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Flood Risk Assessment

Jepco

Gedney Marsh H3 Access Road Project

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1. INTRODUCTION

JEPCO, always at the forefront of innovation and sustainability have embarked upon an ambitious venture to develop and operate a highly efficient, ultimately Carbon Neutral, Agricultural infrastructure at their existing Lincolnshire base.

JEPCO's ultimate development of the site shall consist of sustainable year-round growing supported by renewable energy sources which will serve to contribute towards ongoing decarbonisation of the UK grid and the national target of achieving zero carbon emission by 2050.

The overall project is subdivided into three main elements which shall be delivered in the order listed to a line with Jepco's business model.

- Agritech development Norfolk House Farm as per planning registration no: PP-10163701
- Renewable energy generation.
- Energy storage and distribution.

The Agritech Project has already been submitted for planning and is being considered under planning reference no: PP-10163701. During the submission and consideration of this application, and the development of the pre-planning applications for the subsequent applications, it became apparent that a wider review of access to the site would be required.

Although the operational traffic volumes generated by the completed development are not considered to be onerous, the routing of same through small villages such as Gedney Dyke will serve only to compound an already difficult situation traffic movement.

Hence, in consultation with all stakeholders, Jepco and their partners have taken the decision to apply for permission to construct a new roadway which shall bypass all populated area and provide direct access from the site to the A17.

2. PROPOSED DEVELOPMENT

Key to the accommodation of the development of Jepcos plans is the ability to transport both construction and production materials into a relatively remote site on the main road network.

To maximise the efficiency of this operation, Jepco, with their local partners have devised a scheme to construct a new road North of Gedney Dyke and linking from the B1359 to the existing private Wurth Road and re-joining Roman Bank at the Hovenden Golf Club and hence joining the A17 at the Lowgate junction where the volumes and types of vehicles can be better accommodated.

The location of this proposed road is as indicated on figure 1 & 2 below.

Once completed this road shall provide clear access to all further phases of the development as well as the permanent operations of the site and the sustainable future development of the area. It is intended that the road shall be available for all users which shall significantly improve the local network providing access to private vehicles and farm machinery without the need to travel through Gedney Dyke.



3. Flood Risk Appraisal

The Environment Agency Flood Risk Assessment (FRA) Guidance Note 3 states what should be in an FRA.

“An FRA is required to ensure flood risk to the proposed development is considered, as well as the impact the development will have elsewhere on people and property. The scale, nature and location of the proposed development will inform the scope of the FRA required”

This report has been prepared for the sole use of the named client and consequently, is confidential to the client and his professional advisors. The Contracts (Rights of Third Parties) Act 1999 does not apply, nothing in this report confers or purports to confer on any third party any benefit or right. No responsibility whatsoever is accepted to any other person than the named client and, consequently, the contents of this report should not be relied upon by third parties for the whole or any part of its contents.

1. SOURCES OF INFORMATION

General information regarding the site and local hydrology was obtained from the Ordnance Survey and local Authority maps. Information regarding the current flood risk was garnered from the Environment Agency.

2. DESCRIPTION OF THE SITE

2.1. Site Location

JEPCO occupies over 300 hectares of essentially flat and fertile land approximately 2.5km from the Lincolnshire coast and the Wash, an expansive protected area designated as a Special Area of Conservation, Special Protection Area and Site of Special Scientific Interest bordering the site to the North and East.

