# FLOOD RISK ASSESSMENT

## PROPOSED OFFICE ACCOMMODATION & CONSTRUCTION OF A PONTOON PORT SUTTON BRIDGE SUTTON BRIDGE LINCOLNSHIRE PE12 9QR



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# FLOOD RISK ASSESSMENT FOR PROPOSED OFFICE ACCOMMODATION & CONSTRUCTION OF A PONTOON, PORT SUTTON BRIDGE, SUTTON BRIDGE, PE12 9QR

## 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 and to direct development away from areas at highest risk.

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-year 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 the Port of Sutton Bridge. Sutton Bridge, PE12 9QR, which lies within the South Holland District Council's administrative area. **Plan 1**

The National Grid Reference for the site is TF 48455 22323

The site lies within an area defined in the South Holland Local Plan as the Port of Sutton Bridge which is a major employment area.

The Site would be classed as Major Development applying the National Planning Policy Guidance (NPPG) as the site is to be developed for more than 10 dwellings.

Full Planning permission is sought for the construction of a pontoon for mooring, loading of specialised boats for use in connection with offshore wind turbines together with the use of land for the stationing of portakabin office accommodation and associated storage containers. Dong Energy are presently constructing wind farms in the North Sea and Port Sutton Bridge is being used as a base for maintenance personnel

A previous permission (H18-0104-11) granted consent for a similar pontoon development and Portakabin arrangement for Centrica who were also involved in offshore wind turbine maintenance. Both the portakabins and pontoons were removed after Centrica had finished work.

A suite of portakabin offices will provide the base for the personnel involved in the operation together with storage facilities in associated containers. There is no intention to provide any living accommodation in connection with the use. Up to 10 portakabins and two storage containers will be placed within the storage area of the port, together with a parking area for Dong Energy personnel. The area is currently used for port related activities and parking of plant equipment and vehicles etc. and has also most recently been used by Centrica for the same use as now proposed.

The proposed office accommodation is required as a base for personnel who are involved in the maintenance and operation of the wind turbines located within The Wash. This consists of a collection of single storey portakabin type accommodation units which are securely fastened down to prevent any floatation together with 4 No storage containers and ancillary water containers and waste collection facilities.

The pontoon is described above and will be used for the loading and unloading of maintenance equipment and personnel, and will be used solely by Dong Energy. Specially constructed craft provided by Turbine Transfers Ltd will occupy the moorings next to the existing crane on the quayside that will be used to load maintenance equipment, stored within the port.

From the topographical survey the highest land level for the Dock area is 6.54mODN with the ground level at the site for the office blocks 3.27mODN. It is proposed that the minimum ground floor level for the new offices be will be 450mm above the existing ground level. **Plan 3 (Section)**

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.

**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 the proposed development use for offices is classified as "Less Vulnerable", and the pontoons classified as "Water Compatible" with Table 1 of NPPF stating that such uses are permitted in this zone.

**Table 2: Flood Risk Vulnerability Classification**

| **Less vulnerable** |
| --- |
| • Police, ambulance and fire stations which are *not* required to be operational during flooding.<br>• 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.<br>• Land and buildings used for agriculture and forestry.<br>• Waste treatment (except landfill and hazardous waste facilities).<br>• Minerals working and processing (except for sand and gravel working).<br>• Water treatment works which do *not* need to remain operational during times of flood.<br>• Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place). |

**DRAINAGE AUTHORITIES**

**Environment Agency**

The Environment Agency has permissive powers for reducing the risk of flooding from designated main rivers and from the sea.

