

FLOOD RISK ASSESSMENT

PROPOSED INDUSTRIAL DEVELOPMENT

ELSOMS WAY

PINCHBECK

SPALDING

LINCS.

PE11 3JG

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Version 1 June 2014

FLOOD RISK ASSESSMENT FOR PROPOSED INDUSTRIAL DEVELOPMENT, ELSOMS WAY, PINCHBECK, SPALDING. PE11 3JG

INTRODUCTION

The Government has placed increasing priority on the need to take full account of the risks associated with flooding at all stages of the planning and development process. This seeks to reduce the future damage to property and the risk to life from incidents of flooding. Their expectations relating to flooding are contained in the National Planning Policy Framework (NPPF) March 2012, which identify how the issue of flooding is dealt with in the drafting of planning policy and the consideration of planning applications by avoiding inappropriate development in areas at risk from flooding.

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. Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change.

The Environment Agency's flood maps show areas that are at risk, from fluvial and tidal flooding. These maps show the limits of the flood plain of the area which could be affected by flood events, over topping or breaching of flood defences. They are based on the approximate extent of floods with a 1% annual probability of exceedance (1 in 100 year flood) for rivers and 0.5% annual probability of exceedance (1 in 200 years flood) for coastal areas under present expectations or the highest known flood. However they do not take into account of the presence of defences or the likelihood that flood return intervals will be reduced by climate change.

This Flood Risk Assessment has been prepared in support of the planning application and considers the risk of flooding from fluvial and tidal sources. It also considers the risks of localised flooding due to inadequate Foul and Surface Water Sewers, Failure of Reservoirs, Water Main pipe bursts, Sewer Blockages, Pump Failures or High Ground Water Table etc.

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APPLICATION SITE

The site is located at an area of land off Elsoms Way Pinchbeck Spalding, PE11 3JG, which is adjacent to the major Wardentree industrial development area for Spalding, within the administrative area of South Holland District Council. **Plan 1**

The National Grid Reference for the middle of the site is TF 25602 25660, which consists of a total area of some 9.63 hectares comprising of arable agricultural land.

At present the land has an extant planning permission ref H14 - 0407 - 11 was granted on the 20th September 2011 for the development of the land for industrial purposes. The road infrastructure to access the proposed site has already been provided.

This Flood Risk Assessment has been prepared for this replacement outline application to develop the area for B1 (Light Industrial), B2 (General Industrial), and sui-generis uses **Plan 2**

The Site would be classed as Major Development applying the Town & Country Planning (Consultation) (England) Direction 2009 as the site is to be developed is more than 1 hectare.

The National Planning Policy Framework Technical Guidance (NPPF TG) defines three levels of flood risk depending upon the annual probability of fluvial flooding occurring.

Zone 1 – Low Probability (<0.1%)

Zone 2 – Medium Probability (0.1 – 1.0%)

Zone 3 – High Probability (>1.0%)

The proposed development site is shown to be within Flood Zone 3a 'High Probability' as detailed on the Environment Agency's Flood Zone Maps without defences, and as defined in Table 1 of NPPF TG.**Map1**

Table 1: Flood Zones Definition (Ignoring the presence of defences)

Zone 3a - high probability
Definition This zone comprises land assessed as having 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.
Appropriate uses The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.
Flood risk assessment requirements All development proposals in this zone should be accompanied by a flood risk assessment.
Policy aims In this zone, developers and local authorities should seek opportunities to: • 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; and • create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Applying the Flood Risk Vulnerability Classification in Table 2 of NPPF TG the proposed Industrial use development is classified as “Less Vulnerable”, with Table 1 of NPPF TG stating that such uses are appropriate in this zone.

Table 2: Flood Risk Vulnerability Classification

Less vulnerable • Police, ambulance and fire stations which are <i>not</i> required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in “more vulnerable”, and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do <i>not</i> 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).

From the topographical survey the site is fairly level site with levels varying from a maximum of 3.28mODN to 2.78mODN, with the average being 3.00mODN. It is proposed that the lowest ground floor level of the buildings be raised 500mm above the existing ground level to 3.50mODN. **Plan 3**

DRAINAGE AUTHORITIES

Environment Agency

The Environment Agency is responsible for reducing the risk of flooding from designated main rivers and from the sea.

The following potential sources of flooding affecting the development site have been identified as:

- From the River Welland (Tidal)
- From the River Glen (Fluvial)
- Welland & Deepings Internal Drainage Board system

The Flood Zone Maps identify river catchments over 3 sq. km. These maps are a theoretical estimate of areas that could be inundated should no defence exist. In practice current standards of protection would result in flood envelopes substantially less than shown by these maps. The maps make no allowance for local, site specific features.

The flood zone maps show that the site of the proposed development is considered at risk from flooding. These maps indicate that the area would be flooded without flood defences, which are in place, (with an annual probability of more than 0.5% i.e. return frequency of less than 1 in 200 years for tidal flooding or more than 1.33% return frequency of less than 1 in 100 years for fluvial flooding). **Map 1**

The Environment Agency Risk of flooding from Rivers and Sea shows that the site is at low risk of flooding. Low means that each year, this area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%).