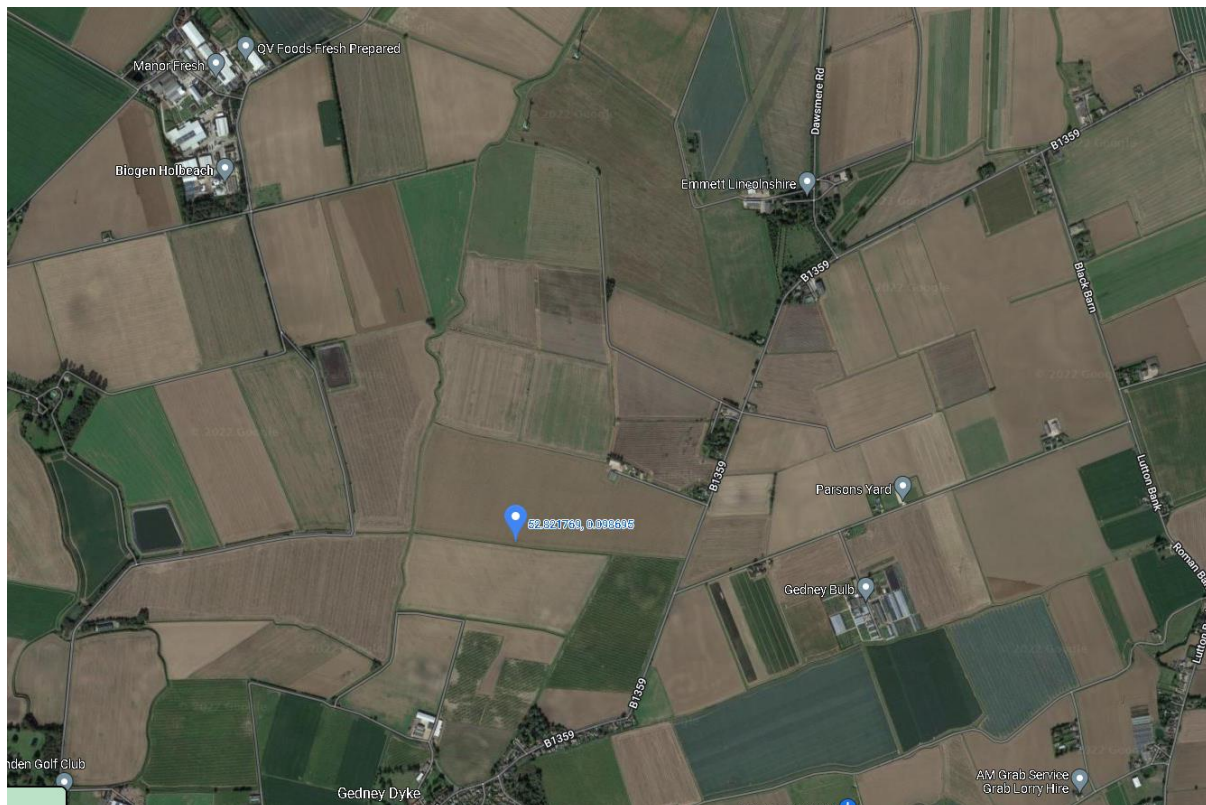


Figure 1 Site Location.

3.2 Site Location

The subject site of this particular planning permission is located on reclaimed fenland to the east and adjoining the existing Norfolk Farm site and covers approximately 0.7 ha

