

# Flood Risk Assessment

Proposed Hard Standing, Dunster House,  
Palgrave Way, Benner Road Industrial Estate,  
Pinchbeck,  
PE11 3YW

Version 01

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## 1. INTRODUCTION

Government Guidance states:

***'Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.'***

To demonstrate the appropriateness of any new development in areas at risk of flooding a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

The requirements for flood risk assessments are generally as set out in the National Planning Policy Framework (NPPF) and the National Planning Policy Framework Planning Practice Guidance. The FRA should be commensurate with the risk of flooding to the proposed Development, for example, where the risk of flooding to the site is negligible (e.g. 'low probability' Flood Zone 1), there is little benefit to be gained in assessing the potential risk to life and/or property as a result of fluvial (river) flooding. Rather, emphasis should be placed on ensuring that runoff from the site does not exacerbate flooding lower than in the catchment.

This assessment has been produced in accordance with "Preparing a Flood Risk Assessment: Standing Guidance" by DEFRA and the Environment Agency.

This Flood Risk Assessment considers the impact of the proposed development in addition to the common ways in which flooding can occur. The conditions that currently exist in the location of the site are described, together with the methods used to identify and assess potential impacts caused from the development proposals.

Instruction has been received to produce a Flood Risk Assessment in support of an application for the construction of a new hard standing for Dunster House at Palgrave Way, Benner Road Industrial Estate, Pinchbeck CP, PE11 3YW.

This report is for the sole use of the applicant and only in respect of the application for which it was prepared. The report is, in part, based upon information provided by others and on the assumption that all relevant information has been provided by those parties from whom it has been requested. Information obtained from any third party has not been independently verified unless otherwise stated in the report.

## 2. SITE DESCRIPTION

The site is located on the East side of Palgrave Way in on the south side of Pinchbeck, Spalding.

The application site (red line boundary) measures 0.019ha and forms part of a site measuring 0.169ha (blue line boundary) which is operated as a distribution centre by Dunster House.

The application site is centred approximately on national grid reference TF 24752 24687.

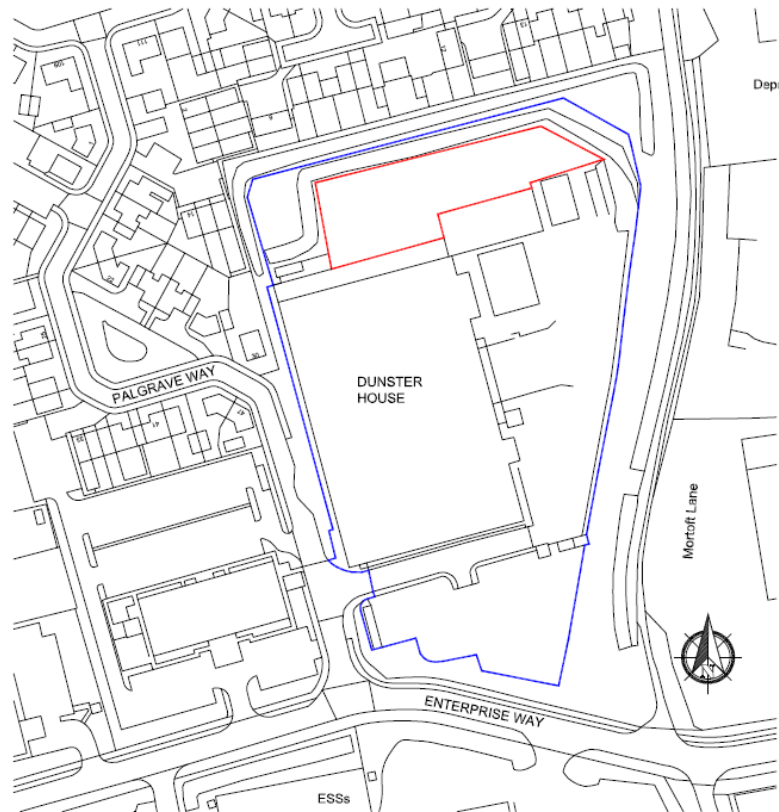


Fig.1. Site Location Plan

The site is identified on publicly available mapping as falling within flood zone 3a: **High Probability**. Having greater than 1% (1 in 100) annual probability of river flooding or 0.5% (1 in 200) annual probability of flooding from the sea **without defences**.