The following potential source of flooding affecting the development site has been identified as:

- From the River Nene (tidal)

The Flood Zone Maps identify river catchments over 3 sq. km. These maps are a theoretical estimate of areas of land that could be inundated by floodwater during a flooding event was it not for the presence of flood defences. 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 tidal flooding. These maps indicate that the area would be flooded without flood defences, which are in place along the river edge (with an annual probability of more than 0.5% return frequency of less than 1 in 200 years for tidal flooding**). Map 1**

The Environment Agency Risk of flooding from Rivers and Sea shows that the site is a Low Risk of Flooding, Low means that each year, this area has a chance of flooding of less than 1 in 1000 (0.1%). **Map 2**

**River Nene**

The site is located adjacent to the left bank of the River Nene. The 1 in 200-year flood level present day in the river channel is 5.91mODN and including for climate change (2115) is 7.39mODN. The left bank defence level is

6.35mODN and at this point has no raised defences. The average width of the dock area, which has a concrete surface, from the river edge is 55m therefore the chance of a breach to this area is minimal.

With climate change (2110) the increase in tide level would overcome the present level of defence along the Port frontage. Therefore, it will be necessary for these defences to be improved to accommodate climate change. The current earth banks to the River Nene downstream of the site are marginally above the increased level in tidal levels.

The flood level in the Washes varies are set out below.

| Location | Chainage Km | Peak 1 in 200year Extreme Tide level (mODN) | | Peak 1 in1000yearExtreme Tide level m(ODN) | | Defence Crest level m(ODN) | Defence Type |
|---|---|---|---|---|---|---|---|
| | | 2007 | 2115 | 2007 | 2115 | | |
| Port Sutton Bridge | 3.5 | 5.91 | 7.05 | 6.25 | 7.39 | 6.00 | No raised defence |
| | 4.0 | 5.89 | 7.03 | 6.24 | 7.38 | 6.32 | No raised defence |

These levels are taken from the South Holland Strategic Flood Risk Assessment

**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

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 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.

The South Holland Strategic Flood Risk Assessment contains hazard maps for both the present day and including climate change to year 2115 for flooding from the River Nene following a breach to the defences. The maps illustrate the likely maximum values of Hazard Rating, Depth and Velocity based on a combination of results from the assessment of individual breaches. Hazard Rating has been calculated using the intermediate approach (Table 13.1) of Flood Risk Assessment Guidance for New Development (FD2320).

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.

**HR = d x (v + 0.5) +DF**

HR = (flood) hazard rating d = depth of flooding (m)

V = velocity of flood waters (m/sec) DF = debris hazard = 0.5. (1.0 depth above 250mm)

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

**Maps 3, 4, 5 & 6** show the results for the Hazard Rating and Depth around the site for a breach to the River Nene, taken from the Strategic Flood Risk Assessment

The Residual Peak Flood Hazard Sutton Bridge - Year Present day and for 2115 0.1% Tidal Event Probability maps from the update of strategic flood risk assessment for South Holland District Council, show the site to be in an area Danger for Most (1.25 – 2.0). The Residual Peak Depth Sutton Bridge - Year Present day and for 2115 0.1% Tidal Event Probability Maps show the site could be subject to a depth of flooding 1.0 – 1.5m deep.

**South Holland Internal Drainage Board**

The proposed development site is located within Catchment I Westmere area of South Holland Drainage Board. The Board is responsible to operate and maintain the arterial fluvial system. **Map 7**

The Board's nearest maintained drain is over 800m north-west of the site and will not affect the proposed site

The Board do not have any record of any flooding in this area associated with the Board's system.

**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 reasonably flat, with no high ground around the site this will not cause any rapid inundation of the site and is likely only lead to local ponding of shallow depth and low velocity following the natural land contours. The offices are also raised 450mm above the average ground level. It is 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 at a lower level following the natural land contour to the south-west. It is therefore 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 sources within the vicinity of the site.

**SEQUENTIAL APPROACH**

When considering the sequential approach for flood risk from fluvial flooding in accordance with NPPF the area of the site for the offices 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.

The flood zones as detailed on the flood map show the area of land, which theoretically, would be inundated by floodwater during a flooding event from either tidal or fluvial sources without flood defences. The Environment Agency categorise land into one of three Flood Zones.

