Flood Risk Assessment and Surface Water Drainage Strategy

Hemel 465 – Boundary Way, Hemel Hempstead, HP2 7LF

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Executive Summary

Engineeria have been commissioned by J. Murphy & Sons Limited to provide a Flood Risk Assessment for the proposed development at Hemel 465.

The proposals consist of a full Planning Application for the construction of a new multi-storey car park (and linked consolidation of the existing car parking provision across the site), and any associated access, infrastructure and hard and soft landscaping works (as well as minor external alterations to the ancillary office building).

The application area is 0.97ha. The site is located within Dacorum district of Hemel Hempstead, Hertfordshire.

The development is in Flood Zone 1 classified as low risk of flooding from rivers or sea.

The low-level areas of the site along the northern boundary (edge of the car park) and to the south and east of the existing office building are at high risk of flooding from surface water. The proposed multistorey car park accesses and access paths leading to it will be set above the existing levels where at risk of surface water flooding.

The site is at low risk from all other flood risks (i.e. groundwater, reservoir and sewer flooding).

The surface water drainage strategy for the proposed multistorey car park is to limit the surface water discharge rate to 2.0l/s for all storms up to and including 1 in 100years storms plus climate change, and therefore providing a significant reduction in the discharge rate. Proposed SuDS will include SuDS Pipes (perforated pipes surrounded in granular material) and below ground attenuation tanks.

The foul drainage from the office building will remain as existing and will continue draining into the Thames Water manhole with reference 5014.

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1. Introduction

1.1. Scope of Report

Engineeria have been commissioned by J. Murphy & Sons Limited to provide a Flood Risk Assessment and Surface Water Drainage Strategy to be included as part of the planning pack for Hemel 465 – Boundary Way, Hemel Hempstead, HP2 7LF.

This report undertakes screening of risk from all publicly available key sources of flood risk (identified in CIRIA Report C624). It then undertakes a scoping study to establish whether, and how, any of the sources of flooding may affect the site.

1.2. Preliminaries and Exclusions

This report has been prepared for exclusive use by J. Murphy & Sons Limited for the purpose of assisting them in evaluating the potential risk of flooding associated with the site. Engineeria accepts no liability for any use of this document other than by its client and only for the purposes, stated in the document, for which it was prepared and provided. No person other than the client may copy (in whole or in part) use or rely on the contents of this document, without the prior written permission of Engineeria.

This report has been prepared in accordance with the NPPF, the associated PPG and Local Planning Policy. The proposed flood management (including ground floor level recommendations) and surface water management strategies are based on the relevant British Standards, the standing advice provided by the EA or based on common practice.

The insurance market applies its own tests to properties in terms of determining premiums and the insurability of properties for flood risk. Those undertaking development in areas which may be at risk of flooding are advised to contact their insurers or the Association of British Insurers (ABI) to seek further guidance prior to commencing development. Engineeria do not warrant that the advice in this report will guarantee the availability of flood insurance either now or in the future.

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2. Site Settings

2.1. Existing Site information

The site is located within the industrial estate on Boundary way, Hemel Hempstead, HP2 7LF and is adjacent to the Buncefield Petrol Storage site.

The application area (the Site) is 0.97ha in size and is bound by the following:

- East – Access Road serving Hemel 465 Visitors and Office Entrance, DBD Group of Companies and Majestic Wine Warehouse
- North – Existing Warehouse Building
- West – Roundabout at the junction between Boundary Way and Bouncefield Lane
- South – Boundary Way

The largest part of the site is occupied by an open car park serving the existing office and for visitors and the rest of it is occupied by the existing office building.

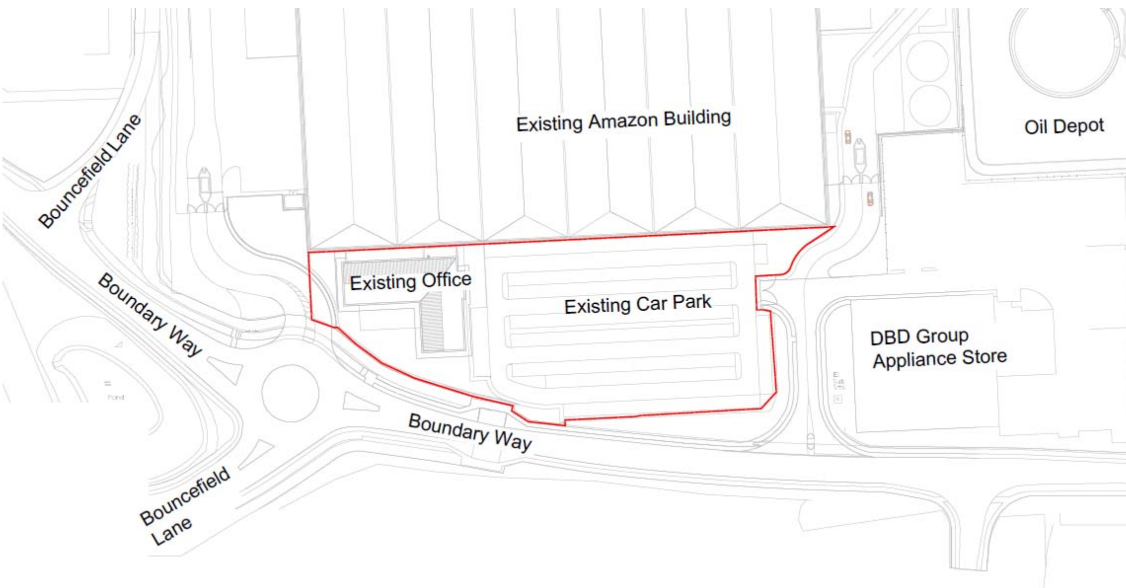


Figure 1 - Site Location Plan (Red Line represents Site Boundary)

2.2. Topography

A topographical and utilities survey was undertaken by Terrain Surveys in December 2023. Copies of this survey are included in Appendix B.

The topographical survey indicates that levels fall from the south-eastern to north-western corner of the existing car park, with the highest point being circa 137.35mAOD and the lowest point being circa 135.19m AOD respectively.

2.3. Hydrological Setting

A review of the OS mapping indicates that there are no watercourses in the immediate vicinity of the site.

The closest rivers and canals to the development are River Gade and Grand Union Canal approximately 3.4km and 3.8km west of the Site respectively and River Ver approximately 3.9km east of the Site.

2.4. Geology and Hydrogeology

The British Geological Survey (BGS) Online Geology Viewer provides the following information for the Site:

- Superficial deposits – Clay with flints Formation (clay silt, sand and gravel)
- Bedrock – Lambeth Group (clay, silt, and sand)

A site investigation was undertaken by WSP in 2003, a copy of which is included in Appendix 3. The nearest trial pit and boreholes located immediately to the north of the Site, indicate the following:

- Made ground is present from ground level up to a maximum depth 1.2m BGL:
- Clay with occasional fine to medium angular flint (Woolwich and Reading Beds) is present from a depth of 0.4m up to a maximum depth of 4.7m BGL; and
- Chalk is present from a depth of 1.90m BGL.

Furthermore, the WSP site investigation indicates the regional groundwater is believed to be at a depth of 40m to 50m. However, historic site investigation works summarised in the WSP report indicate that perched groundwater was encountered up to a depth of 3.66m BGL.

Referring to the Defra's Magic Maps the upper Chalk strata (bedrock) is classified as a Secondary A aquifer. Environment Agency's definition of Secondary A aquifers is that *'…these comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers'.*

The Defra's Magic Maps indicate that the groundwater is at medium vulnerability and that there is soluble rock risk. Environment Agency's definition for groundwater medium vulnerability is that '…*these are medium priority groundwater resources that have some natural protection resulting in a moderate overall groundwater risk. Activities in these areas should as a minimum follow good practice to ensure they do not cause groundwater pollution.*

Hertfordshire County Council Strategic Flood Risk Assessment Level 1, Map 6 (see Appendix 4) places the development in a Zone III of groundwater protection zone.

2.5. Existing Sewers

The drainage asset records and the utilities survey provided in Appendix 2 indicate that the site is already served by foul and surface water sewers which outfall into the Thames Water Sewers in Boundary Way (south of the site).

The foul water sewers within the site serve not only the existing office building but also the Waterhouse to the north of the site. The foul drainage connection from the site is a 225mm diameter pipe, which drains into the Thames Water manhole with reference 5014.

The surface water sewers within the site serve not only the existing office building and car park but also the Waterhouse and parking areas to the north of the site. The surface water drainage connection from the site is a 750mm diameter pipe, which drains into the Thames Water manhole with reference 5002.

3. Development Proposals

The proposals consist of the construction of a new multi-storey car park (and linked consolidation of the existing car parking provision across the site), and any associated access, infrastructure and hard and soft landscaping works, as well as minor external alterations to the ancillary office building.

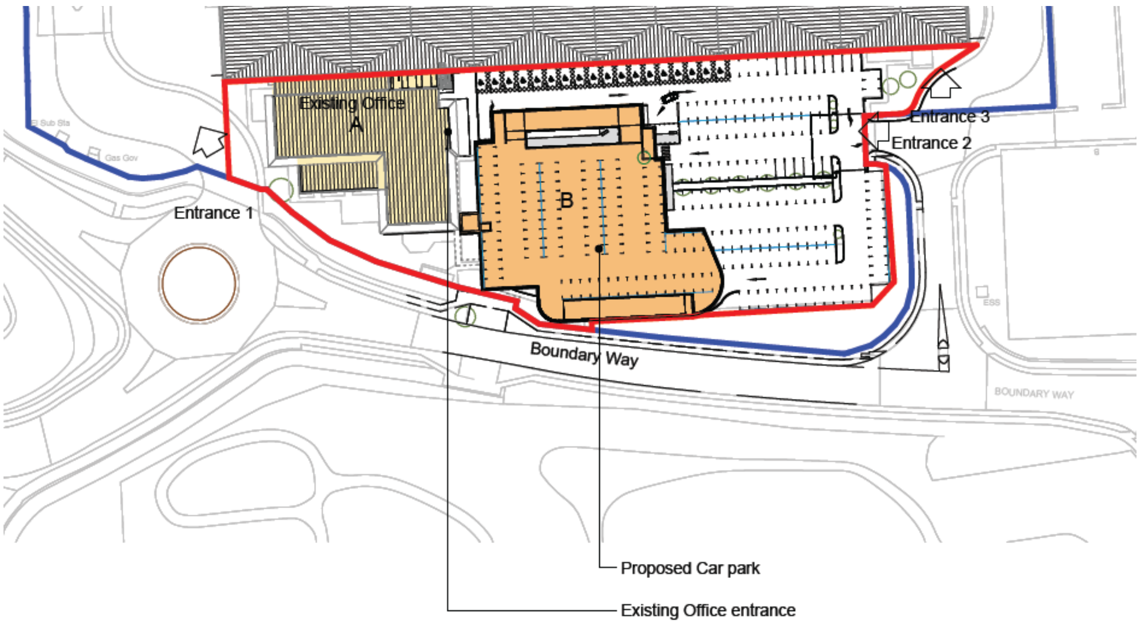


Figure 2 - Proposed Site Development

4. Planning Policy Guidance and Framework

4.1. National Planning Policy Framework

National Planning policy set through the National Planning Policy Framework (NPPF, updated December 2023) sets various overarching requirements for development in the context of flood risk. These requirements are set out in paragraphs 159 to 169.