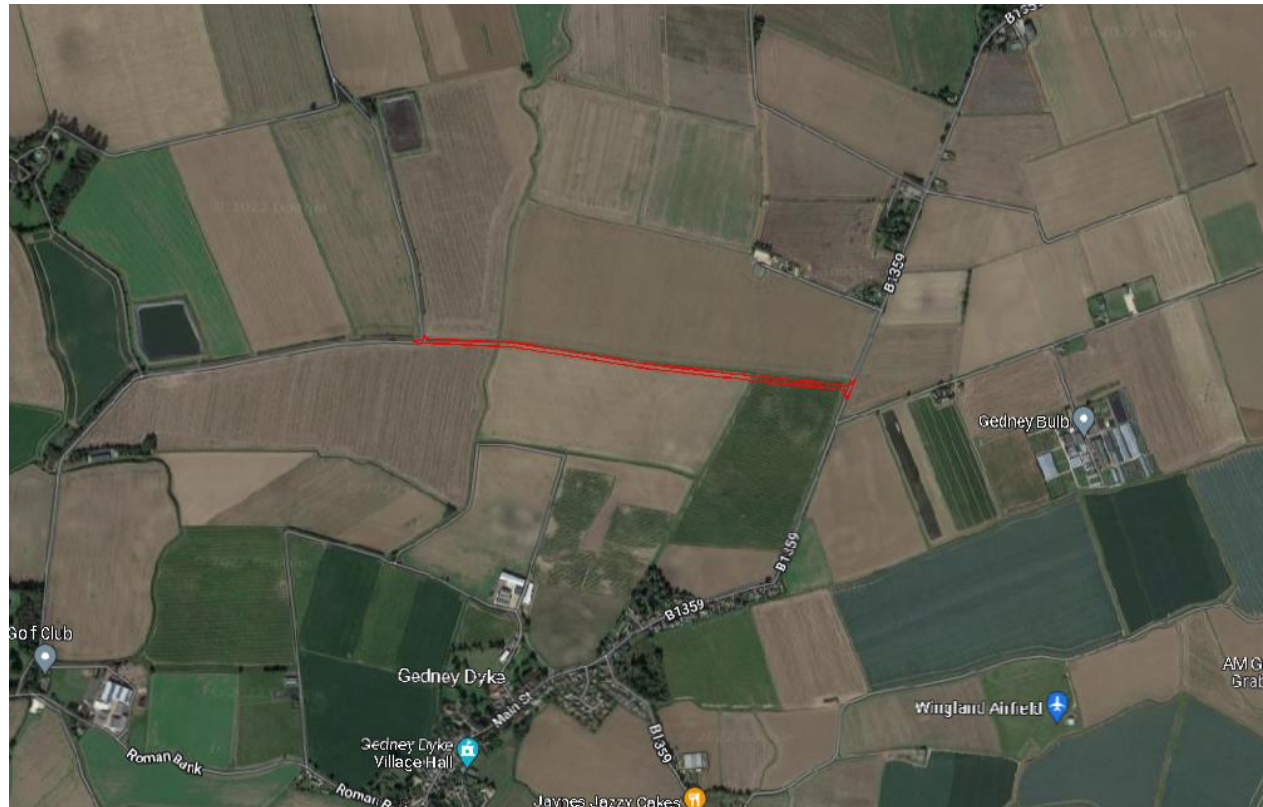


Figure 2 Existing Site.

The site is currently in agricultural use and is bounded on the North and South by additional Agricultural holdings and on its East and West by roadways.

4 PROPOSED DEVELOPMENT

Key to the accommodation of the development of the three phases of Jepcos plan is the ability to transport significant volumes of infrastructural materials into a relatively remote site on an ostensibly Broad network and through small village communities.

To alleviate this temporary issue, Jepco, with their local partners have devised a scheme to construct a new haul road North of Gedney Dyke and linking across to the existing private Wurth Road and re-joining Roman Bank at the Hovenden Golf Club and hence joining the A17 at the Lowgate junction where the volumes and types of vehicles can be better accommodated.

The location of this proposed haul road is as indicated on figure 1 & 2 below.