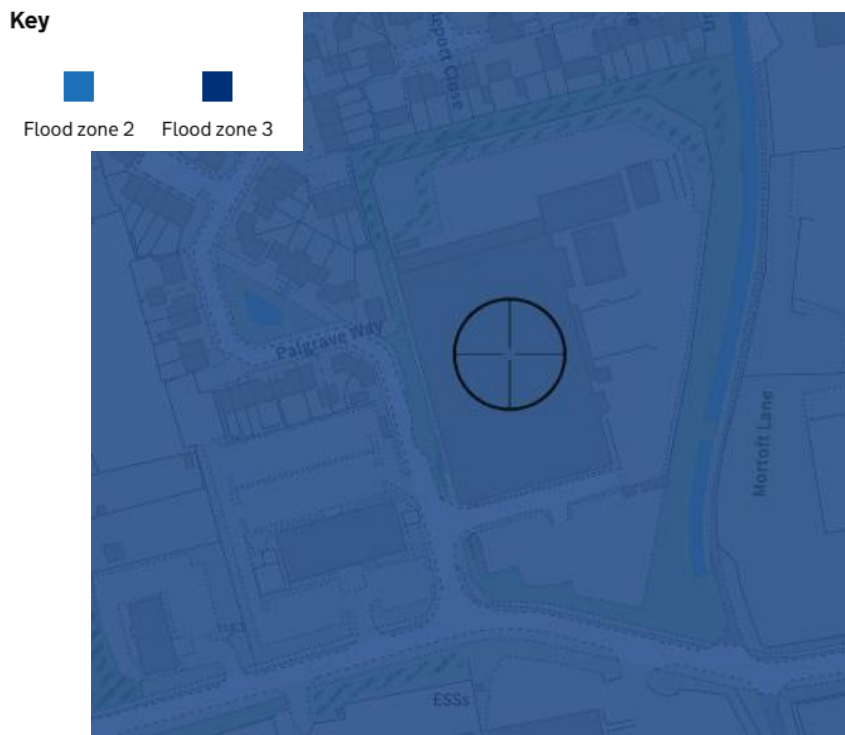


Fig.2. Flood Map for Planning

Figure 3 overleaf shows modelled areas affected by the surface water flooding during 1% (1 in 100) AEP events.

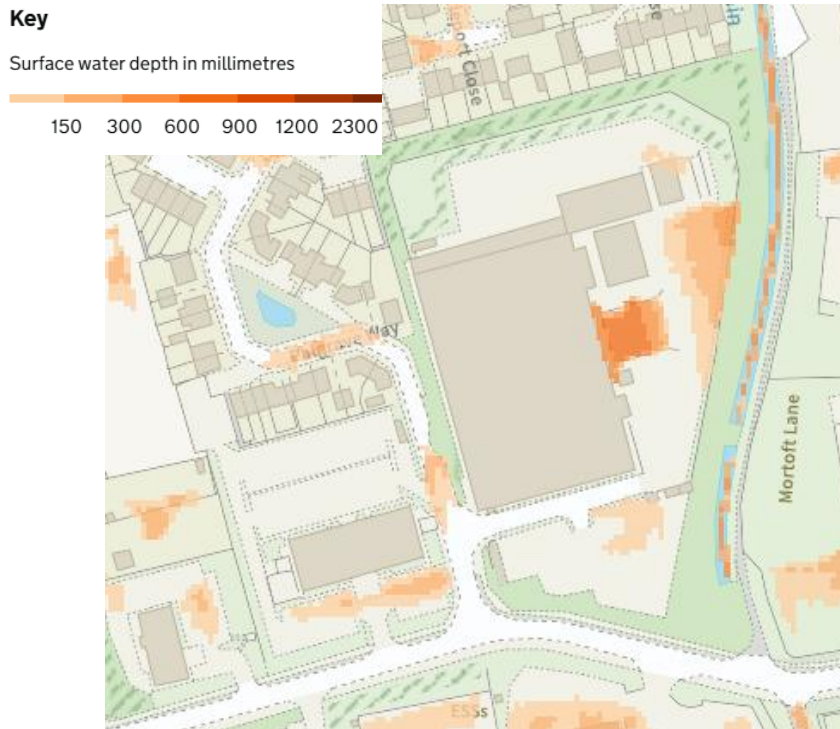


Fig.3. 1% (1 in 100) AEP Surface Water Flood Extents

No Critical Drainage Areas and been identified in the locality.