Development should be considered sequentially so new development is steered to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding.

In instances where it proves impractical to establish development in zones with a lower risk of flooding, considering broader sustainable development objectives becomes imperative. In such cases, the Exception Test must be undertaken to establish that:

- The proposed development will yield overarching sustainability benefits to the community, surpassing the associated flood risk.
- The development, throughout its lifecycle, will ensure the safety of its occupants, accounting for their vulnerability. Moreover, it should not escalate flood risk elsewhere and, where feasible, contribute to an overall reduction in flood risk.

The NPPF states that when determining planning applications, Local Planning Authorities (LPA) should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific Flood Risk Assessment. Development should only be allowed in areas at risk of flooding where it can be demonstrated that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- The development is appropriately flood resistant and resilient;
- It incorporates Sustainable Drainage Systems (SuDS), unless there is clear evidence that this would be inappropriate;
- Any residual risk can be safely managed; and
- Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Major developments should incorporate SuDS unless there is clear evidence that this would be inappropriate. The systems used should:

- Take account of advice from the lead local flood authority; Have appropriate proposed minimum operational standards;
- Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- Where possible, provide multifunctional benefits.

4.2. Planning Practice Guidance

The Planning Practice Guidance (PPG) serves as supplementary information for Local Planning Authorities (LPAs) to facilitate the effective implementation of planning policies outlined in the National Planning Policy Framework (NPPF) concerning development in flood-prone areas. Notably, an updated version of the PPG, influencing site-specific Flood Risk Assessments (FRAs), has been in effect since August 25, 2022. Key amendments include:

- **Flood Zone 3b Definition Change:** Flood Zone 3b is now defined as a 1 in 30 (3% Annual Exceedance Probability - AEP) event instead of the previous 1 in 20 (5% AEP), potentially restricting development land on policy grounds.
- **Commercial Development Lifetime Assumption:** The assumed lifetime of commercial development is now set at 75 years, necessitating an adjustment in climate change allowances.
- **Expanded Design Flood Criteria:** The "design flood" now encompasses the 1 in 100 (1% AEP) pluvial/surface water flood event, requiring consideration in the assessment of access and egress routes.
- **Evacuation Procedures Enhancement:** Evacuation procedures must now account for the extreme 1 in 1,000 (0.1% AEP) flood event.
- **Introduction of "Non-Major" Development Category:** A new "non-major" category of development has been introduced, positioned between minor/permitted and major developments.

The PPG emphasizes the responsibility of developers and LPAs to explore opportunities for reducing overall flood risk, both within the development area and beyond. The layout and form of the development, along with the application of Sustainable Drainage Systems (SuDS), are identified as crucial elements. The guidance draws on information from the Environment Agency (EA) and offers recommendations for accommodating climate change, including contingency allowances for net sea level rise and peak rainfall intensities. Additionally, it provides advice on flood resilience and resistance measures, particularly for residual risks after applying the sequential approach and mitigating actions.

The PPG classifies flood zones based on the probability of river and sea flooding without defense presence:

- **Zone 1:** Low probability (<0.1%): Less than 1 in 1000 annual probability of river or sea flooding.
- **Zone 2:** Medium probability (1% to 0.1%): Between 1 in 100 and 1 in 1000 annual probability of river flooding or between 1 in 200 and 1 in 1000 annual probability of sea flooding.
- **Zone 3a:** High probability (>1%): 1 in 100 or greater annual probability of river flooding or a 1 in 200 or greater annual probability of sea flooding.
- **Zone 3b:** The functional floodplain: Designed to flood with an annual probability of 1 in 30 (3.3%) or greater or is designed to flood in an extreme 1 in 1,000 (0.1%) flood.

Table 2 of the PPG outlines five classifications for flood risk vulnerability, and Table 3 details their compatibility within each Flood Zone:

- **Essential Infrastructure:** e.g., essential transport and utility infrastructure, wind turbines.
- **Highly Vulnerable:** e.g., emergency services, basement dwellings.
- **More Vulnerable:** e.g., residential dwellings, hospitals, schools, hotels, drinking establishments.
- **Less Vulnerable:** e.g., retail, offices, storage and distribution, leisure, restaurants.
- **Water-Compatible Development:** e.g., Dock, marinas, wharves.

4.3. Hertfordshire County Council as the Lead Local Flood Authority (LLFA)

The Local Flood Risk Management Strategy 2 (LFRMS2) produced by the LLFA (adopted in February 2019) aims to give an understanding of local flood risk in Hertfordshire and the actions that will be taken to manage it most appropriately within available resources. In addition, LFRMS2 lists out the relevant flood and drainage policies for proposed developments within the Hertfordshire County Council.

Policy 13: Discharge hierarchy for SuDS

The discharge hierarchy should be appropriately assessed and the selected discharge point for proposed SuDS must be justified in accordance with the SuDS standard requirement for runoff destination using a methodology acceptable to Hertfordshire County Council and the Local Planning Authority.

To support the drainage strategy, approval for discharge should be sought from the owner/operator of the receiving system. This should include permission to cross the land adjacent to the site and/or land in third-party ownership to secure access to the proposed connection point.

Policy 15: Runoff rates for previously developed sites

Previously developed sites should aim to discharge at the original pre-development greenfield rate for the whole site area where possible. If not, a significant reduction in the current rate of discharge should be achieved and evidence provided as to why greenfield rates are not viable.

The volume of attenuation storage that would be required for the site should be based on the 1 in 100 year critical storm duration with an allowance for climate change and the allowable discharge rate.

Policy 16: Flooding on and from development sites

Flooding must not occur on any part of the site for a 1 in 30-year rainfall event except in areas that are designed to hold and convey water.

During a 1 in 100 year plus climate change rainfall event no flooding should occur in any part of a building (including a basement); utility plant susceptible to water (e.g. pumping station or electrical sub-station) or on neighbouring sites.

If there is flooding during 1 in 100 year plus climate change rainfall event, this should be indicated on plan showing extent and depth. Flows that exceed design criteria must be managed in exceedance routes) that minimise risks to people and property both on and off the site.

Policy 18: SuDS to be designed at or near the surface

Proposals must demonstrate that the SuDS have been designed at or near the surface in line with the SuDS hierarchy. Underground attenuation features will only be acceptable where it is proven that alternate surface-based methods are not appropriate or feasible.

The design of the drainage system must account for the likely impacts of climate change and changes in impermeable area over the design life of the development. Appropriate allowances should be applied in each case.

Policy 19: During construction arrangements

There should be appropriate arrangements for surface water drainage during the construction phase of a development site. A construction management plan to address all surface water runoff and any flooding issues during the construction stage should be submitted at detailed design stage.

Policy 20: SuDS to have a design life compatible with the development and to include a management and maintenance plan

Drainage components should have a design life compatible with the development. Design should be based on actual site levels, ensuring that the construction of any other infrastructure and services does not compromise the final construction of the SuDS.

Proposals for SuDS must include a management and maintenance plan for the lifetime of the development which shall include arrangements for adoption and any other arrangements to secure the operation of the scheme throughout its lifetime.

Policy 21: SuDS to have wider benefits

In accordance with relevant local plan policies and guidance, proposals for SuDS must maximise wider benefits as appropriate, which include consideration of:

• Safeguarding Water Quality

• Designing for Amenity and Multi-Functionality

4.4. Dacorum Borough Council Local Plan

The Dacorum Local Plan was adopted in September 2013. This sets out the statutory development plan for the borough. The document contains planning policies to guide growth and development throughout the Borough up until 2031.

CS29 – Sustainable Design and Construction

New development will comply with the highest standards of sustainable design and construction possible. The following principles should normally be satisfied:

(a) Use building materials and timber from verified sustainable sources;

(b) Minimise water consumption during construction;

(c) Recycle and reduce construction waste which may otherwise go to landfill.

(d) Provide an adequate means of water supply, surface water and foul drainage;

(e) Plan to limit residential indoor water consumption to 105 litres per person per day until national statutory guidance supersedes this advice;

(f) Plan to minimise carbon dioxide emissions;

(g) Maximise the energy efficiency performance of the building fabric, in accordance with the energy hierarchy set out in Figure 16;

(h) Incorporate at least one new tree per dwelling/per 100sqm (for non residential developments) on-site;

(i) Minimise impacts on biodiversity and incorporate positive measures to support wildlife;

(j) Minimise impermeable surfaces around the curtilage of buildings and in new street design;

(k) Incorporate permeable and lighter coloured surfaces within urban areas; and

(l) Provide on-site recycling facilities for waste.

Buildings will be designed to have a long life and adaptable internal layout. Applicants will therefore need to explain how:

> (i) they have considered the whole life cycle of the building and how the materials could be recycled at the end of the building's life; and
>
> (ii) their design has been 'future proofed' to enable retrofitting to meet tighter energy efficiency standards and connection to decentralised community heating systems.

For specified types of development applicants should provide a Sustainability Statement.