This takes into account the effect of any flood defences that may be in this area. Flood defences reduce, but do not completely stop the chance of flooding as they can be overtopped or fail. **Map 2**

RIVER WELLAND

The River Welland is located some 800m east of the site and the left bank of the tidal river is formed by an earth bank. The crest of the defence bank at the A16 road bridge is in the order of 7.60mODN, and the 1 in 200 year extreme tide level present day is 5.98mODN and for year 2115 is 7.12mODN. Flooding from this river would pose the greatest risk to the proposed development following a breach to the defences

RIVER GLEN

The River Glen is located some 1.8km to the north-west of the site and the right bank of the fluvial river is formed by earth embankments. The crest of the defence at Crossgate Bridge, Pinchbeck is in the order of 4.70mODN and the present day peak fluvial level is 4.33mODN and for year 2115 is 4.71mODN. Due to its distance from the site the 800

Taking the precautionary approach the Hazard Rating following a breach which in Flood Risk Assessment (FD 2320) Guidance for New Development Phase 2 R& D Technical Report these are classified as low <0.75, moderate 0.75 - 1.25, significant 1.25 - 2.50 and extreme >2.50 based upon an empirical measure of velocity and depth.

Flood Hazard value	Degree of flood hazard	Description	Indicative depth range
< 0.75	Low	Caution 'Flood zone with shallow flowing water or deep standing water'	Up to 0.25 m
0.75 – 1.25	Moderate	Danger for some (i.e. children) 'Danger: flood zone with deep or fast flowing water'	Up to 0.5 m
1.25 – 2.0	Severe	Danger for most 'Danger: flood zone with deep fast flowing water'	0.5 m to 3 m
> 2.0	Extreme	Danger for all 'Extreme danger: flood zone with deep fast flowing water'	0.5 m to over 3 m

$$HR = d \times (v + 0.5) + DF$$

Where V = Flood flow velocity (m/sec)

D = Flood depth (m)

DF = A debris factor included to represent the greater damage, or risk of injury to people, that can occur if debris is swept along with the water. = 0.5 for depths <0.25 or 1.0 for depths >0.25.

Flood depth (m)	All areas (rural and urban)
≤ 0.25	0.5
> 0.25	1

For the degree of Flood Hazard to be classified as low HR has to be <0.75

The updated South Holland SFRA carried out Hazard Mapping following a breach to the flood defences. With climate change up to year 2115 the Actual Flood Hazard Spalding - Year 2115 1% Fluvial / 0.5% Tidal Event

Probability maps show that the site is within Hazard Rating areas varying from Low to Danger for Most, and the Actual Peak Depth Spalding - Year 2115 1% Fluvial / 0.5% Tidal Event Probability map shows that the site could flood to a depth of 0.5m deep. Therefore the site is subject to flooding following any breach to the flood defences. **Map 3 and Map 4**

It is therefore proposed that the ground floor for the new buildings be 500mm above the existing Ordnance Survey ground level at 3.50mODN.

South Holland District Council

In order to inform the process of risk assessment and site selection the District Council commissioned Haskoning UK Ltd Consultants to prepare a Strategic Flood Risk Assessment in December 2002. They have carried out an update of this report and this report was published in January 2010

This Flood Risk Assessment has taken the results of the updated South Holland Strategic Flood Risk Assessment (SHSFRA) into account in its findings.

It was found that the actual risk from primary sources of flooding (taken as being rivers and the sea) was assessed as being the product of:

- Medium probability (assigned because the standards of the primary defences are variable) and
- Low consequence (assigned because of the District's generally rural nature and because any urban flooding is likely to be shallow with minimal impact).

The findings reflect the considerable protection afforded to the area by coastal and tidal & fluvial flood defences and by the extensive well organised system of lowland IDB fluvial drainage.

The computer modelling used in the SFRA to produce the Hazard, depth and velocity maps simulated the spread of flood waters over the land and allowed for the presence of locally raised features such as road embankments etc. The maps produced by the Environment Agency took a more precautionary approach.

The potential flooding consequences shown on this map relate to flooding from the sea, main rivers and Internal Drainage Board systems taking into account the presence of current flood risk management measures such as flood defences.

The consequences designated as being an Actual Risk arise from direct overtopping of defences, where this would occur, together with assumed breach failure of some defences. Breach failure has been assumed to occur in places where the freeboard between peak sea or river water level and the defence crest level is less than the minimum desirable for structural security of the defence.

From the Actual Peak Depth Spalding - Year 2115 1% Fluvial / 0.5% Tidal Event Probability and Actual Flood Hazard Spalding - Year 2115 1% Fluvial / 0.5% Tidal Event Probability maps from the update of the Strategic

Flood Risk Assessment for South Holland District Council the majority of the site could flood to a depth of 500mm following any breach to the flood defences. **Map 2 & Map 3**

Welland & Deepings Internal Drainage Board

The proposed development site is located within Catchment area of Welland & Deepings Internal Drainage Board. The Board is responsible to operate and maintain the arterial fluvial system. **Map 4**

It is stated in the South Holland SFRA that generally there should be no flooding problems associated with the Board's drains up to the 1 in 100 year return period and have a reasonable freeboard between water level and land levels.