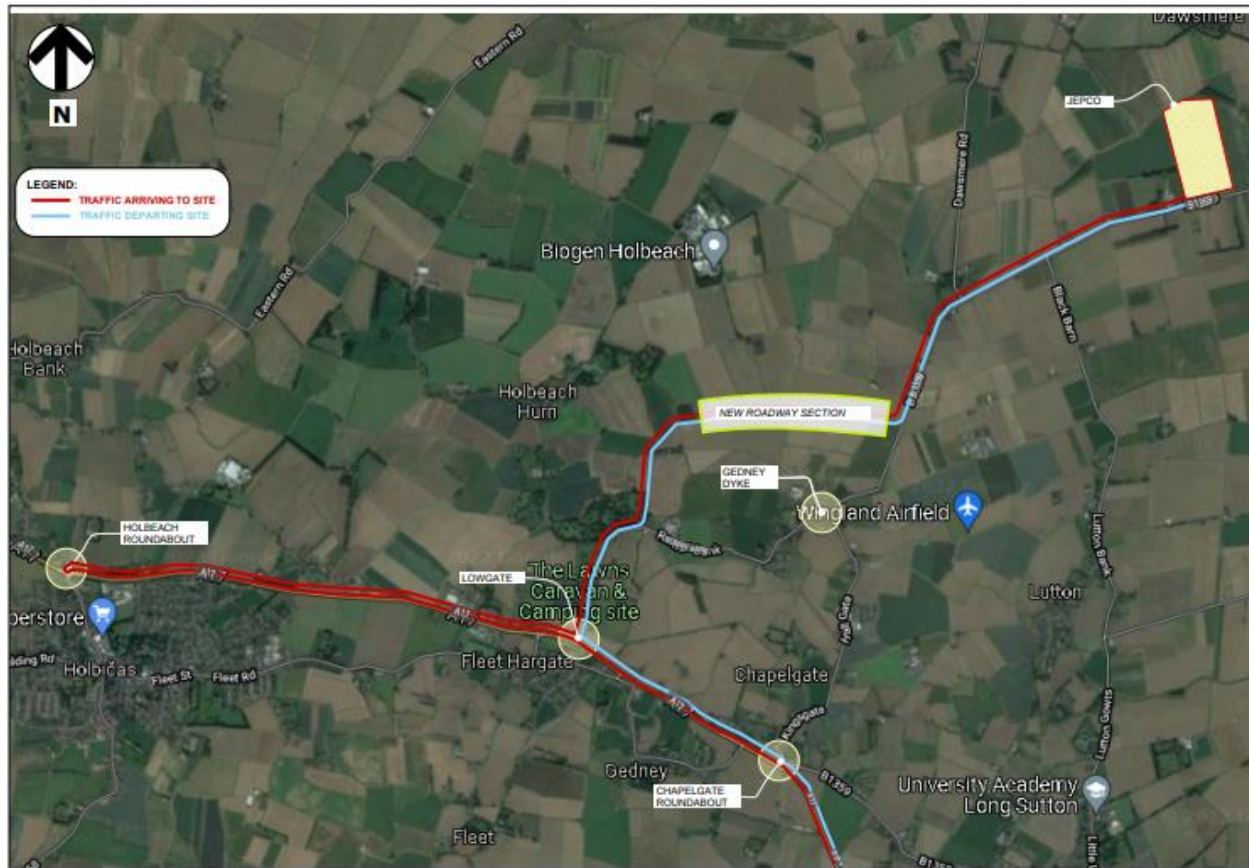


Figure 3

The road shall be formed in blinded compacted MOT 1 hardcore with a surface layer macadam to maintain the integrity of same for the duration of the works. The road shall be barriered each end and each barrier manned during working hours to ensure discipline amongst the users of same.

Given the nature of the Lowgate junction as a Tee junction onto the A17, vehicles turning North onto same and vehicles turning East from same currently experience some difficulty in crossing the carriageway and hence to avoid exacerbating this issue it is intended to impose a strict traffic regime on all vehicles entering and leaving the site to ensure a minimal impact on the operations of the A17. Relevant traffic issue with Gedney Dyke is proposed to condiment in new pass road located to the East Dyke End link in by existing private road link and link in R1359.

Jepco and their partners have recognised the potential positive impact of making this haul road a permanent fixture in that it would not only give direct access for vehicles from the wider area to the A17 avoiding Gedney Dyke, but also alleviate the significant

local farm traffic through the Village during the busy growing and Harvest Seasons. It would also enhance the potential for future sustainable development in the area.