Where new development cannot meet on-site energy or tree planting requirements, the applicant will be expected to contribute towards sustainability offsetting if at all possible (see Policy CS30).

If a scheme would be unviable or there is not a technically feasible approach, the principles in this policy may be relaxed.

CS31 – Water Management

Water will be retained in the natural environment as far as possible. Measures to restore natural flows in the river systems and the water environment will be supported. Supply to the Grand Union Canal will be maintained.

Development will be required to:

(a) avoid Flood Zones 2 and 3 unless it is for a compatible use: Flood Risk Assessments must accompany planning applications for development in these areas, explaining how the sequential approach to development has been taken into account and outlining appropriate mitigation measures;

(b) minimise water runoff;

(c) secure opportunities to reduce the cause and impact of flooding, such as using green infrastructure for flood storage;

(d) secure opportunities to conserve and enhance biodiversity; and

(e) avoid damage to Groundwater Source Protection Zones.

4.5. Non-Statutory Technical Standards for Sustainable Drainage Systems

Published in March 2015, the Non-Statutory Technical Standards for Sustainable Drainage Systems (SuDS) represent the current guidance for the design, maintenance, and operation of SuDS.

- Peak run-off rates: the standards state that peak runoff rates should closely approximate the greenfield rate, with an emphasis on practicality. Importantly, these rates must never surpass the pre-development runoff rate.
- Flood Resilience Design Criteria: the standards state that the drainage system's design should preclude flooding across any part of the site during a 1 in 30-year rainfall event. Furthermore, it stipulates that no building, including basements, should experience flooding during a 1 in 100-year rainfall event.
- Considerations for Pumping Usage: within the standards, it is explicitly noted that pumping should only be employed when the discharge by gravity is deemed not reasonably practicable.

4.6. Water Industry Act

Thames Water is the local Sewerage Undertaker and provides sewerage services under the guidance of the Water Industry act 1991.

Under Section 106 of the Water Industry Act, the developer has an automatic right to ‘communicate’ with the public foul water sewer system.

5. Climate Change

Climate change allowances are a vital part of the assessment of flood risk and surface water management. With projected changes to temperatures, rainfall, river flow and coastal change, it is vital to consider the proposed development site in the future considering its design life.

The proposed design life for this development is 100 years and when considering climate change allowances, it is important to consider a time epoch of 100 years in the future (2123).

5.1. Management Catchment

The Environment Agency's guidance notes on Flood Risk Assessments: climate change allowances (27 May 2022) identify management catchments across the country which determine spatially determined climate change allowances.

The proposed site is located within the Colne Management Catchment.

5.2. Climate Change Allowances for Rainfall

The peak rainfall allowances for the Colne Management Catchment are as follows:

Table 1 - Peak Rainfall Allowances

Rainfall Event	Epoch	Central allowance	Upper end allowance
3.3% Annual Exceedance Rainfall Event	2050s (Lifetime up to 2060)	20%	35%
	2070s (Lifetime between 2061 and 2125)	25%	35%
1% Annual Exceedance Rainfall Event	2050s (Lifetime up to 2060)	20%	40%
	2070s (Lifetime between 2061 and 2125)	25%	40%

In accordance with the EA's guidance, Flood risk assessments: climate change allowance, updated 27 May 2022, an upper-end allowance for peak rainfall should be used for development with a lifetime beyond 2100 for the 1% and 3.3% annual exceedance probability rainfall event.

To provide a resilient design, the peak design rainfall considers an upper end climate change allowance of 40% above the peak rate for climate change (CC) for the 1% Annual Exceedance Probability (AEP) rainfall event.

6. Flood Risk Assessment

This section provides an appraisal of flood risk from all relevant data sources.

Flood risk screening (level 1) provides a general indication of the potential flood risk to the site and identifies whether there are any flood or surface water management issues which warrant further consideration.

Flood risk scoping (level 2) then provides a qualitative appraisal of flood risk posed to a site and the potential impact that will have on flood risk elsewhere.

This Flood Risk Assessment comprises both a screening and scoping study.

6.1. Data Sources

The following information has been appraised as part of this Flood Risk Assessment. All the below maps are included in Appendix 4.

Table 2 - Flood Risk Assessment Data Sources

Title	Author	Dated	Form
Environment Agency Fluvial and Sea Flood Mapping	EA	2022	Online via EA Flood Mapping Tool
Environment Agency Surface Water Flood Mapping	EA	2022	Online via EA Flood Mapping Tool
Hertfordshire County Council Strategic Flood Risk Assessment Level 1 (SFRA): Map 3 - Historic Flooding, Map 4 - Flood Warning Areas, Map 5 - Lakes Inland Water and Reservoirs, Map 6 - Groundwater Source Protection Zones, Map 7 - Areas Susceptible to Groundwater Flooding, Map 8 – Areas at Risk of Surface Water Flooding, Map 9 Flood Management Features	Hertfordshire County Council	2022	PDF Document downloaded from Hertfordshire County Council
Hertfordshire County Council Local Flood Risk Management Strategy (LFRMS 2): Map 1, 1a, 1b, 1c – Flood Incident Record Map 2, 2a, 2b, 2c - Risk of Flooding from Surface Water Map 6, 6a, 6b, 6c – Areas Susceptible to Groundwater Flooding Map 10c – SWMP Hotspots and Risk of Flooding from Surface Water (1% AEP Event) Map 11, 11a, 11b, 11c – Surface Water Management Plan Hotspots	Hertfordshire County Council	2019	PDF Document downloaded from Hertfordshire County Council

6.2. Fluvial and Tidal Flood Risk

Existing Flood Risk to Site

The Environment Agency's Flood Map for Planning confirms that the site is in Flood Zone 1 defined as a low-risk flood zone.

Flood Zone 1 (Fluvial Flooding) is defined as:

Areas with the lowest probability of flooding. This zone is classified as having less than a 0.1% annual probability of river or sea flooding equating to less than 1 in 1000 chance.

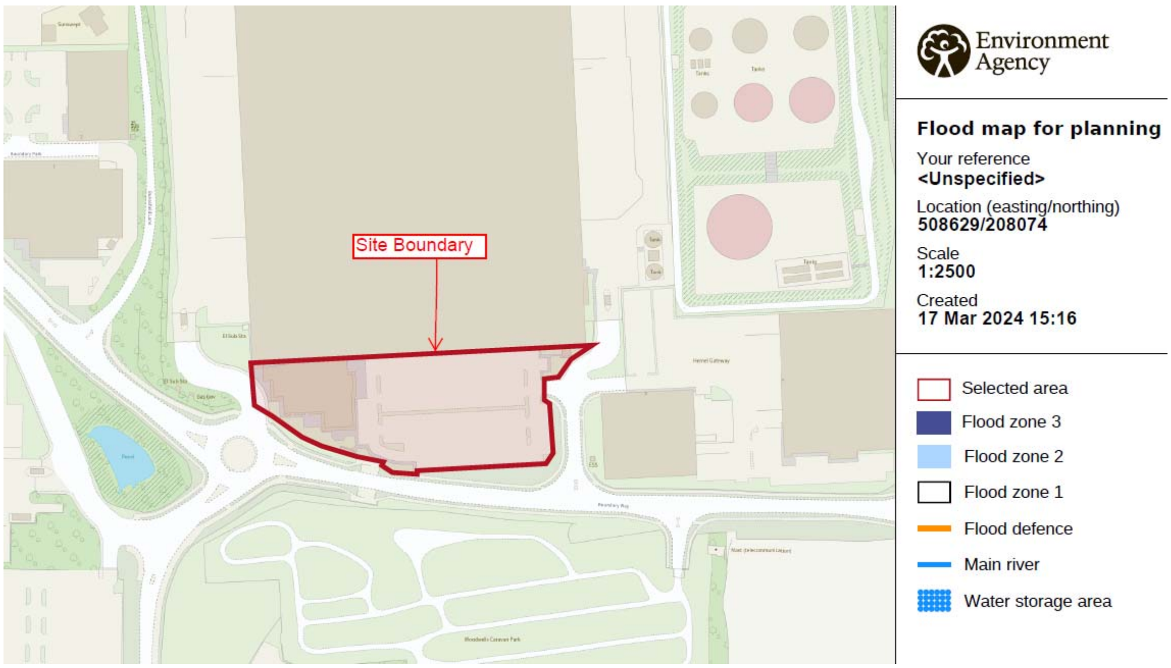


Figure 3 Fluvial and Tidal Flood Map

Considering the location of the site the risk of fluvial and tidal flooding is **low**.

6.3. Surface Water Flooding

Existing Flood Risk to the Site

The EA Flood Risk Maps for Surface Water (FRMfSW) have been appraised to determine the potential risk of surface water flooding to the site. Surface water flooding is sometimes known as flash flooding. It happens when rainwater cannot drain away through normal drainage systems.

4 different risk levels have been appraised which are as follows:

- **Very low risk**: an annual risk of flooding of below 0.1%
- **Low risk:** an annual risk of flooding of between 0.1% and 1%
- **Medium risk:** an annual risk of flooding of between 1% and 3.3%
- **High risk:** an annual risk of flooding of more than 3.3%

An extract of the surface water flood map is shown in **Figure** 4 below.

