
drawing title:
Parameter Plan

job number: HAR102	drawing number: 3501C
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date: December 2023	status: Preliminary

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- Site boundary
- Land also under the control of the applicant
- Proposed all modes access
- Proposed pedestrian and cycle access
- Proposed pedestrian access
- Proposed pedestrian route
- Proposed shared pedestrian and cycle route
- Residential development
- Self build development
- Proposed main street and pathway
- Proposed shared surface
- Public open space
- Meadow grassland with mown paths
- Maintenance area
- Attenuation area / swales
- Existing hedges / trees / planting
- Proposed trees
- Proposed woodland
- Proposed hedges / strategic planting infrastructure
- Play area
- Outdoor recreation
- Walking routes
- Offsite proposed permissive pedestrian route



client:
Harrow Estates

project:
Land East of The Common, Barwell

drawing title:
Illustrative Masterplan

urbandesignbox.co.uk

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job number:
HAR102

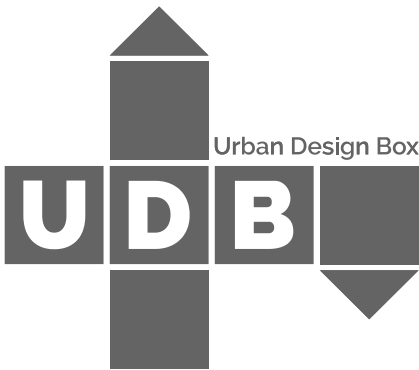
scale
1:2000 @ A3

date:
December 2023

drawing number:
4001G

drawn
AJ

status:
Preliminary



Appendix 3: NPPF Flood risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classifications (recreated from the NPPF Planning Practise Guidance)

Vulnerability Classification	Description
Essential infrastructure	• 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; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood. • Wind turbines. • Solar farms.
Highly Vulnerable	• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • 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	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • 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. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; 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. • Car parks.
Water-Compatible Development	• 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. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Flood Zone Compatibility (recreated from the NPPF Planning Practise Guidance)

Flood Zone	Vulnerability Classification				
	Essential infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 1 (Low Probability)	Development is appropriate	Development is appropriate	Development is appropriate	Development is appropriate	Development is appropriate
Flood Zone 2 (Medium Probability)	Development is appropriate	To be deemed appropriate an exception test is required to demonstrate: - The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk - the sustainability benefits of the development to the community outweigh the flood risk.	Development is appropriate	Development is appropriate	Development is appropriate
Flood Zone 3a (High Probability)	To be deemed appropriate an exception test is required to demonstrate: The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk the sustainability benefits of the development to the community outweigh the flood risk. Additionally, essential infrastructure should be designed and constructed to remain operational and safe in times of flood.	Development should not be permitted	To be deemed appropriate an exception test is required to demonstrate: - The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk - the sustainability benefits of the development to the community outweigh the flood risk.	Development is appropriate	Development is appropriate

Flood Zone	Vulnerability Classification				
	Essential infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 3b (The Functional Floodplain)	To be deemed appropriate an exception test is required to demonstrate: - The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk - the sustainability benefits of the development to the community outweigh the flood risk. Additionally, development should be designed and constructed to: - remain operational and safe for users in times of flood; - result in no net loss of floodplain storage; - not impede water flows and not increase flood risk elsewhere.	Development should not be permitted	Development should not be permitted	Development should not be permitted	Development is appropriate if designed and constructed to: - remain operational and safe for users in times of flood; - result in no net loss of floodplain storage; - not impede water flows and not increase flood risk elsewhere.

Appendix 4: EA Response



Craig Crowe
Via Email

Our Ref: EMD-233234

Your Ref:

Date: 29 September 2021

Dear Ella

**RE: Request for information under the Freedom of Information Act 2000 (FOIA) /
Environmental Information Regulations 2004 (EIR)**

We refer to your request for Product 4 - The Common, Barwell

There is no modelled data for this site since it is unaffected by main rivers.

We have considered your request under the provisions of the Freedom of Information Act 2000 / Environmental Information Regulations 2004 (EIR). The Act requires that we respond to requests by advising you whether or not information is held, and if so by providing you with that information.

EIR Regulation 3(2) states that information is held if it is in our possession and has been produced or received by us, or it is held by another person on our behalf at the time the request is received.

Information not held

In this case, the information you have requested is not held by the Environment Agency, and we are therefore refusing your request on the grounds that there is no information we can provide.

Where a request is for environmental information, the Regulations allow us to refuse to disclose it if the exception at EIR Regulation 12(4)(a) applies. The regulation states that a public authority may refuse to disclose environmental information to the extent that it does not hold that information when an applicant's request is received.

It is not possible for us to conduct a public interest balancing test because the reason for non-disclosure is that the information is not held.

Rights of appeal

If you are not satisfied you can contact us within 2 calendar months to ask for our decision to be reviewed. We shall review our response to your request and give you our decision in writing within 40 working days.

If you are still not satisfied following this, you can raise a concern with the Information Commissioner, who is the statutory regulator for Freedom of Information and the Environmental Information Regulations. The contact details are:

Information Commissioner's Office
Wycliffe House

Water Lane
Wilmslow
Cheshire
SK9 5AF
Tel: 0303 123 1113
Website: <http://ico.org.uk>

Yours sincerely

Ray Gallagher
Customers & Engagement Officer
East Midlands

For further information please contact the Customers & Engagement Team on 02084 747770

Direct e-mail:- EMDenquiries@environment-agency.gov.uk

Appendix 5: STW Sewer Records