• Flood Zone 1 is land outside the 0.1% floodplain (with a chance of flooding of less than 0.1% chance in any given year).

• Flood Zone 2 is land that falls between the 1 in 100-year extent and the 1 in 1000-year extent (a chance of flooding between 1% and 0.1% in any given year)

• Flood Zone 3a is land which falls within the 1 in 100-year flood extent (has a 1% chance of a flood occurring in any given year).

The Sequential Test principal aim is the steering of new development to areas of the lowest probability of flooding (Flood Zone 1). Where there are no reasonably available sites in Flood Zone 1 then decision makers should first consider Zone 2and then Zone 3 taking into account the flood risk vulnerability of land uses as categorised in Table 2 of NPPF.

The proposed use for the proposed offices falls within "The Less Vulnerable" uses of land and the pontoons classified as "Water Compatible" Table D.3 Flood Risk Vulnerability Classification and Table 1 shows that

developments of this nature is permitted in Zone 1. Development in Zones 2 and 3 is restricted based on Table 3 of NPPF replicated below.

**Table 3: Flood risk vulnerability and flood zone '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 | ✓ | × | Exception Test required | ✓ |
| | Zone 3b functional floodplain | Exception Test required | ✓ | × | × | × |

Buildings used for office purposes are appropriate in Flood Zone 3a as well as water compatible uses. With the nature of the business being associated with off-shore Wind Farm purposes the offices could not be located elsewhere as they need to be located adjacent to the river for access to boats to transport personnel and equipment to the wind farm site in the Wash.

It is essential that the entire operation is located within the port and, as such, the proposed use is compliant with policy EC3 of the South Holland Local Plan, in that the proposal is located within an existing area of employment and will not have an unacceptable impact in terms of traffic movement and intrusion into the open countryside.

The Environment Agency recommends that for Non-Major Less Vulnerable developments the finished floor level should be raised as high as practicable (minimum of 300mm above existing ground level). Where the floor level is not raised above the flood level and it is not practicable to do so an appropriate Flood Warning and Evacuation Plan should be provided to demonstrate the safety of the buildings users.

The floor level is to be raised 450mm above the ground level and a Flood Warning and Evacuation Plan is to be prepared.

**CLIMATE CHANGE**

Global warming is now recognised that it is likely to affect the frequency and severity of extreme events as both tidal and fluvial flooding. The Climate change allowances in the NPPF Guidance was updated on the 19th February 2016.

The site is located within the Anglian River Basin, for sites within Flood Zone 2 and for "More vulnerable" land uses the Higher Central and Central Peak river flow allowances figures in Table 1 should be used.

| Table 1 Peak river flow allowances by river basin district (1961 to 1990 baseline) | | | | |
|---|---|---|---|---|
| River basin District | Allowance category | Total potential change anticipated for '2020s' | Total potential change anticipated for '2050s' | Total potential change anticipated for '2080s' |
| Anglian | Upper End | 25% | 35% | 65% |
| | Higher central | 15% | 20% | 35% |
| | Central | 10% | 15% | 25% |

The effect of global warming on peak rainfall allowances is given in Table 2.

| **Table 2** Peak rainfall intensity allowance in small and urban catchments (1961 to 1990 baseline) | | | |
|---|---|---|---|
| Applies across all of England | Total potential change anticipated for 2010 to 2039 | Total potential change anticipated for 2040 to 2059 | Total potential change anticipated for 2060 to 2115 |
| Upper End | 10% | 20% | 40% |
| Central | 5% | 10% | 20% |

The annual sea rise due to climate change is given in NPPF and the recommended contingency allowances are stated in Table 3.

| **Table 3** Peak sea level allowance for each epoch in (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline) | | | | | |
|---|---|---|---|---|---|
| Area of England) (Use River Basin maps | 1990 to 2025 | 2026 to 2050 | 2051 to 2080 | 2081 to 2115 | Cumulative Rise 1990 to 2115 (m) |
| East, Midlands, London, South East | 4 (140mm) | 8.5 (212.5mm) | 12 (360mm) | 15 (525mm) | 1.24m |

**INFRASTRUCTURE**

The property will be connected into a foul drainage system which will connect into the foul sewer serving the Port

The surface water from the development will be connected into the existing outlets or to soakaways designed in accordance with BRE Digest 365. Parking areas will be constructed with permeable materials.