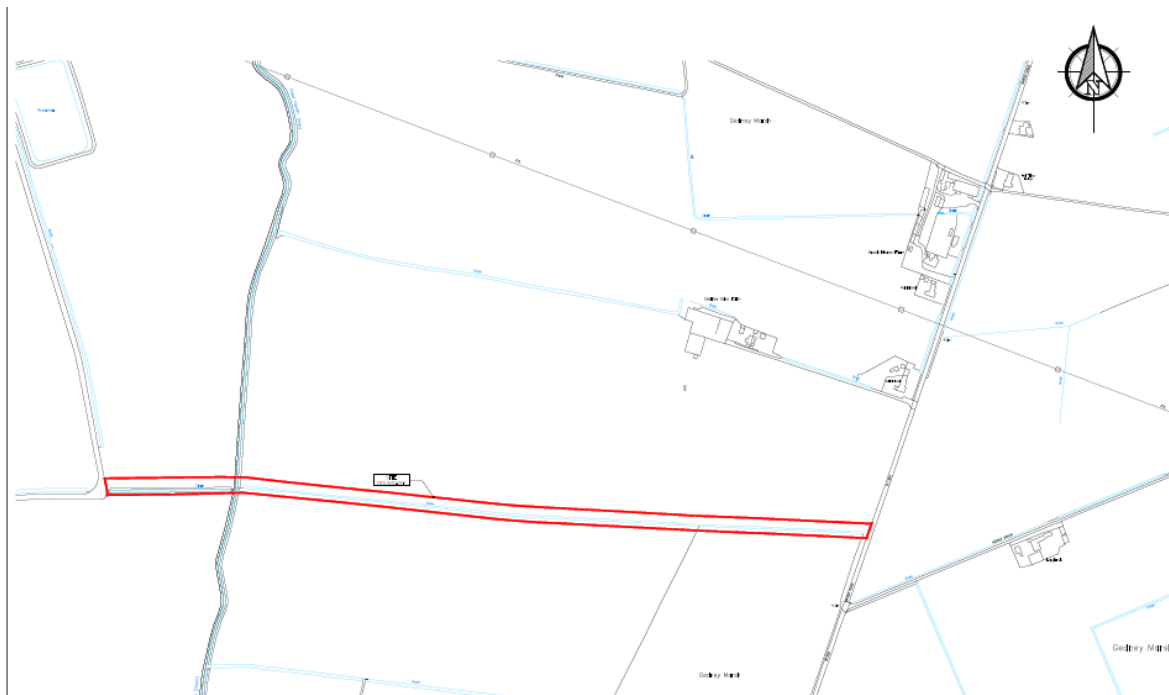


Figure 4

The road construction itself would be of reinforced concrete similar to the existing private road and would be open to all agricultural traffic from all operators in the area thus removing all of this traffic other than the operators directly located in Gedney Dyke.

4.1 Proposed Drainage System

The CIRIA SuDS design document provides guidance on the control and management of stormwater from new development sites in their publications.

The storm management system design has been prepared on the basis of minimising the effect of the development by comparison with the expected storm run off for an undeveloped site. The attached HR Wallingford preliminary SUDS estimation tool gives (SAAR) average annual rainfall of 801mm.

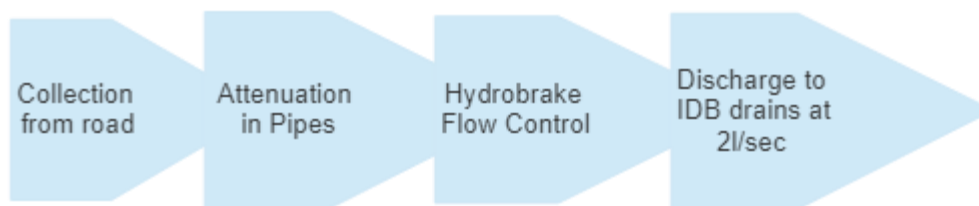
The attenuation requirements of this development shall include for the entire area of new road which is circa 0.7ha

3.1 Stormwater Mitigation Measures

To comply with the principles of SuDS, stormwater mitigation measures are outlined below to ensure the proposed development has a minimal impact on the local drainage Board Infrastructure.

The storm water systems will be constructed to allow for a 1:100-year storm event with a Climate change factor of 1.4.

All new hardstanding and roads shall be drained via underground pipework systems to four discharge points along the road length.



The attenuation system shall be achieved within oversized pipes combining all run off and be controlled by a hydro brake as per figure 3 limiting discharge to 2l/sec to the existing IDB drainage ditch, the location of which is indicated on the drainage layout.

The junction between the ditch and the new pipework shall be formed with a concrete headwall and stilling chamber complete with grilles across the entry to the pipe to prevent water surge into the ditch causing erosion of the banks and bed, this access point shall be maintained by the site team.