The Boards Drains which serve the site are:-

Blue Gowt Drain

This watercourse is one of the Boards main drains which runs along the southern boundary of the proposed development site, which discharges into Vernatts Drain at Pinchbeck Pumping Station which flows by gravity to Surfleet Seas End where it discharges through pointing doors into the tidal River Welland.

The Board's byelaws will apply to the Blue Gowt Drain and no development will be permitted within 9 metres of the top edge of the watercourse. The Board will need to access the drain for regular maintenance with equipment and may need to undertake improvement works in the future.

Vernatts Drain

The Vernatts Drain is located some 600m to the east of the site and is an earth embanked watercourse with a crest level of 4.25mODN, with the 1 in 100 year fluvial level for both the present day and for year 2115 of 3.80mODN. This provides an adequate freeboard against flooding, therefore it is not considered to be a significant risk of flooding from this source.

The Board have confirmed that Riddington Pumping Station at Pinchbeck Marsh was designed and constructed to accommodate additional flows into the system as a result of future industrial development in this area. (Letter dated 28th May 2014)

FLOODING FROM OTHER SOURCES

Flooding is a natural process and can happen at any time from sources other than watercourses and the sea.

- Flooding from land can occur from intense rainfall, often over short duration of time that is unable to soak into the ground or enter the drainage system. However with the natural topographic nature of the ground being flat, with no high ground around the site this will not cause any rapid inundation of the site and is likely to only lead to local ponding, of shallow depth and low velocity, and follow the natural land contours. The buildings are

also raised 500mm above the average ground level. The updated SFRA concluded that flooding from this source is limited to minor isolated cases and is not of strategic significance as regards to flood risk.

- The area is not known to suffer from any groundwater problems and therefore is taken as having no strategic significance as regards to flood risk.
- Flooding from sewers can occur from over loading from heavy rainfall caused by blockages or having inadequate capacity. The resulting back pressure could cause foul sewage to flow from manholes which would flow over areas of the carriageway at a lower level and be contained within the confines of the kerb lines following the natural land contour to the south-west. The Updated SFRA concluded that flooding from sewers is limited to minor isolated cases and is not of strategic significance as regards to flood risk.
- Non natural or artificial sources of flooding such as reservoirs, lakes or canals where water is stored above natural ground level could cause flooding if the structure fails or is over topped. There are no known such facilities close to the site

SEQUENTIAL APPROACH

When applying the sequential approach for flood risk in accordance NPPF the site would fall into Zone 3a (High Probability) as the site is shown to be within the tidal flood plain as shown on the Environment Agency's Flood Map without defences in place.

However the results of the updated SHSFRA shows that the site is located within a low/medium probability flood zone but the area is reliant on protection by flood defences providing a standard of protection of 1 in 100 years return period.

Applying the Flood Risk Vulnerability Classification in Table 2 of NPPF TG, the proposed residential development is classified as "More Vulnerable", with Table 1 of NPPF TG stating that such uses are appropriate in this zone (as summarised in Table 3 NPPF TG).

TABLE 3: Flood risk vulnerability and flood zones 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	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

The Sequential and Exception Tests are considered to be passed for the proposed development as this application is to renew the planning permission that exists for the site.

The lowest floor level for the buildings has been set at 500mm above the site ground level to ordnance datum at 3.50mODN.

CLIMATE CHANGE

It is now recognised that global warming is likely to affect the frequency and severity of extreme events as both tidal and fluvial flooding.

The annual sea rise due to climate change is given in NPPF TG and the recommended contingency allowances are stated in Table 4.

TABLE 4: Recommended contingency allowances for net sea level rises

	Net sea level rise (mm per year) relative to 1990			
	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, east midlands, London, south-east England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South-west England	3.5	8.0	11.5	14.5
North-west England, north-east England (north of Flamborough Head)	2.5	7.0	10.0	13.0

Table 5: Recommended National Precautionary Sensitivity Ranges for Peak Rainfall Intensities. Peak River Flows, Offshore Wind Speeds and Wave Heights.

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

The effect of global warming on fluvial flood peaks is given in Table 5. It is expected that the overall effect up to 2025 will result in an increase of rainfall of 5%, 2025-2055 10%, 2055-2085 20% and 2085-2115 of 30% with Peak River flows increasing by 10% and from 2085-2115 by 20%.

INFRASTRUCTURE

Surface Water Drainage

Section 2, Part H of the Building Regulations states a hierarchy of how surface water disposal should be managed. This hierarchy should be followed where practicable, and is listed below:

- 1) Infiltration (SUDS)
- 2) Watercourses
- 3) Public Sewers

The site is shown on the British Geology Survey to be underlain by predominately cohesive soils which are not considered to be suitable for infiltration methods.

As the Welland and Deepings Internal Drainage Board have confirmed that their system has been improved to cater for the surface water run-off from this area, an application will be made to the Board for consent to discharge surface water into the Blue Gowt Drain, which will be conditional on payment of a development contribution currently assessed at £50919.00 per impervious hectare.

Foul Water

Foul sewers designed and laid in accordance with Sewers for adoption 7th edition, adopted by Anglian Water Services Ltd, under Section 104 of the Water Industry Act 1991, (as amended by the Water Act 2003) will be provided to serve the development and connected into the Anglian Water sewer serving the area.