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

**CONCLUSION**

- The site does at present have the benefit of protection from tidal flooding by the existing defences which are properly maintained to a 1 in 200-year standard of protection from tidal flooding.

- The Residual Peak Flood Hazard Sutton Bridge - Year Present day and for 2115 0.1% Tidal Event

Probability maps from the update of strategic flood risk assessment for South Holland District Council, show the site to be in an area Danger for Most (1.25 – 2.0). The Residual Peak Depth Sutton Bridge - Year Present day and for 2115 0.1% Tidal Event Probability Maps show the site could be subject to a depth of flooding 1.0 – 1.5m deep.

- Whilst the site lies within the High Probability Zone 3a without defences as stated in NPPF. The proposed Office Use falls within the “Less Vulnerable” and the pontoons classified as “Water Compatible” uses of land as defined in Table 2 NPPF this development use is appropriate in Flood Zone 3a.

- Floor levels for the office accommodation are to be set 450mm above ground level.

- Flooding from other sources is unlikely to affect the site.

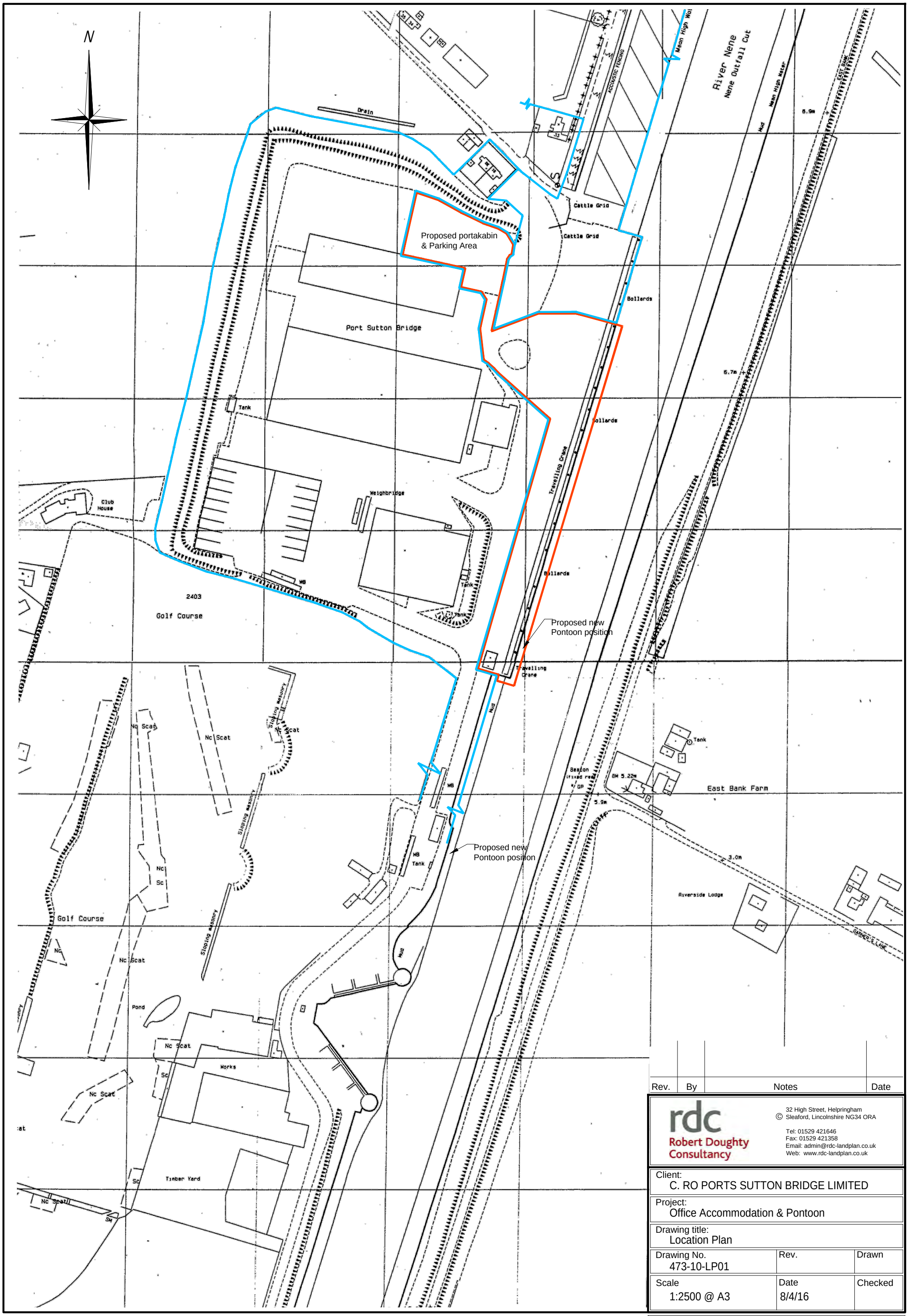
- The company will register the offices with the Environment Agency to receive automated early warnings of potential flood events.