Figure 3 MD 5 Hydro brake

5 FLOOD RISK ASSESSMENT REVIEW

Potential Sources of Flooding — Level 1 Screening Study

It is necessary to consider all forms of flooding for any proposed development. A summary of the potential sources of flooding and a review of the potential risk posed by each source at the application site is presented in Table 1.

TABLE I — POTENTIAL RISK POSED BY FLOODING SOURCES			
Potential Source	Potential Flood Risk at Application Site	Potential Source	Data Source
Fluvial flooding	Yes	Local IDB network	EA
Tidal flooding	Yes	The Wash	EA
Flooding from rising/high groundwater	No	None reported	EA
Overland flow flooding	No	None reported	EA
Flooding from artificial drainage systems	No	None reported	EA
Flooding due to infrastructure failure	No	None reported	EA

Fluvial Flooding Sources

A system of local IDB drainage ditches surround and drain the site and the adjoining areas.

Tidal Flooding Sources

The proposed development site is located approximately 2km from the nearest coast with therefore tidal flooding is considered a risk within this FRA. The tidal hazard mapping shows that the site may be subject to depths greater than 1.6 metres following a breach in the defences in a 0.5% event and 0.1% event with climate change.

Groundwater Flooding

The Companion Guide to Planning Policy Statement 25 (PP525) identified that:

“Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rock (aquifers).”

The ground level of the proposed development site is approximately 3.1 m AOD ground investigation report found that will there are layers of silts and clay to a depth of 1m below topsoil; this did not give rise to any flooding.

Flooding from artificial drainage systems

Under the planning application a new surface water drainage and attenuation system will be put in place. The purpose of this system is to retain accumulated rainwater from the 0.7ha roadway and to store same within oversized pipes before discharge to IDB drains.

Overland flow Flooding

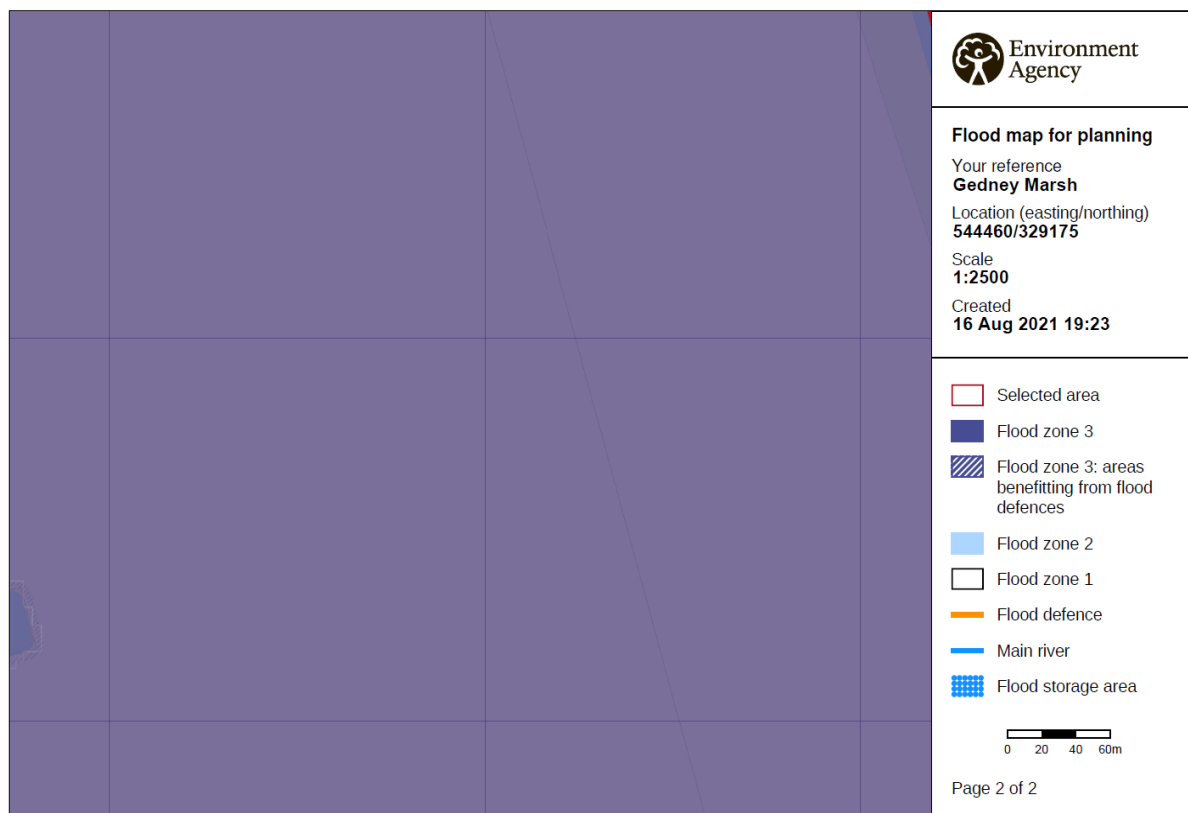
Due to the nature of the levels of the site, and it is surrounding regime of IDB drains the potential for surface flow of rainwaters is minimal other than part of the Tidal flooding as previously outlined.