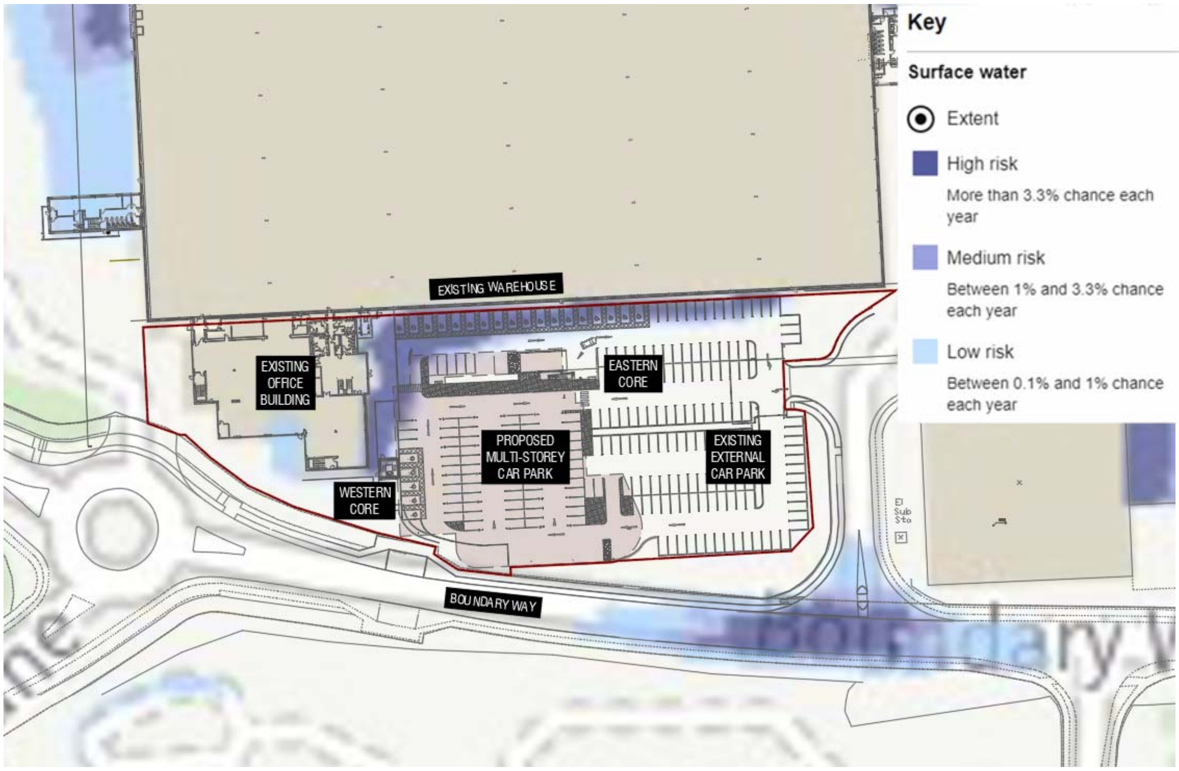


Figure 4 - Surface Water Flood Risk

This indicates that surface water flooding occurs on the low points of the site along the northern boundary (edge of the car park) and to the south and east of the existing office building, all as detailed below:

- High Risk flooding along the northern boundary and to the east of the existing office building;
- Medium Risk flooding along the northern boundary and to the east of the existing office building; and
- Low Risk flooding along the southern boundary and to the south of the existing office building.

The FFL of the office building is at 135.51m AOD and as shown in the topographic survey (see Appendix 2) the external levels along the eastern, southern and western side of the building are generally between 135.30-135.40m AOD. These levels either ramp or step up to 135.51m at the existing building entrances, therefore providing protection against surface water flooding. The EA surface water flood maps indicate no flooding for the areas where levels are 135.41m AOD or higher.

The SFRA Map 3 indicates that there is no historic flooding within or in the immediate vicinity of the site.

The LFRMS 2 Map 1c shows that there have been no records of flooding on site. The LFRMS 2 Map 10c and 11 show that the site is not within an area of surface water flooding hotspots.

Proposed Development and Mitigation Measures

As part of the development, it is proposed to provide a new entrance at the eastern flank of the existing office building. In the same fashion as existing, the external area will ramp up locally to the proposed building, providing a level access and also protect against surface water flooding. It is intended that the existing levels of the external car park and elsewhere around the building will be retained as existing, except at the proposed access paths and stair-cores of the multi-storey car park.

The proposed pedestrian access at the western corner of the multistorey car park (western stair core) is in an area of high risk of surface water flooding (see Figure 4). It is proposed that the FFL of this stair core and paths leading to it are set above 135.51m and a minimum 150mm above the existing ground level to provide a safe access.

The proposed pedestrian access at the northeastern corner of the multistorey car park (eastern stair core) is not in an area at risk of surface water flooding (see Figure 4). It is proposed that the FFL of this stair core and paths leading to it are set 100-125mm above existing ground levels (raised path / kerb upstand) and therefore continue being at no risk of surface water flooding.

The existing surface water flood / exceedance routes will be retained, therefore avoiding risk of flooding elsewhere onsite or outside of the site.

The existing threshold drains at the office building accesses are to be retained and the new access will be equipped with a threshold drain as a safeguard against external flooding.

As detailed in Section 7.0 of this report the surface water discharge from the multi-storey car park area will be reduced significantly and therefore reducing the risk of flooding of the existing surface water sewers within the site.

As a result of all the above, in the event of an exceedance event or flash flooding the flood water will continue being stored at the lowest areas of the site, as existing. Therefore, the risk of surface water flooding to the existing office building and proposed stair cores of the multistorey car park is considered low.

6.4. Groundwater Flooding

Existing Flood Risk to Site

There are 3 main mechanisms of groundwater flooding:

- Prolonged rainfall which causes the water table to rise in unconfined aquifers.
- Lateral flow through riverbanks (particularly raised embankments) into low lying areas as river levels rise.
- Blockage of groundwater flow routes. This would be caused when there is a thick layer of permeable artificial ground and creates a perched water table.

Due to the nature of the flood risk, information on susceptibility to groundwater flooding and modelling of this is sparse. Therefore, potential mechanisms for flooding are identified through a review of historic flooding incidents, geology, springs, land use and potential receptors.

As detailed in Section 2.4, the site's bedrock geology comprises Clay (up to 4.7m BGL) underlain by Chalk, which is classified as a permeable layer. The presence of the top layer of Clay suggests a low permeability and therefore a limited potential for groundwater flooding, despite perched groundwater being encountered at shallow depths, as documented in the historic site investigation works.

The SFRA Map 7 places the development in an area with a medium risk of susceptibility to groundwater flooding. The LFRMS 2 Map 6c places the development in an area with less than 25% risk of susceptibility to groundwater flooding.

Based on the above, the risk of groundwater flooding is considered low.

6.5. Reservoirs/ Lakes / Inland Water Flooding

According to EA flood mapping the site is at risk when there is also flooding from reservoirs/canals. However, reservoirs in the UK have an extremely good safety record. The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers. It is assumed that these reservoirs are regularly inspected, and essential safety work is carried out. These reservoirs therefore present a minimal risk.

The SFRA Map 7 shows that there are no reservoirs, lakes and inland water bodies in the immediate vicinity of the site.

The OS and EA maps (see **Figure 3**) indicate the presence of a drainage attenuation pond southwest of Boundary Way, circa 75m away from the existing Office Building. In the event of this basin flooding, the flood water will be draining on Boundary Way in a westerly direction away from the site. The levels of Boundary way fall from east to west.

The potential risk of reservoirs, lakes and inland water bodies flooding to the site area is considered **low**.

6.6. Sewer Flooding

During heavy rainfall, flooding from the sewer system may occur if:

1. The rainfall event exceeds the capacity of the sewer system/ drainage system.
    - o Sewer systems are typically designed to accommodate rainfall events with an annual probability of 3.3% (1 in 30-year event) or greater.
    - o Rainfall events with an annual probability less than 3.3% would be expected to result in surcharging of some of the sewer system.
2. The system becomes blocked by settlement of debris.
3. The system surcharges due to high water levels in the receiving watercourse.

Drainage in the borough of Dacorum is served by separate foul and surface water sewers owned and maintained by Thames Water.

The SFRA Map 3 indicates that there is no historic flooding within or in the immediate vicinity of the site.

The LFRMS 2 Map 1c shows that there have been no records of flooding on site.

As detailed in **Section** 7 and 8 of this report, the surface water discharge rate from the site will be reduced by more than 90% and the foul water discharge rates will be remain as existing.

Therefore, based on the above, the risk of sewer flooding to the site area is considered **low**.

6.7. Residual Risks

Various residual risks have been considered in the preparation of this Flood Risk Assessment.

Flooding and drainage are considered using design return periods which are probability based. Design standards and guidance require consideration of a specific probability event. However, there is a residual risk that the considered flood risk probability event is exceeded which could cause flooding.

In addition, there is a risk that flood management infrastructure, such as drains, fail. This can also cause flooding.

Residual risks will be managed in various ways, as follows:

- The finished floor levels are above the surface water flood level;
- A building/ estate management company will be engaged to manage the property and manage:
    - o Drainage infrastructure
    - o Any flooding events.
    - o Any failure of flood protection infrastructure; and
    - o The evolving risk to the development from flood risk sources, which may change with time and when/ if the assumptions within this report are superseded (for example, if the building has a lifecycle beyond 100 years)

6.8. Flood Risk Conclusion

Table 3 - Flood Risk Conclusion

Flood Source	Summary	Existing Flood Risk	Mitigation Identified	Potential Development Flood Risk
Fluvial	The site is in Flood Zone 1.	Low	N/A	Low
Surface Water	EA flood modelling tools indicate that the external areas of the site are at risk surface water flooding	Low for buildings Medium and High for some external areas	Yes	Low for buildings Medium and High for some external areas
Groundwater	The general risk of ground-water flooding is considered low, and it is in area with limited potential for groundwater flooding.	Low	No	Low
Reservoirs/ Lakes / Inland Water	The site is outside the extent of flooding from reservoirs/ lakes / inland water	Low	No	Low
Sewer Flooding	No sewer flooding issues identified which impact the site.	Low	No	Low

7. Surface Water Drainage Strategy

7.1. Overview

The Lead Local Flood Authority (LLFA) is the statutory consultee on planning applications for surface water management. As the LLFA, Hertfordshire County Council is therefore responsible for the approval of surface water drainage systems within new major development. Major development consists of any of the following:

a) the provision of dwelling houses where residential development of 10 or more units; or where the development is to be carried out on a site having an area of 0.5 hectares or more and the number of units is not known;

b) the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or

c) development carried out on a site having an area of 1 hectare or more.

The following sections detail the proposed surface water drainage to serve the proposed development. The drainage system has been designed in accordance with the requirements for "Flood risk within the development" set out in "Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems", published by Department for the Environment and Rural Affairs, March 2015.