- A Flood Evacuation and Warning Plan will be produced.

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# APPENDIX

| | |
|---|---|
| Plan 1 | Location Plan |
| Plan 2 | Site Plan & Section |
| Plan 3 | Site Layout |
| Plan 4 | Proposed Office Layout |
| Plan 5 | Proposed Office Elevations |
| Map 1 | Extract from Environment Agency Flood Zone Map |
| Map 2 | NaFRA Flood Map |
| Map 3 | Extract from South Holland SFRA Residual Peak Flood Hazard Present Day Map |
| Map 4 | Extract from South Holland SFRA Residual Peak Flood Hazard 2115 Day Map |
| Map 5 | Extract from South Holland SFRA Residual Peak Flood Depth Present Day Map |
| Map 6 | Extract from South Holland SFRA Residual Peak Flood Depth 2115 Map |
| Map 7 | South Holland IDB Drainage Plan |




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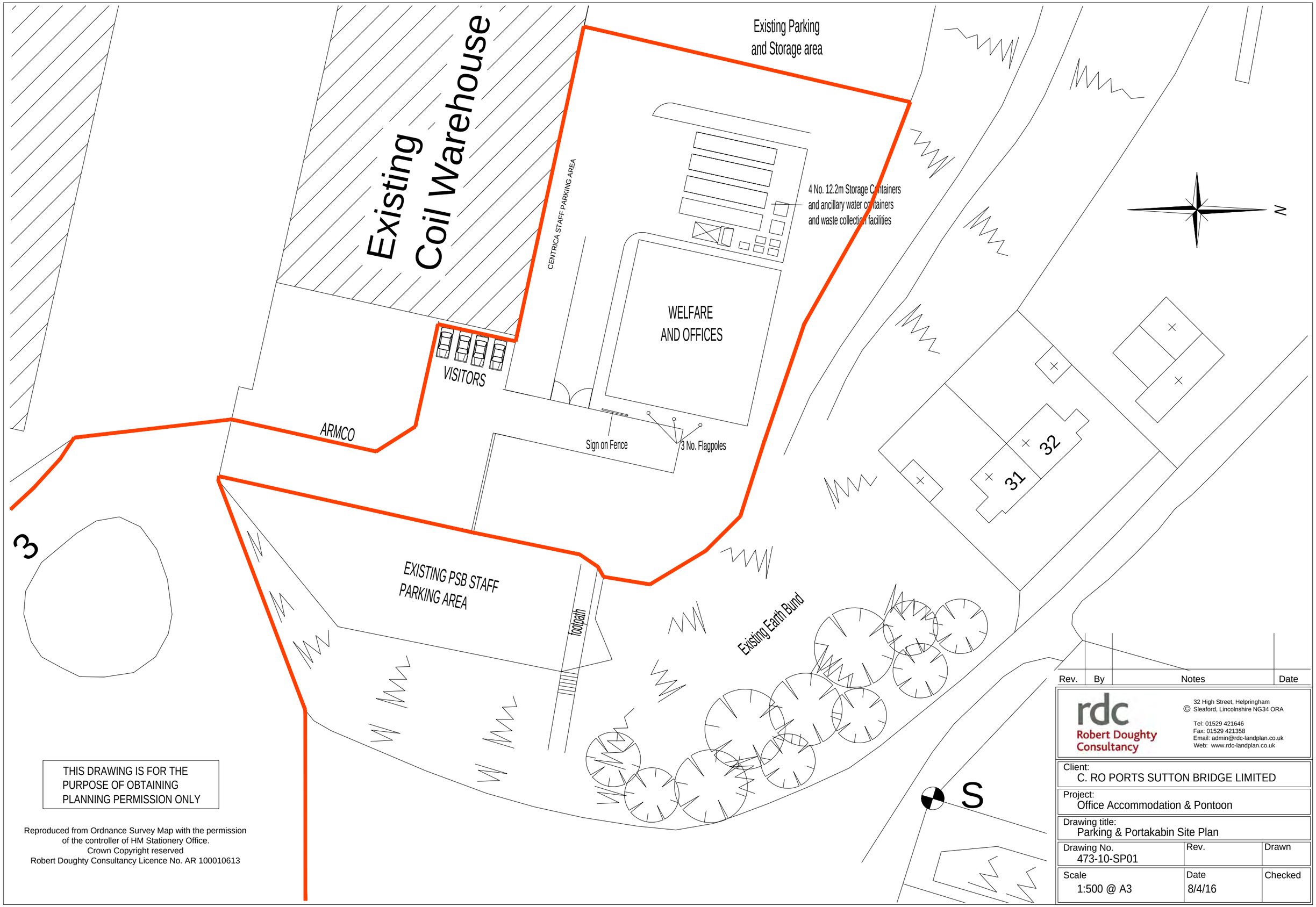
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Plan 1