Flooding due to infrastructure failure

Research into the site infrastructure and that of adjoining developments have indicated that there is no infrastructure present which could pose a flood risk. Therefore, infrastructure failure is only considered as part of the surface water back up plan, see 7.1.

Environmental Agency Flood Map

A review of the EA's flood map (extract in figure 3 overleaf, full details contained in appendix H) indicates that the development site is located within flood zones 3, Therefore, the site as indicated is considered to have a high probability of fluvial flooding over some of its area. The EA Flood Zone references and acceptable development types are explained in Table 2.



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Figure 3 Environmental Agency Map

TABLE 2— FLOOD ZONES, IN PPS25 (Table D.2 of PPS25) LAND IN ENGLAND IS DIVIDED INTO THREE FLOOD RISK ZONES

Flood Zone	Probability	Explanation	Appropriate Land use
Zone 1	Low	Less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)	All development types generally acceptable.
Zone 2	Medium	Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% 0.1%) in any year	Most development types are generally acceptable. Exception and Sequential test may be required.
Zone 3a	High	A 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year	Some development types not acceptable. Exception test may be required.
Zone 3b	Functional Floodplain'	This zone comprises land where water has to flow or be stored in times of flood	Some development types not acceptable, Exception may be required.

Existing and Planned Flood Defence Measures

The entire area is protected by Environment Agency Sea flood defences from the Wash.

Current Flood Risk

As noted above the site lies within Flood Zone 3. indicating that the site is currently at risk from flooding from the sea of rivers. Given the proximity to the coastline, and the absence of any rivers nearby it is clear that this specifically relates to storm surges and sea level rise.

Therefore, the site as a whole has a high probability of flooding, and a Sequential test is required to assess the suitability of development on the site.

Table D.3²²: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)	Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	x	Exception Test required	✓
Zone 3b 'Functional Floodplain'	Exception Test required	✓	x	x	x

Key:

✓ Development is appropriate

x Development should not be permitted

Given the nature of the development is deemed less vulnerable, it is considered appropriate for siting within Flood Zone 3a as stated in the Technical Guidance to National Planning Policy Framework 2018.

The listed policy aims for development in this zone are listed as follows:

- Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems.
- Relocate existing development to land in zones with a lower probability of flooding.
- Create space for flooding to occur by restoring functional flood plain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage

In addition, within the development it must 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 such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment.
- it incorporates sustainable drainage systems, 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.

In demonstration of compliance with these points, the system as proposed including the proposed system of attenuation has sufficient capacity to collect and contain all rainfall runoff up to and including a 1 in 100-year event including an allowance for climate change.