#### LOCAL HYDROLOGY

No records of the on-site drainage systems are available, however it is understood that the surface water drainage for the wider site (blue outlined in Fig.1) discharges via a combination of infiltration and positive connections to the ordinary watercourse which runs to the east of the site.

The Pennygate Drain collects runoff from the Pinchbeck March catchment, running in a southerly direction along the eastern boundary of the site. Pennygate Drain connects to the Vernatts Drain approximately 300m south of the site, which outfalls to the River Welland approximately 6km NE of the site.

The watercourse in the area are maintained by Welland and Deepings Internal Drainage Board.

#### LOCAL GEOLOGY AND GROUND CONDITIONS

British Geological Survey mapping indicates that the site is underlain by the Oxford Clay (Mudstone) with variable superficial deposits comprising a mix of clay and silt.

Published borehole records in the vicinity of the site are consistent with these findings, indicating topsoil to depths of approximately 0.30 m, underlain by 0.5m of soft to firm clay over 0.4m of fine to medium sand with soft silty clay to the maximum recorded depth of 2.0m.

### 3. DEVELOPMENT PROPOSALS

It is proposed to replace an area of porous granular surfacing (outline red in figure 1) with a new concrete hard standing to be used as open storage.

The table below summarises the existing and proposed areas:

|                       | Existing Area<br>(m <sup>2</sup> ) | Proposed Area<br>(m <sup>2</sup> ) | Increase<br>(m <sup>2</sup> ) |
|-----------------------|------------------------------------|------------------------------------|-------------------------------|
| Roof                  | 6,650                              | 6,650                              | 0                             |
| Impermeable Surfacing | 4,140                              | 6,025                              | 1,885                         |
| Porus Surfacing       | 3,725                              | 1,840                              | -1,885                        |
| Landscaped Area       | 2,345                              | 2,345                              | 0                             |
| Total                 | 16,860                             | 16,860                             | 0                             |

Fig.4. Proposed Area Take-off Plan

## 4. SEQUENTIAL TEST

Planning Policy Guidance states that all developments in areas of flood risk have to show how they have passed the sequential test and the exception test.

The aim of the Sequential Test, as set out in the Planning Practice Guidance, is to ensure that a sequential approach is followed to steer new development to areas with the lowest probability of flooding through a review of available sites in the local area and their relative flood risk categorisation.

NPPF extracts shown below confirm that buildings used for general industry, storage and distribution are classified as 'Less Vulnerable' in terms of flood risk.

### 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.
- Land-raising (unless part of or enabling a development with a higher vulnerability classification).

Fig 5: Technical Guidance to the National Planning Policy Framework, Annex 3 (extract)

Table 3 of the Technical Guidance to the NPPF establishes that the Exceptions Test need not be applied for Less Vulnerable development in Flood Zone 3a, meaning that the development is appropriate, subject to it being demonstrated that it will not increase flood risk elsewhere.

| Flood zones | Flood Risk Vulnerability Classification |                         |                         |                 |                  |
|-------------|-----------------------------------------|-------------------------|-------------------------|-----------------|------------------|
|             | Essential infrastructure                | Highly vulnerable       | More vulnerable         | Less vulnerable | Water compatible |
| Zone 1      | ✓                                       | ✓                       | ✓                       | ✓               | ✓                |
| Zone 2      | ✓                                       | Exception test required | ✓                       | ✓               | ✓                |
| Zone 3a †   | Exception test required †               | X                       | Exception test required | ✓               | ✓                |
| Zone 3b *   | Exception test required *               | X                       | X                       | X               | ✓ *              |