7.2. Surface Water Drainage Design Criteria

The surface water drainage strategy for the proposed multistorey car park has been developed based on the following key design criteria:

- 1 in 30-year rainfall event – no flooding of any of the site (unless designated to hold and convey water as part of the design)
- 1 in 100-year rainfall event (the peak design storm) – no flooding of any part of a building or utility plant susceptible to water within the development (unless designated to hold and convey water as part of the design)
- > 1 in 100-year rainfall event – where reasonably practicable, flows are managed in exceedance routes that minimise the risk to people and property.

The surface water drainage is detailed in the drawing no. E0837-EEE-07-00-DR-C-0500 in Appendix 5.

The surface water drainage arrangement of the remaining part of the open surface car park and office building will remain as existing. However, there is a requirement for minor diversions of some of the existing pipe work to coordinate with the proposed multistorey car park foundations.

7.3. Planning Policy Requirement

The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface runoff from development sites and recommends that priority is given to the use of Sustainable Drainage Systems (SuDS) in new development, this being complementary to the control of development within the floodplain.

As the intention of SuDS is to mimic the natural drainage regime of the undeveloped site, the NPPF PPG states (consistent with the Building Regulations H3 hierarchy) that drainage solution for the proposed multistorey car park should allow surface water to be discharged according to the following hierarchy of drainage options:

- into the ground (infiltration);
- into to a surface water body;
- into a surface water sewer, highway drain or another drainage system, and
- into a combined sewer

Consideration of Infiltration Drainage

Based on the aforementioned hierarchy, we have firstly considered disposal of surface water from the new development via infiltration.

Based on the underlying geology as described in **Section 2.4**, infiltration is unlikely to be feasible within the first 4.0-5.0m of strata due to the presence of Clay soils. Therefore, the use of infiltration techniques to manage surface water discharge has been discounted and not pursued further at this stage of development.

Consideration of Discharge to Watercourse

Where infiltration is not appropriate, the next preference in the Building Regulations H3 Hierarchy is to discharge to a watercourse.

As described in **Section 2.3** there are no watercourses present within and in the vicinity of the site. Therefore, discharge to watercourse has been discounted and not pursued further at this stage of development.

Consideration of Discharge to Sewer

In line with the NPPF PPG guidance, where discharge via infiltration or into watercourse is not appropriate, the next preference is to discharge to a surface water sewer.
There are existing surface water sewers present within the site. As noted in **Section 2.5** these sewers drain into the Thames Water manhole with reference 5002. Therefore, it is proposed that the development drains into this existing surface water sewers within the site.

Consideration of Discharge to a Combined Sewer

This option has not been considered as there are no combined sewers in the vicinity of the site and as it is the least preferred solution.

7.4. Proposed Discharge Rate

As described above the proposed development includes the provision of a multistorey car park with the rest of the of the site remaining as existing. Therefore, this section of the drainage strategy covers the area associated with the multistorey car park only.

Table 5 Existing site permeability

Total Area (m^2)	Impermeable Area (m^2)	Permeable Area (m^2)
Area of the Proposed Multistorey Car park	3080	None

Greenfield run-off rates have been calculated for the site using the methodology set out within Institute of Hydrology Report 124. Calculations are shown in **Appendix 5**.

Table 6 Greenfield Run-off rates

Return Period	Run-off Rate (l/s)
QBAR	0.05
1 in 1 year	0.04
1 in 30 year	0.17
1 in 100 year	0.19

The existing greenfield run-off rates are very low and it wont be practical to limit the surface water runoff to these rates. Therefore, in line with the HCC Policy 15, it is proposed that the surface water discharge rate from the proposed multistorey car park is limited to 2.0l/s, as close as reasonably practicable, to the greenfield runoff rate. Based on experience a 2.0l/s discharge rate will require a control device (i.e. hydroobrake) with a 50mm opening.

The Design and Construction Guidance for Foul and Surface Water Sewers for Adoption (2023) notes that a minimum 50mm opening is required on control devices to avoid risk of blockage.

Limiting the discharge rate from the proposed multistorey car park to 2.0l/s for all storms up to and including the 1 in 100years plus climate change will provide a significant reduction on the current discharge rate.

The area where the multistorey car park is proposed is currently an open surface car park. It is understood that the surface water runoff from this area drains freely into the Thames Water sewer to the south of the site.

The surface water drainage of the open surface car park that is not to be developed and that of the office building will remain as existing.

7.5. Volume of Attenuation

Based on the proposed discharge rate of 2.0l/s, indicative attenuation storage requirements have been calculated to manage surface water on site for the design storm i.e. the 1% (1 in 100) AP event plus climate change.

The surface water attenuation has been estimated using the 'Source Control' function of Micro Drainage and the Flood Estimation Handbook (FEH) rainfall data. The estimated surface water storage volume is 202-249m^3 and the calculations are included in Appendix 5.

7.6. Sustainable Drainage

To comply with planning policy and best practice, drainage systems should use SuDS as much as possible. SuDS can help manage pollutants before they are discharged and provide attenuation volume to support the controlling of site discharge rate. An assessment of potential SuDS has been undertaken as shown below.

Table 5 Sustainable Drainage Assessment

Component	Description	Comments	✓ [illegible]
Rainwater harvesting systems	Systems that collect runoff from the roof of a building or other paved surface for use	Water re-use is not proposed for the development.	x
Green roofs	Planted soil layers on the roof of buildings that slow and stare runoff	There is no room to put green roofs on the multistorey car park	x
Infiltration systems	Systems that collect and store runoff, allowing it to infiltrate into the ground	As detailed in Section Error! Reference source not found., infiltration is infeasible.	x
Filter strips	Grass strips that promote sedimentation and filtration as runoff is conveyed over the surface	There is insufficient space for the provision of the filter strips	x
Filter drains	Shallow stone-filled trenches that provide attenuation, conveyance and treatment of runoff	It is proposed to use SuDS pipes (perforated pipes surrounded in granular material and wrapped in a combination of geotextile and geomembrane)	✓
Swales	Vegetated channels (sometimes planted) used to convey and treat runoff	There is insufficient space for the provision of swales	x
Bioretention systems	Shallow landscaped depressions that allow runoff to pond temporarily on the surface, before filtering through vegetation and underlying soils	There is insufficient space for the provision of bio-retention systems	x
Trees	Trees within soil-filled tree pits, tree planters or structural sails used to collect, store and treat runoff	There is insufficient space for the provision of trees	x
Pervious pavement	Structural paving through which runoff can soak and subsequently be stored in the sub-base beneath, and/ or allowed to infiltrate into the ground below	Due to the arrangement of the multistorey car park (i.e. stacking of levels) it is not possible to provide permeable paving on the deck car park	x
Detention basins	Vegetated depressions that store and treat runoff	There is insufficient space to provide an open detention basin	x
Ponds and wetlands	Permanent pools of water used to facilitate treatment of runoff can also be stored in an attenuation zone above the pool	There is insufficient space to provide an open pond or wetland	x
Attenuation storage tanks	Large, below-ground voided spaces used to temporarily stare runoff before infiltration, controlled release	It is proposed to provide below ground geo-cellular attenuation tanks as shown in the drainage GA	✓

Proprietary treatment systems	Subsurface structures designed to provide treatment of runoff	It is proposed to use a by-pass oil separator equipped with alarm	✓

7.7. Water Quality

The Simple Index Method for assessing water pollution and water quality improvements has been used to establish that the proposed SuDS suitably treat the pollution anticipated for the site.

There are no reasons to believe that the proposed development would cause abnormal levels of pollution. Therefore, the following pollution hazard levels have been taken for the proposed development (from CIRIA SuDS Manual Table 26.2 (2015)).

Table 6 Development pollution indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Car Parking with Infrequent Change	Low	0.5	0.4	0.4

Rainfall will land on these surfaces, and potentially carry pollution into the downstream drainage network. As such, all rainfall will go through a SuDS feature to treat the pollutants. The following treatment values are taken for the SuDS measures proposed (from CIRIA SuDS Manual Table 26.3 (2015)).

Table 7 SuDS treatment values

Land Use	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Filter Drain	0.4	0.4	0.4
Downstream Defender	0.8	0.5	0.7

The Downstream Defender treatment values have been taken from the manufacturer's datasheet, which is included in Appendix 5.

Proposed Treatment Train

To ensure that the pollution is adequately treated it is important to consider how rainfall lands on the site and how it moves through the SuDS systems to the site outlet.

The surface water runoff will run through the SuDS pipes / filter drains and then through the Downstream Defender before entering the attenuation tanks and then discharging into the existing surface water sewers.

In line with the recommendations of Ciria SuDS Manual (2015), the total SuDS mitigation index will consist of the various components as shown below:

Total SuDS Mitigation Index = Mitigation Index 1 + 0.5 x Mitigation Index 2

The factor of 0.5 is used to account for the reduced performance of secondary or tertiary components associated with already reduced inflow concentrations.

Surface water runoff from deck roof car park (multistorey car park) will have two stages of treatment via the SuDS pipe and Downstream Defender. As shown below the SuDS mitigation indices are greater than the pollution indices.

- Total Suspended Solids = 0.4 + 0.5 x0.8 = 0.9
- Metals = 0.4 + 0.5x0.5 = 0.65
- Hydrocarbons = 0.4 + 0.7x0.5 = 0.75

The proposed mitigations are therefore adequate when compared to the likely pollution.

7.8. Amenity Value and Biodiversity

Due to the nature of the proposed development and spatial constraints, the proposed SuDS will not be able to provide amenity and biodiversity benefits.

7.9. Exceedance and Residual Risk

Surface water drainage design is based on the probabilities of different rainfall events and aims to reduce the risk of flooding rather than eliminate it completely. Flooding could occur at the site for several reasons, including:

- Blocked Collection Systems: Debris, vegetation, or other obstructions can impede the flow of stormwater through collection pipes and channels, leading to accumulation and potential flooding.
- Overwhelmed Conveyance Systems: During extreme rainfall events, the capacity of conveyance systems, such as storm drains and culverts, can be exceeded, causing water to overflow and flood adjacent areas.
- Extended Design Lifetimes: The lifespan of drainage systems often exceeds the assumed design period, increasing the likelihood of rainfall intensity exceeding anticipated levels, leading to flooding events that were not considered during the initial design phase.
- Inaccurate Climate Change Assumptions: Changing climate patterns, including increased rainfall intensities, may not be fully reflected in the original design assumptions, potentially leading to underestimation of flood risks.