As there is a positive drainage system capable of receiving flows from the development there is no likely impact on neighbouring property.

FLOOD PROTECTION

Any impact of damage to the properties can be foreseen and mitigated against by relatively simple design and construction techniques. There are two forms of flood protection works:-

- **Flood-resistance or proofing works:** - these try to reduce the amount of water actually entering a building.
- **Flood-resilient works:** - these reduce the amount of damage caused by water entering the building.

The proposed property will have the following resilient measures incorporated in the construction in accordance with "Improving the flood performance of new buildings" CLG (2007).

- The lowest ground floor level for the Buildings is to be raised 500mm above existing average ground level with a lowest level being 3.50mODN.
- Arrange for all service circuits at ground floor level to be routed at high level and where practical socket outlets, boilers etc. to be a minimum of 0.5m above the raised ground floor level.
- The owners of the property will register their property with the Environment Agency to receive automated early warnings of potential flood events.

CONCLUSION

- o The proposed development site is shown to be within Flood Zone 3a 'High Probability' as detailed on the Environment Agency's Flood Zone Maps without defences.

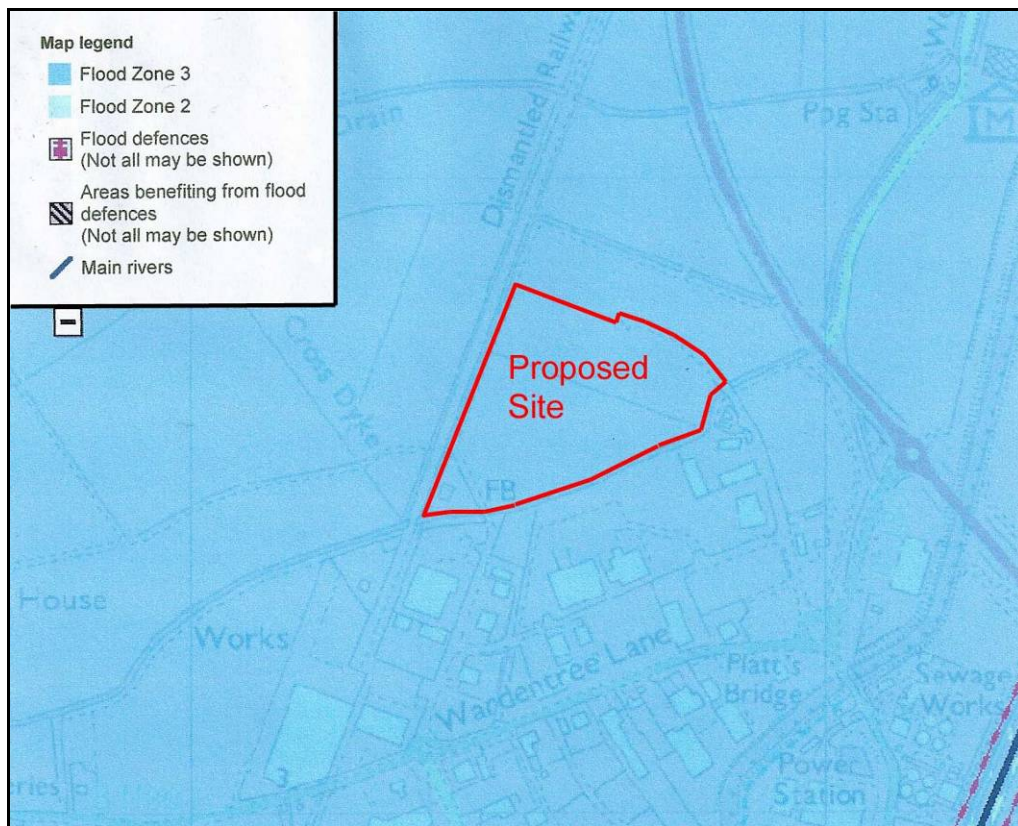
- o The site does have the protection of flood defences which are well maintained by the Environment Agency.
- o The updated South Holland SFRA carried out Hazard Mapping following a breach to the flood defences. With climate change up to year 2115 the Actual Flood Hazard Spalding - Year 2115 1% Fluvial / 0.5% Tidal Event Probability maps show that the site is within Hazard Rating areas varying from Low to Danger for Most, and the Actual Peak Depth Spalding - Year 2115 1% Fluvial / 0.5% Tidal Event Probability map shows that the site could flood to a depth of 0.5m deep.
- o The site has the benefit of an outline planning consent planning permission ref H14 - 0407 - 11 was granted on the 20th September 2011 for the development of the land for industrial purposes. The road infrastructure to serve the proposed site has already been provided. The Sequential and Exception Tests are considered to be passed for the proposed development as an outline planning permission exists for the site.
- o The Flood Risk Vulnerability Classification in Table 2 of NPPF Technical Guide the proposed industrial development is classified as "Less Vulnerable", with Table 1 of NPPF Technical Guide stating that such uses are appropriate in this zone. However the results of the updated SHSFRA shows that the site is located within a low/medium probability flood zone but the area is reliant on protection by flood defences providing a standard of protection of 1 in 100 years return period.
- o Any impact of damage to the properties can be foreseen and mitigated against by relatively simple design and construction techniques. They will be constructed using materials which are flood resilient construction as outlined in the report
- o Flooding from other sources is unlikely to affect the site.