### Key:

✓ Exception test is not required

X Development should be refused

Fig 6: Technical Guidance to the National Planning Policy Framework, Table 3 (extract)

## 5. SUMMARY OF FLOOD RISKS

| Source of Flooding                    | Description                                                                                                                                                                                                | Significance of risk prior to mitigation |   |   | Mitigation Measures                                                                                                                                                             | Significance of risk post mitigation |   |   |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---|---|
|                                       |                                                                                                                                                                                                            | L                                        | M | H |                                                                                                                                                                                 | L                                    | M | H |
| <b>Rivers</b>                         | The site is within Flood Zone 3a (unprotected). The River Welland may be overtopped or be breached in extreme events                                                                                       |                                          |   | ✓ | Investigate modelled river levels and review breach mapping if required. No new buildings are proposed as part of the development                                               | ✓                                    |   |   |
| <b>Tidal/Coastal</b>                  | The SEL SFRA shows the site within Flood Zone 3a (unprotected) and is therefore classified as high-risk tidal flooding. The tidal River Welland coastal defences provide protection against tidal flooding |                                          |   | ✓ | Investigate existing flood defences and assess breach scenarios. No new buildings are proposed as part of the development                                                       | ✓                                    |   |   |
| <b>Water Courses</b>                  | Several ordinary water courses contribute to the IDB systems but are not known to affect the site. Exceedance of these systems may affect the site                                                         |                                          | ✓ |   | Seek evidence of flooding from local authority and riparian systems. Consider flood flow routes and future maintenance.                                                         | ✓                                    |   |   |
| <b>Groundwater</b>                    | BGS identifies the site as being at low risk                                                                                                                                                               | ✓                                        |   |   |                                                                                                                                                                                 | ✓                                    |   |   |
| <b>Overland flow (Surface Water)</b>  | Gov.uk data shows areas within the wider site as being susceptible to surface water flooding for the modelled 1% AEP event                                                                                 |                                          | ✓ |   | Ensure that adequate surface water drainage systems are designed for the proposed development and consider exceedance event flood flow routes in the design of finished levels. | ✓                                    |   |   |
| <b>Ponds/Swales</b>                   | No ponds and swales have been identified in the vicinity of the site                                                                                                                                       | ✓                                        |   |   |                                                                                                                                                                                 | ✓                                    |   |   |
| <b>Public infrastructure failure</b>  | There is no record of public infrastructure failure in the vicinity of the site                                                                                                                            | ✓                                        |   |   |                                                                                                                                                                                 | ✓                                    |   |   |
| <b>Private infrastructure failure</b> | The existing foul and surface water drainage systems on the site have not been investigated for adequacy, however there is no evidence of past failure.                                                    |                                          | ✓ |   | Ensure existing and proposed systems are designed for ease of future maintenance and that a suitable maintenance regime is in place                                             | ✓                                    |   |   |
| <b>Pluvial (urban drainage)</b>       | Impermeable paving is proposed in the development which will reduce time of concentration and prevent natural infiltration                                                                                 |                                          | ✓ |   | Design new surface water drainage systems in accordance with latest relevant SuDS guidance                                                                                      | ✓                                    |   |   |
| <b>Artificial sources</b>             | Several man-made drainage systems form part of the Welland and Deepings IDB catchments.                                                                                                                    |                                          | ✓ |   | SHIDB maintain their networks to a 1 in 100 year level of protection with 300mm freeboard.                                                                                      | ✓                                    |   |   |

## 6. CLIMATE CHANGE

National Planning Policy Framework (which details government requirements for the management and reduction of flood risk) requires the investigation of climate change on any proposed development. The Environment Agency have produced guidance on the allowances that are to be made to mitigate the future impact of climate change.