To effectively address these residual flooding risks, it is essential to consider overland flow routes, which are the pathways that stormwater follows overland when the drainage system is overwhelmed or obstructed. The exceedance routes for the site are displayed in the drainage GA in Appendix 5.

Further mitigations are proposed to reduce the risk of flooding by exceedance including:

- Implementation of threshold drains for level accesses.
- Ensuring that, where possible, surface fall away from the building, especially at buildings.

7.10. Maintenance and Management of Drainage Infrastructure

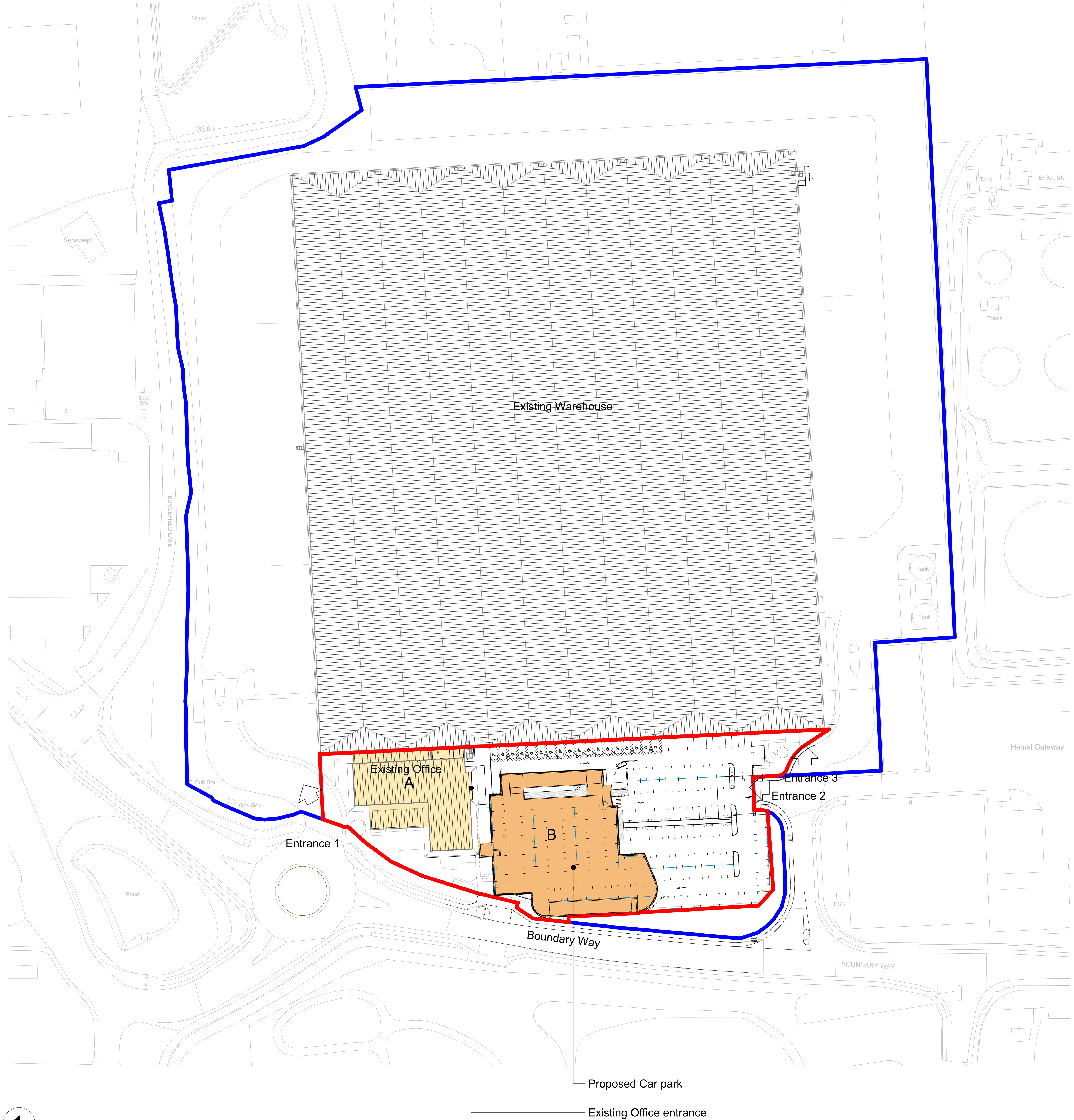
The maintenance and management plan for the drainage infrastructure is detailed in a standalone document.

8. Foul Water Drainage Strategy

8.1. Overview

The foul drainage serving the existing office building will remain unaltered. Therefore, any additional foul drainage points within the office building will be draining into the existing foul drainage system within the site.

Appendix 1 – Proposed Site Layout



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N

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SCALE 1:1000 m

The contractor must check dimensions on site. Only figured dimensions to be worked from.

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DRAWING CONVENTIONS:

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NOTES:

Existing buildings

A - Main office building

Proposed buildings

B - Car park

REVISIONS

Rev.	Description	Date	Checked
A	Draft AFL Drawings issued for discussion	08.01.2024	GTH
B	Draft Planning drawings Issued for discussion	24.01.2024	SN
C	Planning site plan updated	11.03.2024	BA
D	Notes adjusted	12.03.2024	BA

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DOCUMENT TITLE:
Context Plan - Proposed Car Park

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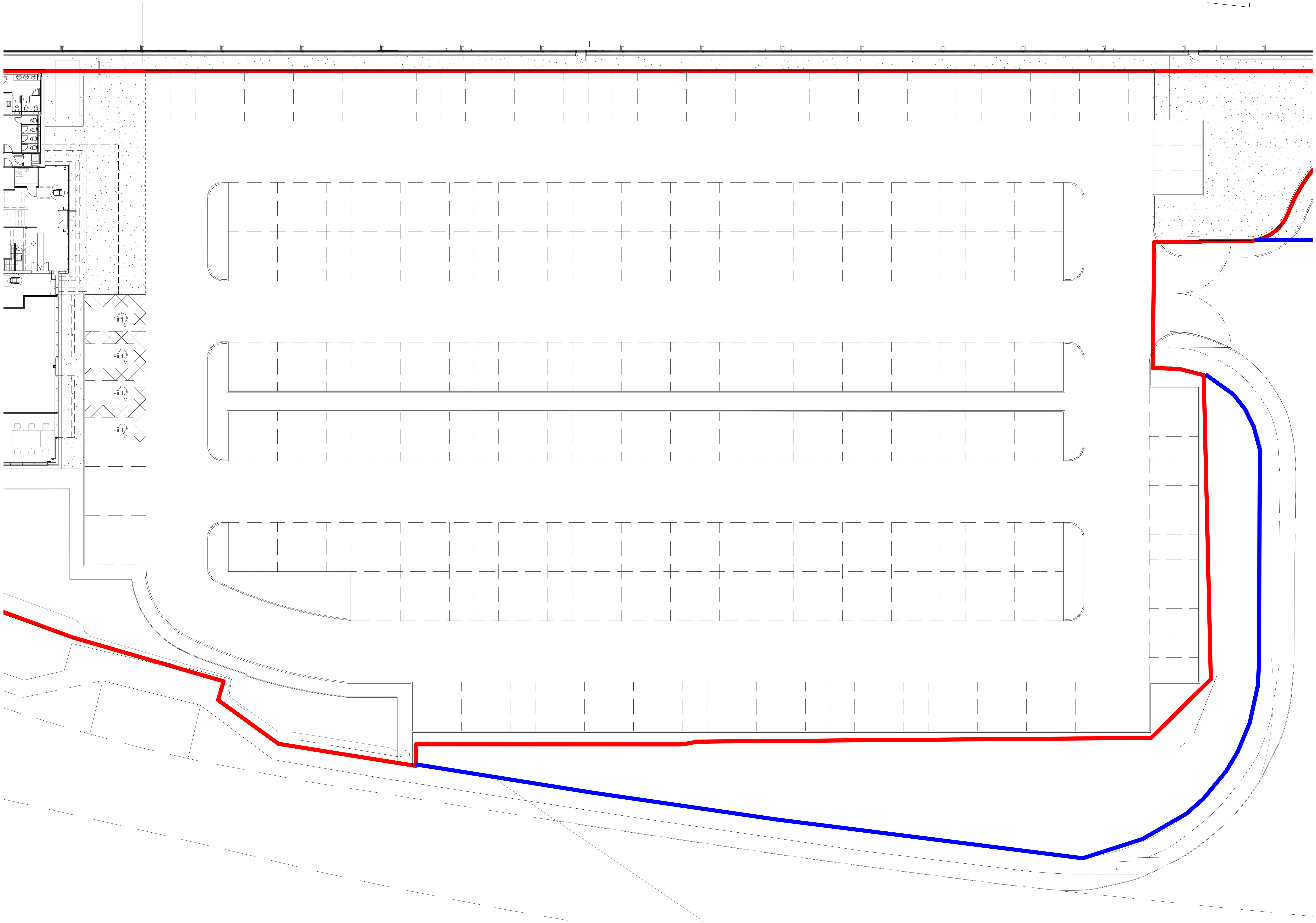

1 — 00 Existing Ground Floor

1 : 200

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SCALE 1:100 m

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Zone: 07

Status: S1

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NOTES:

Rev.	Description	Date	Checked
B	Boundary lines added	15.03.2024	BA
A	WIP Issue. Issued for comment.	08.12.2023	GTH

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DOCUMENT TITLE:
Existing Ground Floor Plan