APPENDIX

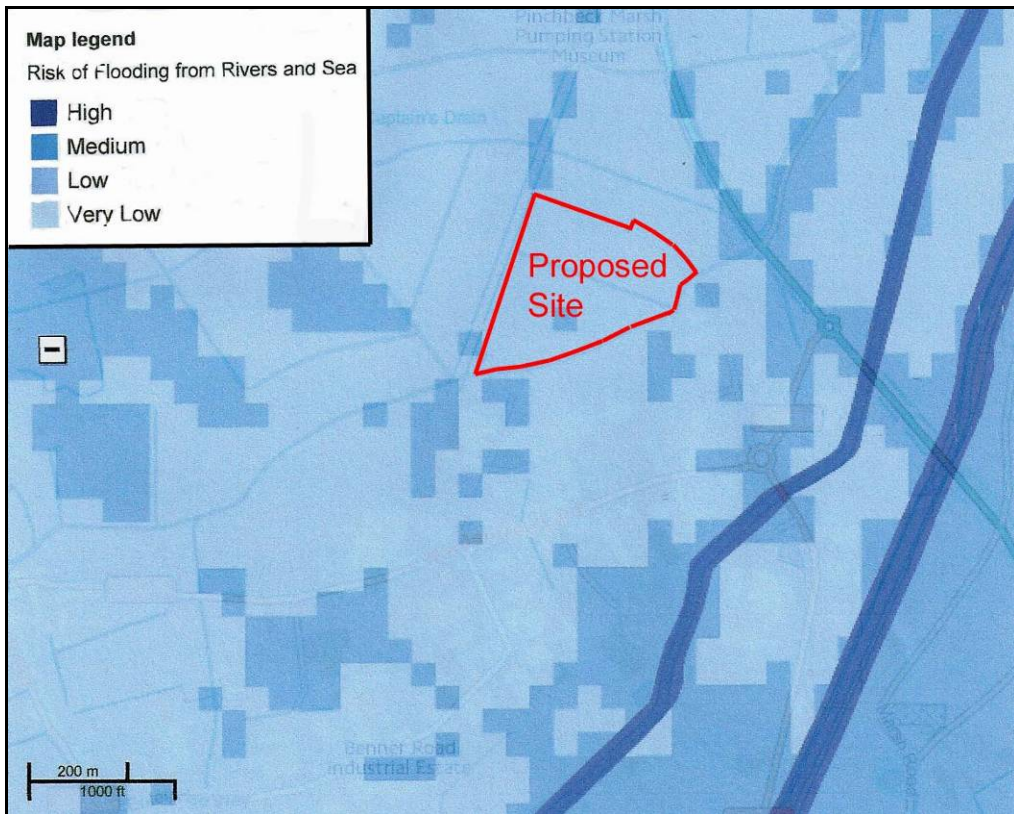
Map 1	Extract from Environment Agency Flood Zone Map
Map 2	Extract from Environment Agency Flooding from Rivers & Sea Map
Map 3	South Holland SFRA Actual Flood Hazard Spalding year 2115 1% Fluvial/0.5% Tidal Event Probability
Map 4	South Holland SFRA Actual Peak Depth Spalding year 2115 1% Fluvial/0.5% Tidal Event Probability
Plan 1	Location Plan
Plan 1	Layout Plan
Plan 3	Site Levels Plan
Photo 1	Blue Gowt Drain
Photo 2	Proposed Site with Access Road