Climate change allowances are predictions of anticipated change for:

- peak river flow
- peak rainfall intensity
- sea level rise
- offshore wind speed and extreme wave height

### 6.1. RIVER FLOW CHANGE

For 'More Vulnerable' development in flood zone 3a EA guidance stated that 'Central' should be used to assess the range of allowances.

| <b>Welland Management Catchment peak river flow allowances</b> |         |        |       |
|----------------------------------------------------------------|---------|--------|-------|
|                                                                | Central | Higher | Upper |
| 2020s                                                          | 5%      | 10%    | 22%   |
| 2050s                                                          | 4%      | 10%    | 26%   |
| 2080s                                                          | 17%     | 28%    | 53%   |

Fig 9: Peak River Flow Climate Change Allowances by Management Catchment (GOV.UK extract)

It is understood that the flood mapping appended to the SEL SFRA includes a climate change allowance of 20% for the year 2115 fluvial breach events. As the latest guidance requires a 17% allowance in accordance with the table above, the SFRA mapping represents a conservative position.

### 6.2. RAINFALL INTENSITY CHANGE

Due to the nature of the development (general industrial use) the design life must be considered to be more than 100 years and therefore the on-site drainage design and flood risk mitigation measures must use Upper End allowances to ensure climate change of 35% and 40% are taken into account for 3.3% (1 in 30) and 1% (1 in 100) annual probability events, in accordance with the table below.

| <b>Welland Management Catchment peak rainfall allowances</b> |                   |                     |
|--------------------------------------------------------------|-------------------|---------------------|
| <b>3.3% annual exceedance rainfall event</b>                 |                   |                     |
| Epoch                                                        | Central allowance | Upper end allowance |
| 2050s                                                        | 20%               | 35%                 |
| 2070s                                                        | 25%               | 35%                 |

#### 1% annual exceedance rainfall event

| Epoch | Central allowance | Upper end allowance |
|-------|-------------------|---------------------|
| 2050s | 20%               | 40%                 |
| 2070s | 25%               | 40%                 |

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

Fig 10: Peak Rainfall Climate Change Allowances by Management Catchment (GOV.UK extract)

### 6.3. SEA LEVEL CHANGE

For 'More Vulnerable' development in flood zone 3a, guidance states that the 'higher central' should be used to assess the range of allowances.

| <u>Area of<br/>England</u> | <u>Allowance</u>  | <b>2000<br/>to<br/>2035<br/>(mm)</b> | <b>2036<br/>to<br/>2065<br/>(mm)</b> | <b>2066<br/>to<br/>2095<br/>(mm)</b> | <b>2096<br/>to<br/>2125<br/>(mm)</b> | <b>Cumulative<br/>rise 2000<br/>to 2125<br/>(metres)</b> |
|----------------------------|-------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|----------------------------------------------------------|
| <b>Anglian</b>             | Higher<br>central | 5.8<br>(203)                         | 8.7<br>(261)                         | 11.6<br>(348)                        | 13<br>(390)                          | 1.20                                                     |
| <b>Anglian</b>             | Upper end         | 7<br>(245)                           | 11.3<br>(339)                        | 15.8<br>(474)                        | 18.1<br>(543)                        | 1.60                                                     |

Fig 11: Peak Sea Level Change Allowances by River Basin District (GOV.UK extract)

To bring this into the context of the development today, it is recommended that climate change contingency allowances are applied in accordance with NPPF guidance for planners.

The SFRA mapping uses a Feb 2017 baseline for 0.5% (1 in 200) annual probability tidal flooding in a 2115 scenario.

$$2115 \text{ to } 2125 = 10\text{yrs} \times 13\text{mm/yr} = 130\text{mm}$$

Given that principal risk of flooding at the site is from a breach in the tidal defences of the River Welland, it is considered that the marginal increase in water level approximately 1.2km from the application site with represent a negligible increase in flood hazard or water depth for the proposed development. A conservative approach in terms of floor level elevation will mitigate this increase.

### 6.4. OFFSHORE WIND SPEED AND EXTREME WAVE HEIGHT

As the development site is more than 18km from the sea at The Wash, offshore wind speed and extreme wave height influences are not considered relevant for this assessment. The primary flood risk remains associated with potential breaches of the nearby river defences, rather than direct coastal forces or wave action.

## **7. FLOOD RISK MITIGATION**

### **7.1. FLOODING FROM RIVERS AND SEAS**

The site is located within Flood Zone 3 and benefits from the presence of raised flood defences. A residual risk would remain in the event of the defences being overtopped or breached.