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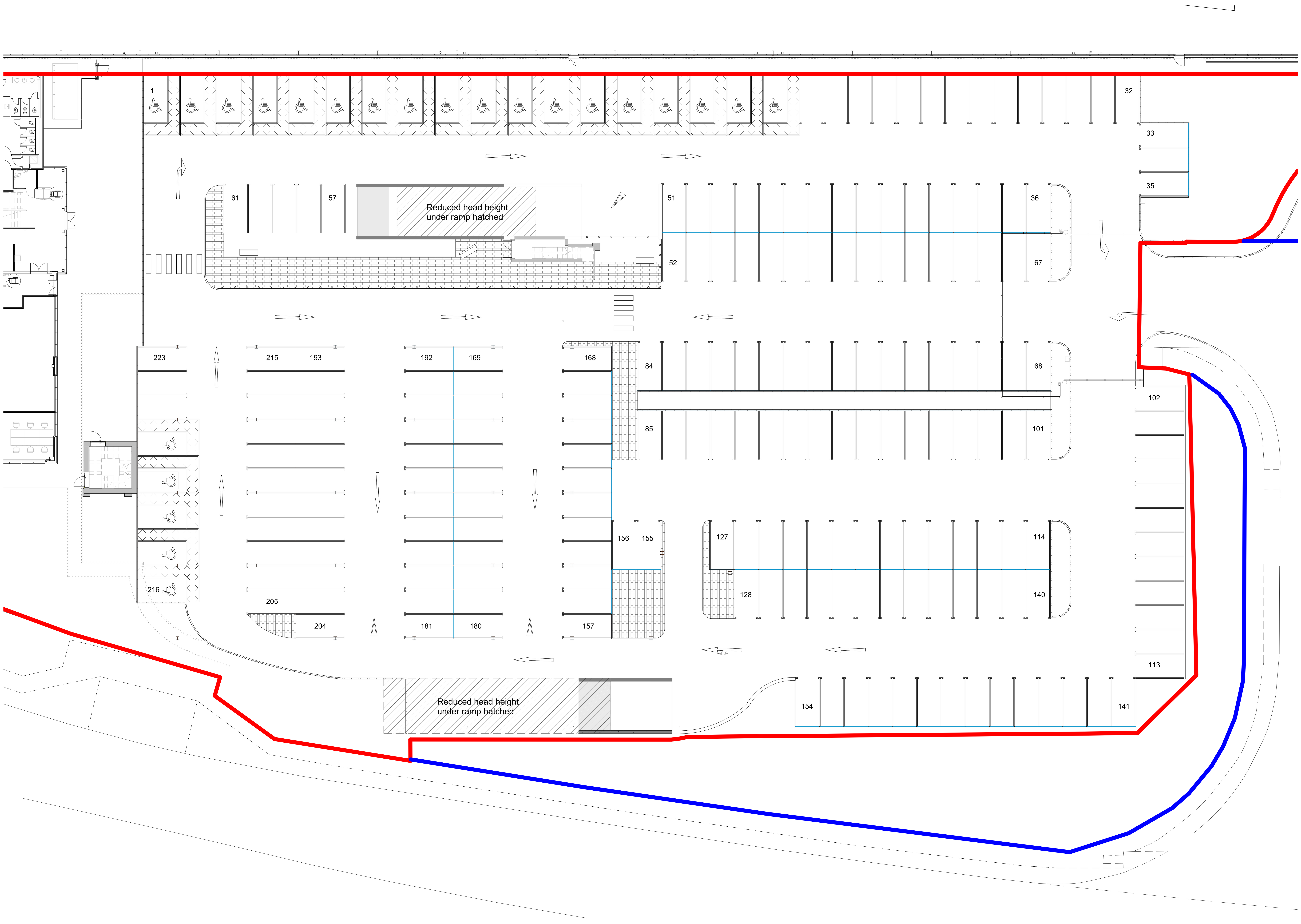

1 Proposed Ground Floor Layout
1 : 200

-1 0 1 2 3 4 5
SCALE 1:100 m

N

Zone: 07

Status: S1

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B	Updated to current layout	11.03.2024	BA
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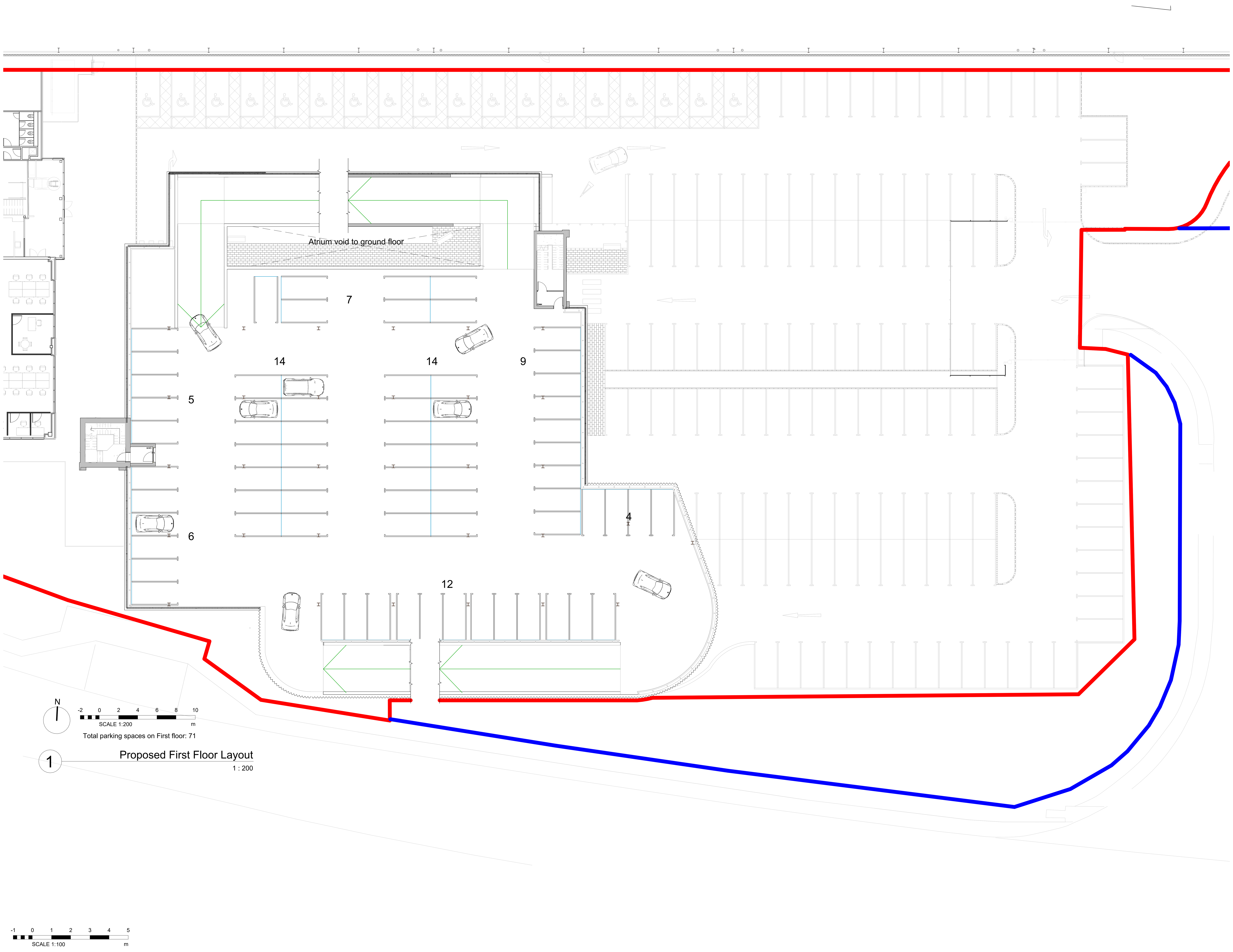

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DOCUMENT TITLE:
Proposed First Floor Plan

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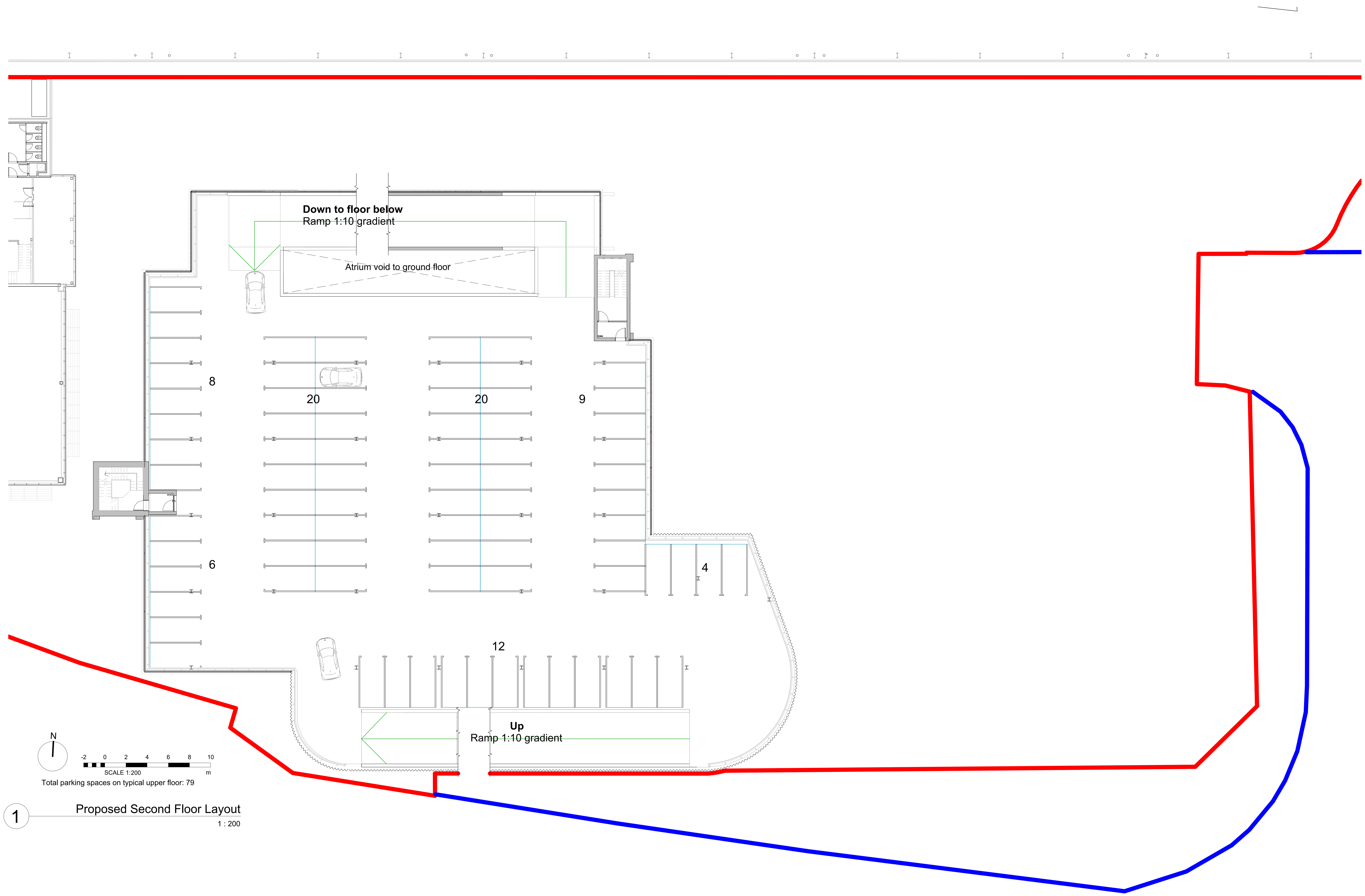