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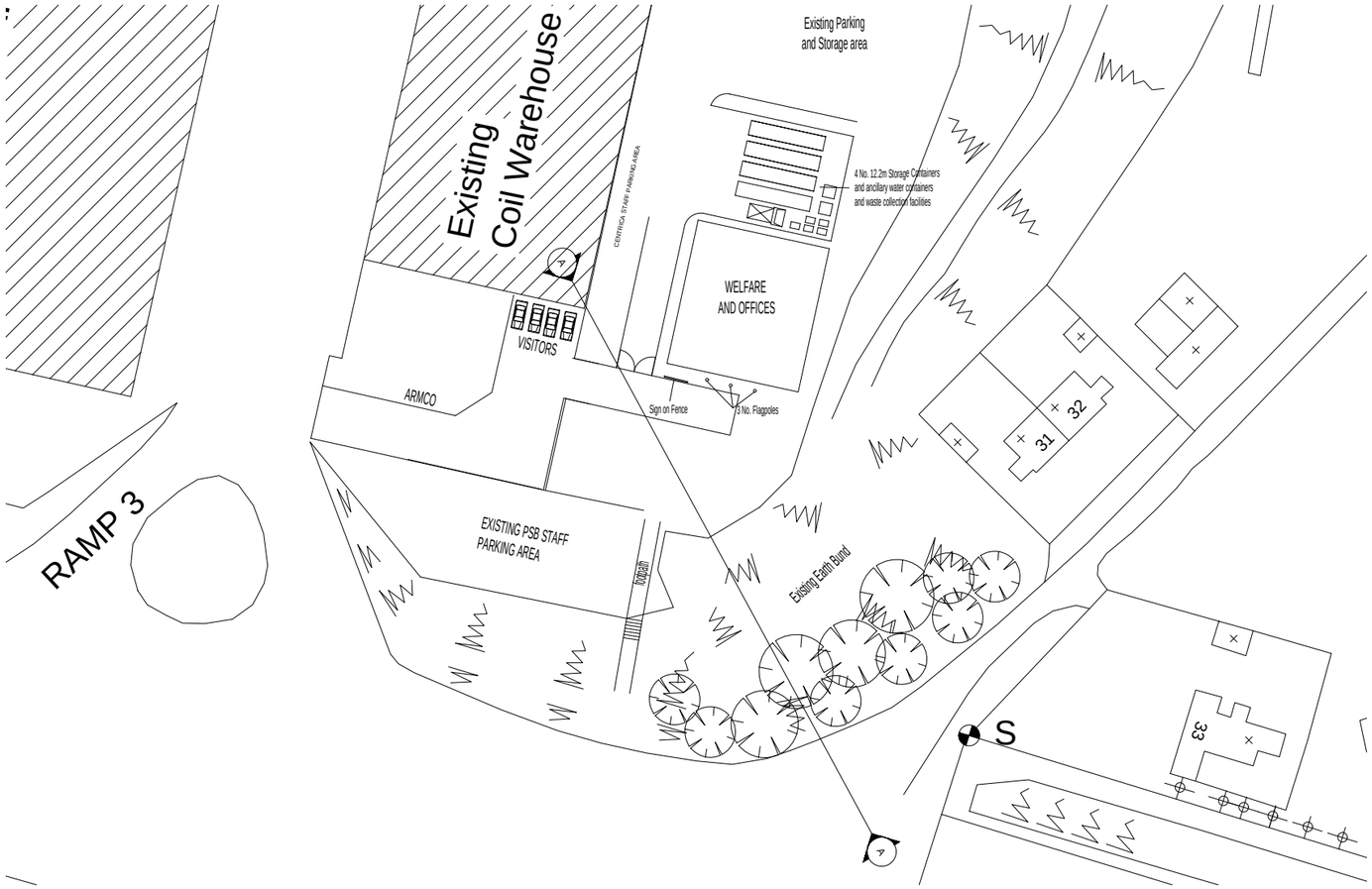