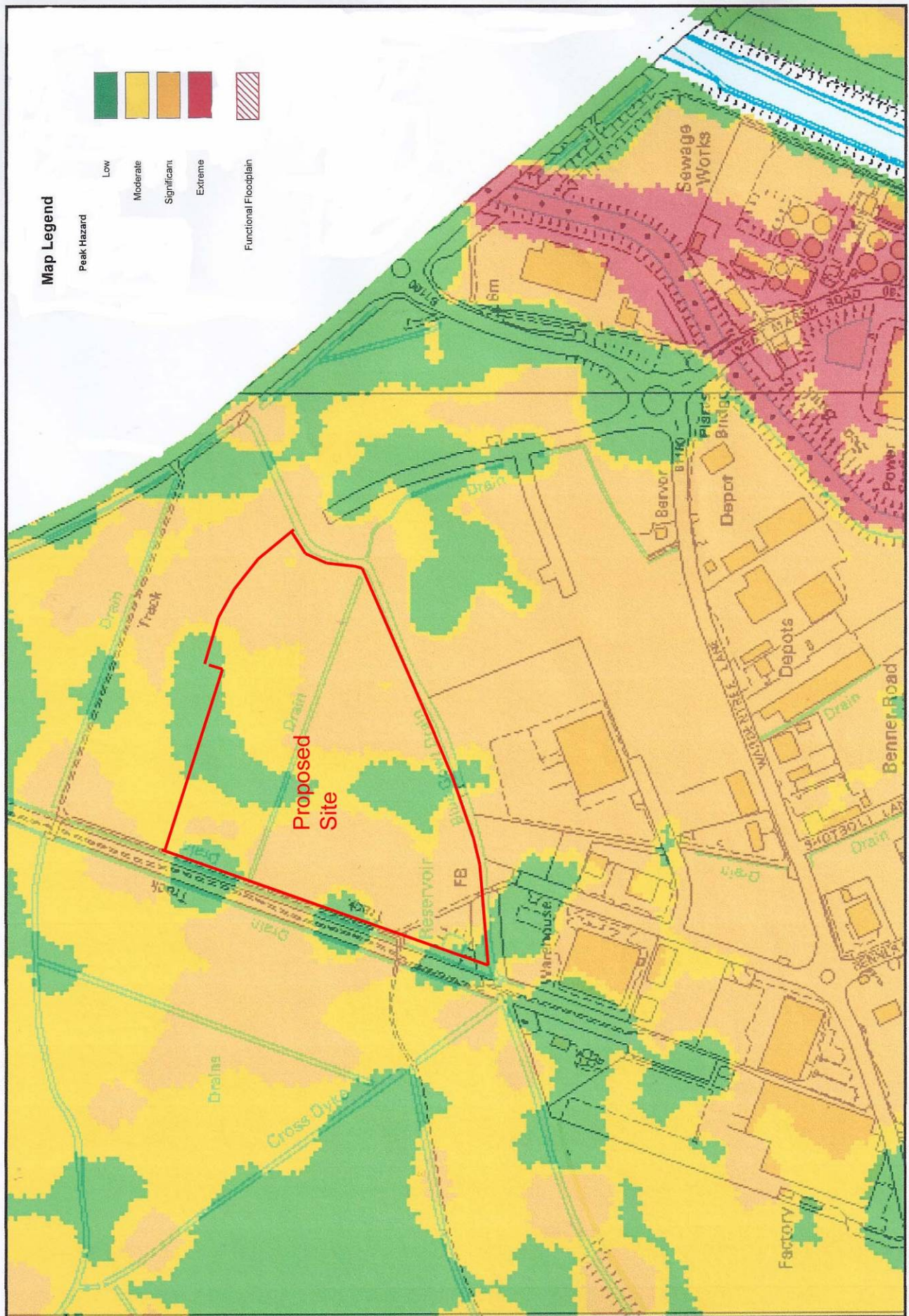
Letter Dated 28th May 2014 Welland & Deepings IDB.

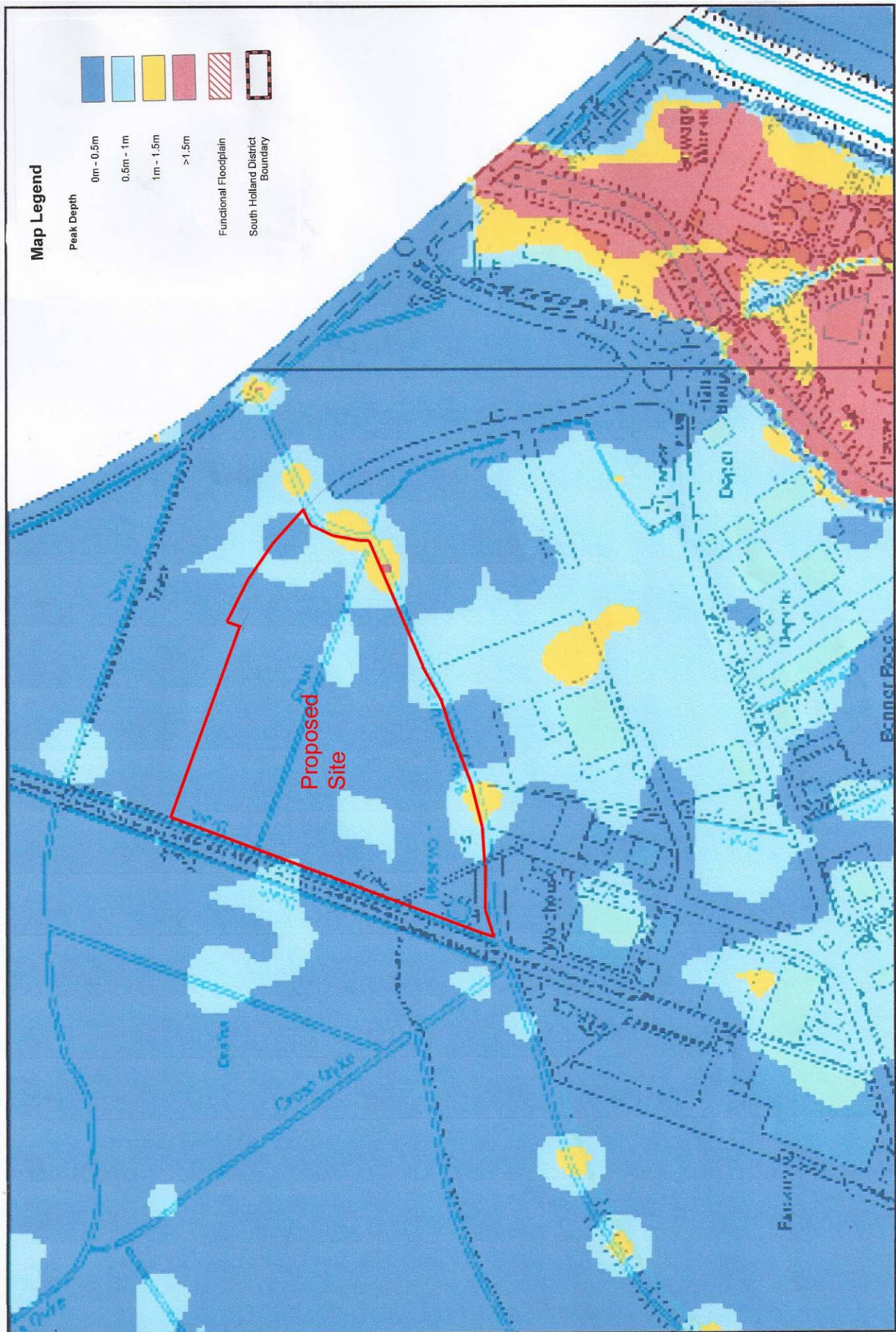
EXTRACT FROM ENVIRONMENT AGENCY FLOOD MAP