Total parking spaces on typical upper floor: 79

1 Proposed Second Floor Layout

1 : 200

Zone: 07

Status: PL

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B	Updated to current layout	11.03.2024	BA
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Proposed Second Floor Plan

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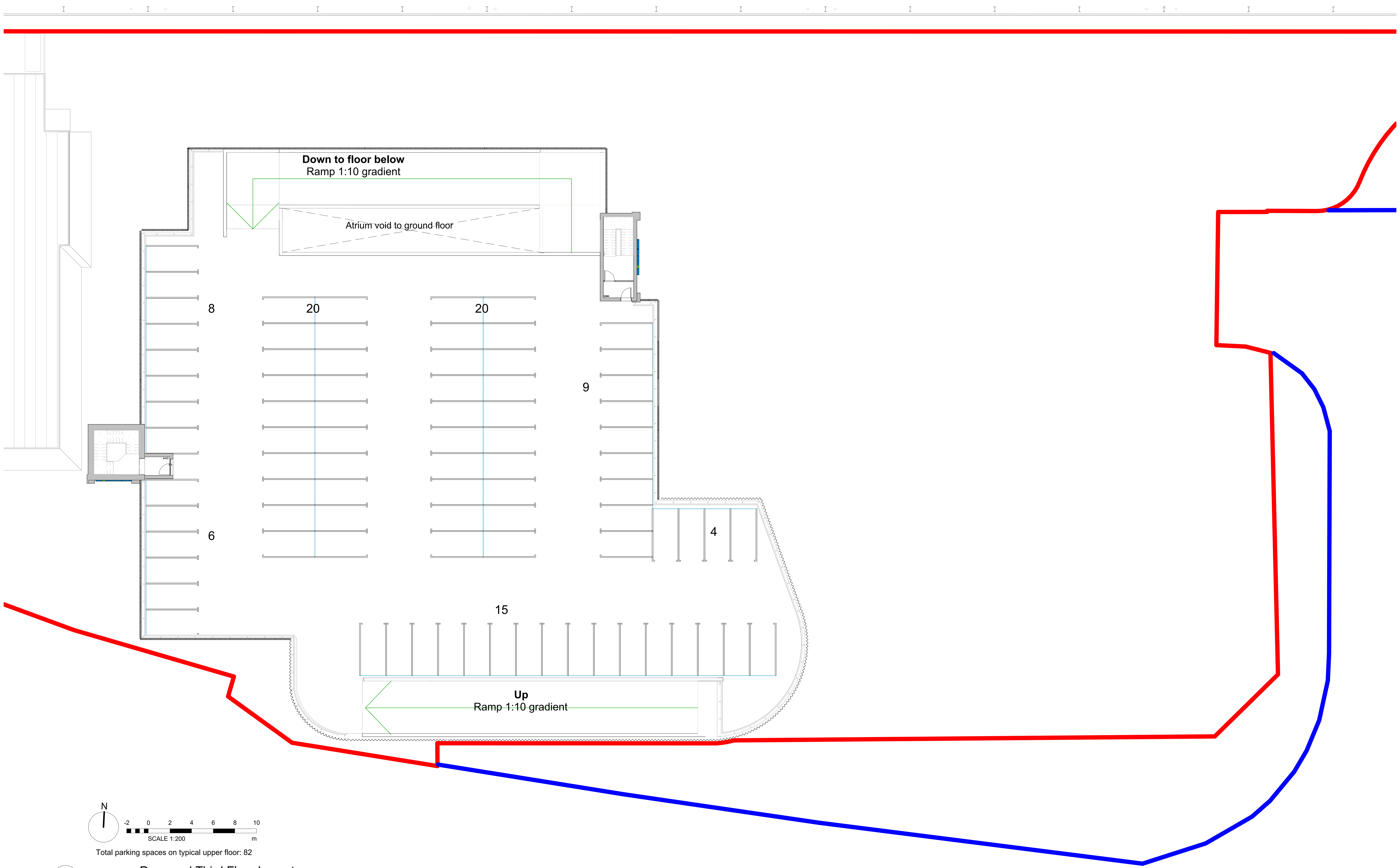

1 Proposed Third Floor Layout
1 : 200

Zone: 07

Status: PL

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Proposed Third Floor Plan

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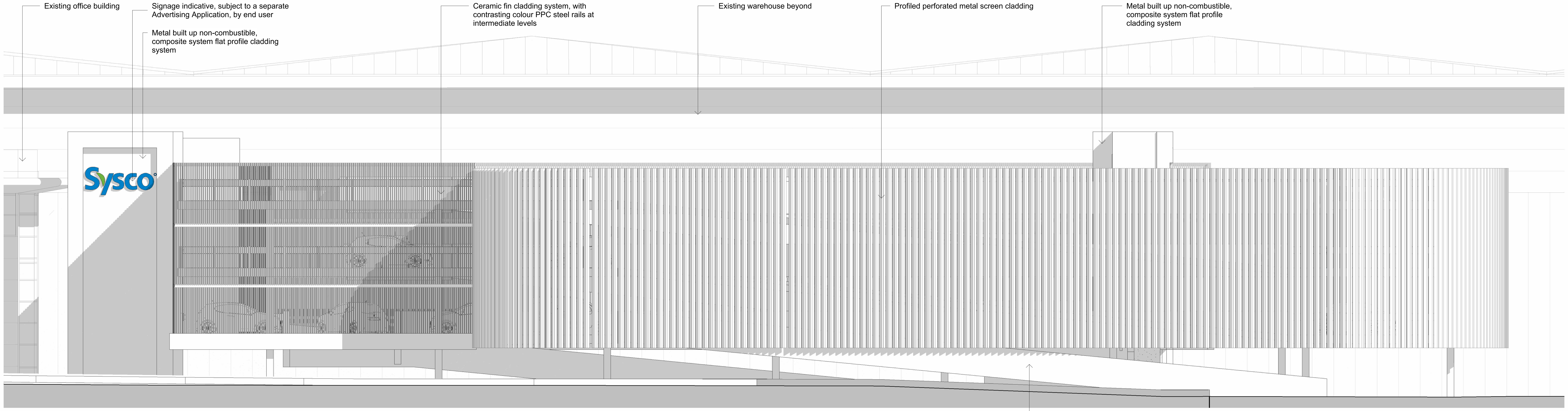

South Elevation

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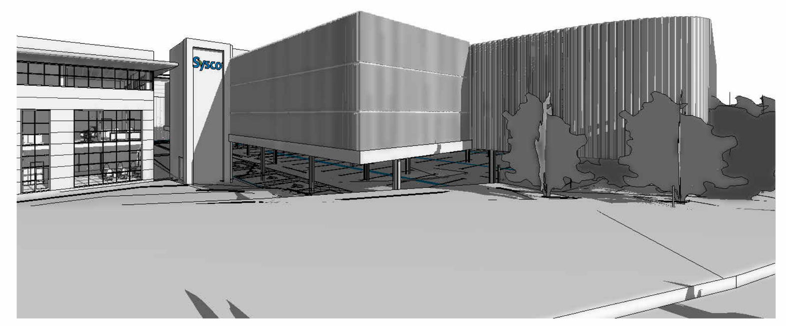
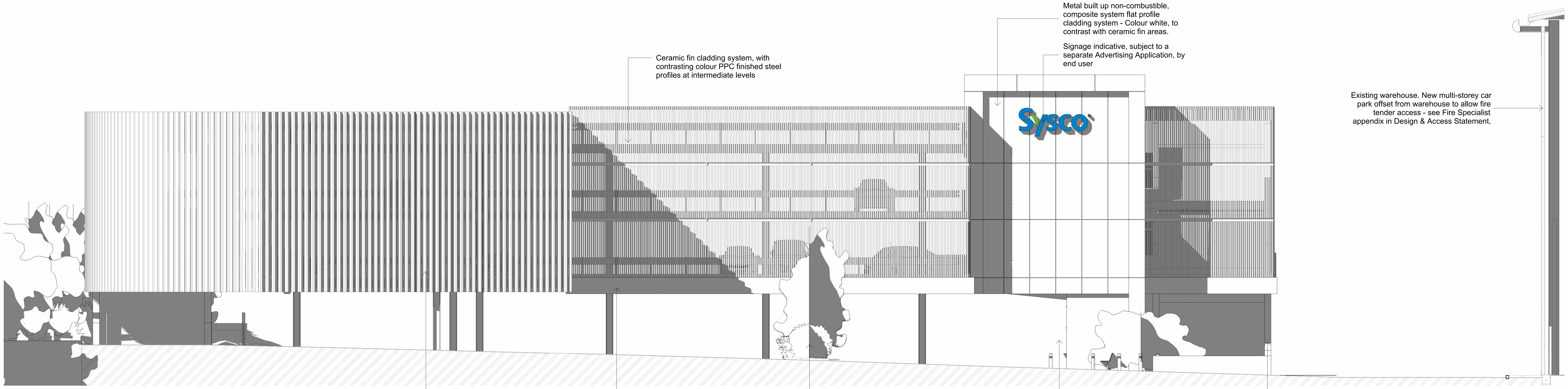
SCALE 1:100 m





East Elevation

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SCALE 1:100 m

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DOCUMENT TITLE:
South & East Elevations - Proposed

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