Site characteristics		Methodology	
Total site area (ha):	0.6	est	94124
Significant public open space (ha):	0	Q _{95%} estimation method:	Calculate from SPR and SAAR
Area positively drained (ha):	0.6	SPR estimation method:	Calculate from SOIL type
Impermeable area (ha):	0.6	Soil characteristics	
Percentage of drained area that is impermeable (%):	100	SOIL type:	Default: 2 Edited: 2
Impervious area drained via infiltration (ha):	0	SPR:	Default: 0.3 Edited: 0.3
Return period for infiltration system design (year):	10	Hydrological characteristics	
Impervious area drained to rainwater harvesting (ha):	0	Rainfall 100 yrs 6 hrs:	Default: -- Edited: 63
Return period for rainwater harvesting system (year):	10	Rainfall 100 yrs 12 hrs:	Default: -- Edited: 102.41
Compliance factor for rainwater harvesting system (%):	66	FBH / FBR conversion factor:	Default: 1.33 Edited: 1.33
Net site area for storage volume design (ha):	0.6	SAAR (mm):	Default: 578 Edited: 650
Net impermeable area for storage volume design (ha):	0.6	M5-60 Rainfall Depth (mm):	Default: 20 Edited: 20
Perious area contribution to runoff (%):	30	Y Ratio M5-60/M5-2 day:	Default: 0.4 Edited: 0.4
* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q _{95%} and other flow rates will have been reduced accordingly.		Hydrological region:	Default: 5 Edited: 5
Design criteria		Growth curve factor 1 year:	Default: 0.87 Edited: 0.87
Climate change allowance factor:	1.4	Growth curve factor 10 year:	Default: 1.65 Edited: 1.65
Urban creep allowance factor:	1.1	Growth curve factor 30 year:	Default: 2.45 Edited: 2.45
Volume control approach:	Flow control to max of 2 l/s/ha or Other	Growth curve factor 100 years:	Default: 3.56 Edited: 3.56
Interception rainfall depth (mm):	5	Q _{95%} for total site area (%):	Default: 0.87 Edited: 1
Minimum flow rate (%):	2	Q _{95%} for net site area (%):	Default: 0.87 Edited: 1

Site discharge rates		Estimated storage volumes	
1 in 1 year (%):	Default: 2 Edited: 2	Attenuation storage 1/100 years (m³):	Default: 606 Edited: 606
1 in 30 years (%):	Default: 2 Edited: 2	Long term storage 1/100 years (m³):	Default: 0 Edited: 0
1 in 100 year (%):	Default: 2 Edited: 2	Total storage 1/100 years (m³):	Default: 606 Edited: 606

Table 1: 1 in 100-year flood event + 40% climate change

The expected attenuation volumes are as outlined in the above SUDS extract. The above estimates have been produced by adopting a 100% runoff of area rainfall as derived using the Ih124 methodology.

This indicates that the site will be able to safely store the 1 in 100-year event for the entire site area.

POTENTIAL IMPACT OF OUTFLOW FROM THE SITE

The installation of Hydro brakes and storage capacity will limit the discharge into the IDB Drain to the existing levels of discharge. This existing drainage watercourse has significant storage capacity. The gradient of the Drain is shallow and water in it is largely moved around by pumping either to waste or into storage reservoirs by the IDB or others.

DAMBREAK ASSESSMENT

The roadway shall be elevated to the level of the top of the existing embankments which are raised an average of 50mm above the natural ground level at the site. Should the embankment fail, then the resulting breach hydrograph would have the following parameters (derived using the *Froelich* and C542 methodology)

Peak Flow: 42 m³/s	Time to peak: 5 minutes	Time to end: 30 minutes
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Given the almost flat topography of the site it would be estimated that the unit peak flow from a flood wave radiating out over level ground from a breach would reduce to approximately 1 l/s/m at a distance of 100 m from the main site. As the roadway is not a vulnerable structure failure of the structure can be thought to have little or no consequence in terms of harm to people or property.

6 Conclusions

This Flood Risk Assessment has been carried out to conform to the Environment Agency Standing Advice Development and Flood Risk.

The entire site is located in flood zone 3a, the development is however considered less vulnerable and therefore development is permitted.

The surface water runoff will be collected by oversized pipes and conveyed to existing IDB drains at a discharge rate of 2l/sec, considerably lower than the existing discharge volumes and rates.

There will be minimal displacement of water and no potential for change of the flooding regime either upstream or downstream of the site.

The development has no impact on fluvial or coastal morphology, even after increases in runoff and sea level as a result of long-term climate change are taken into consideration.