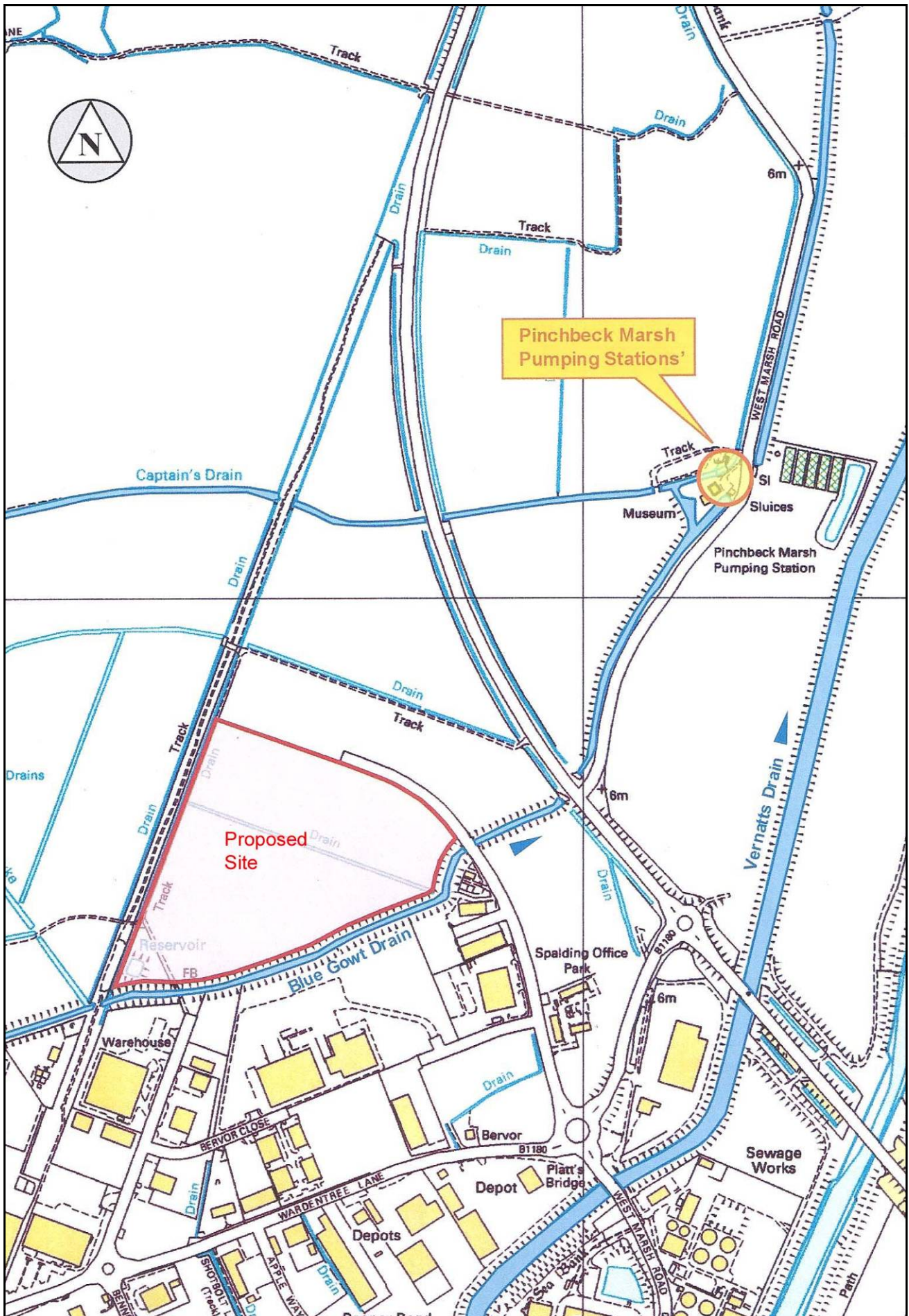


EXTRACT FROM ENVIRONMENT AGENCY FLOODING FROM RIVERS & SEA MAP

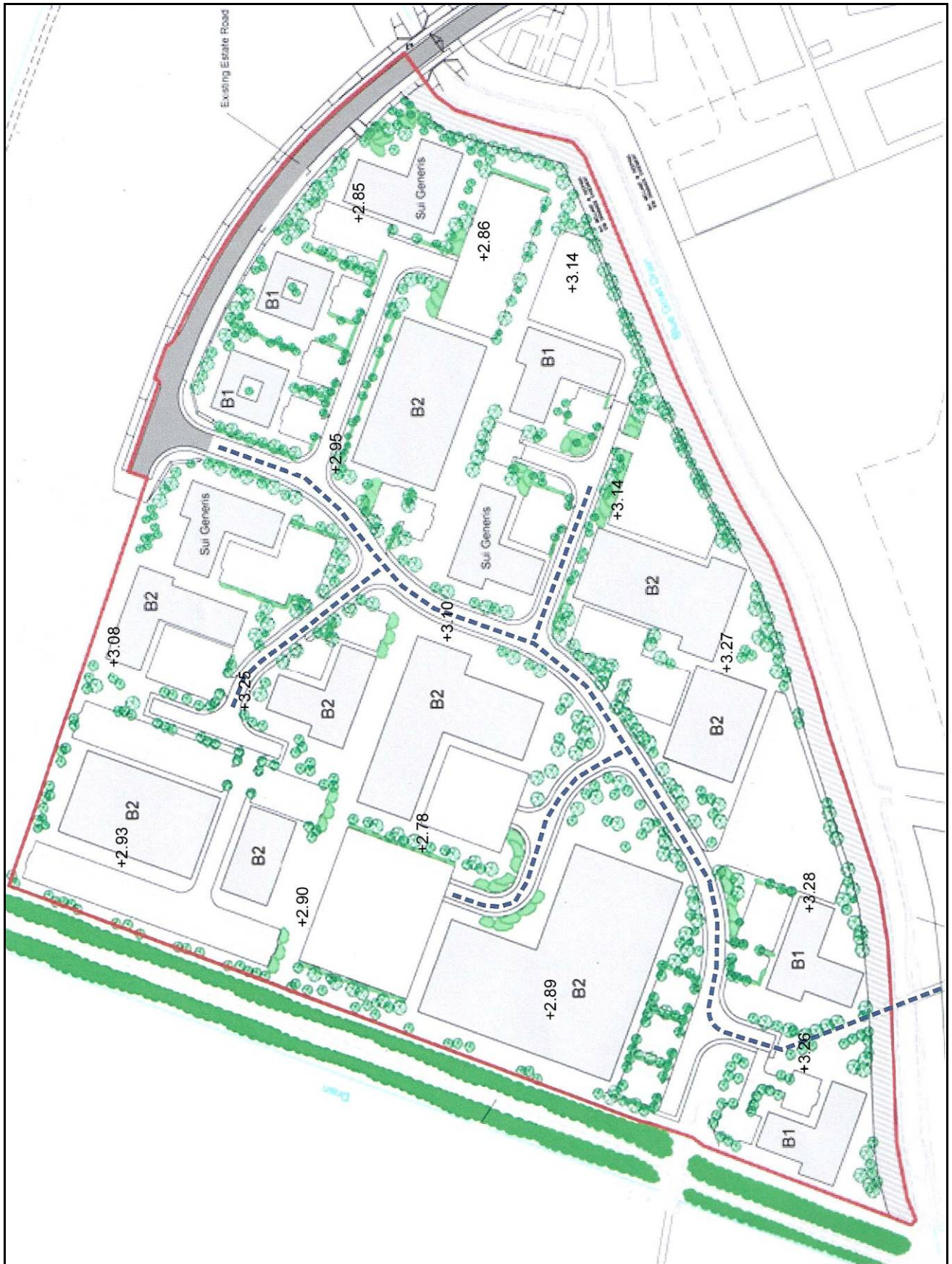












PLAN 3



Photo 1 Blue Gowt Drain



Photo 2 Proposed Site & Access Road

Our Ref. NSM/MPC/P/P/3

This matter is being
handled by
Nick Morris

Your Ref.

28th May 2014

R M Associates
10 Main Street
Thorpe on the Hill
Lincoln
LN6 9BG

Dear Ray

Re: Request for confirmation of previous comments
Elsoms Way, Pinchbeck

Further to our telephone conversation of last week and your subsequent email, I write to confirm the following:

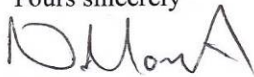
As per Stan Pywell's letter to J Elsey of 6th May 2010 (regarding possible development north of the Blue Gowt Drain at Pinchbeck) surface water from the area contained between the Blue Gowt Drain, the old railway embankment and the projected Elsoms Way Road may be directly discharged to the Board's system.

The Board's Riddington Pumping Station at Pinchbeck Marsh was designed and constructed to accommodate additional flows into the system as a result of future industrial development in this area.

Consent to discharge will be conditional on payment of a development contribution currently assessed at £50,919 per impervious hectare.

Although not directly related to the Flood Risk Assessment any estate layout should ensure there is no encroachment within 9 metres of the top edge of watercourse and that access for tracked excavators is provided between any public highway and the above strip.

Yours sincerely



N S Morris
Operations Engineer