The proposed development comprises external hardstanding only and would not introduce buildings, sleeping accommodation or permanently occupied areas. Property-level measures such as raised finished-floor levels, flood doors and flood-resilient internal construction are therefore not applicable.

The hardstanding should be constructed broadly at existing ground level, subject only to the gradients required for positive drainage. It will therefore not materially reduce floodplain storage, obstruct floodwater movement or redirect flows towards neighbouring land. Any kerbs, fencing, gates or other features should be arranged so that they do not create a significant barrier to flood flows.

The hardstanding will not be used to store hazardous, polluting or readily buoyant materials. External equipment, containers and street furniture should be appropriately secured against movement during flooding.

Where flood warnings are issued, use of the hardstanding should cease and users and vehicles should leave the site, where safe to do so, before hazardous flooding develops. The site should remain closed until the flood risk has passed.

### **7.2. FLOODING FROM PLUVIAL AND SURFACE WATER FLOODING**

The proposed hardstanding has the potential to increase the rate and volume of surface-water runoff.

It is therefore recommended that the surface-water drainage system is designed in accordance with SuDS principles in compliance with building regulations Part H, NPPF and the CIRIA SUDS manual.

Surface water drainage strategies should ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1. Store rainwater for future use
2. Use infiltration techniques, such as porous surfaces and soakaway drainage
3. Discharge rainwater direct to watercourse
4. Discharge rainwater to a surface water drain
5. Discharge rainwater to the combined sewer

The detailed drainage design should accommodate the appropriate design rainfall event, including an allowance for climate change, and restrict discharge to an agreed rate. Attenuation should be provided where necessary to ensure that the development does not increase flood risk elsewhere.

Finished levels should provide positive drainage away from neighbouring properties and other vulnerable receptors. Flows exceeding the drainage system's design capacity should be directed along defined exceedance routes and retained within the site, where practicable.

Where the drainage outfall could be affected by elevated receiving-water levels, suitable backflow protection should be considered. Subject to the implementation and continued maintenance of an appropriate SuDS drainage system, the proposed development should not materially increase pluvial or surface-water flood risk within the site or elsewhere.

## **8. CONCLUSIONS AND RECOMMENDATIONS**

- This Flood Risk Assessment supports the proposed replacement of approximately 1,885 m<sup>2</sup> of porous granular surfacing with concrete hardstanding at Dunster House, Palgrave Way, Pinchbeck.
- The site lies within Flood Zone 3a and benefits from raised flood defences. A residual risk remains from the overtopping or breach of the River Welland defences.
- The proposal comprises external hardstanding for open storage and does not introduce buildings, sleeping accommodation or permanently occupied areas. The development is classified as less vulnerable and is therefore appropriate within Flood Zone 3a, subject to demonstrating that it will remain safe and will not increase flood risk elsewhere.
- The hardstanding should be constructed broadly at the existing ground level, with only the gradients required to achieve positive drainage.
- Kerbs, fencing, gates and other external features should be arranged so that they do not materially obstruct flood flows, reduce floodplain storage or redirect water towards neighbouring land.
- Hazardous, polluting or readily buoyant materials should not be stored within the affected area. External equipment, containers and street furniture should be appropriately secured against movement during flooding.
- A detailed surface-water drainage design should be prepared in accordance with the drainage hierarchy and SuDS principles. The design should establish the condition and capacity of the existing drainage system, accommodate the relevant rainfall events including climate-change allowances, restrict discharge to an agreed rate and provide attenuation where necessary.
- Finished levels and exceedance routes should direct surface water away from buildings, neighbouring land and other vulnerable receptors. Backflow protection should be considered where the drainage outfall could be affected by elevated receiving-water levels.
- The drainage system should incorporate appropriate pollution-control measures and be supported by suitable inspection and long-term maintenance arrangements.
- A flood-management procedure should be incorporated into the site's operational arrangements. This should include monitoring relevant flood warnings, ceasing use of the hardstanding where flooding is anticipated, safely removing personnel and vehicles, and keeping the area closed until the risk has passed.
- Subject to the detailed drainage design and implementation of the mitigation and maintenance measures set out within this assessment, the proposed development is considered capable of proceeding without materially increasing flood risk to the site or elsewhere.

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