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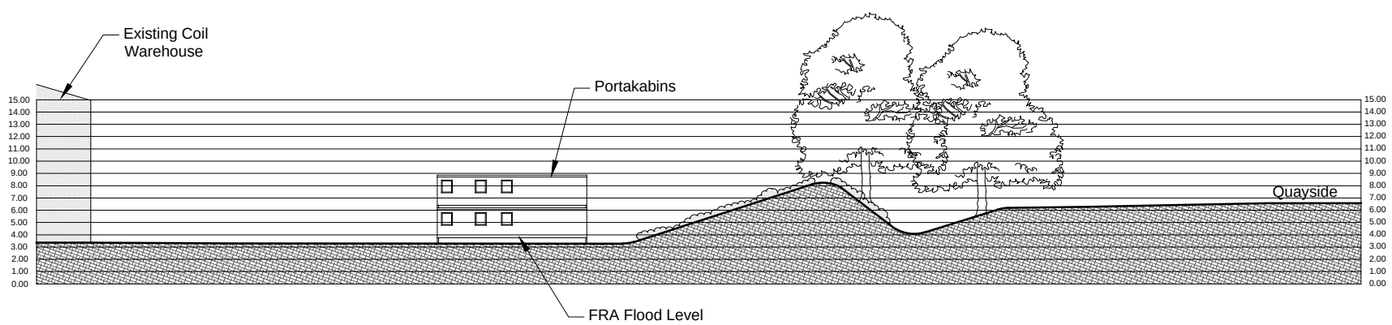
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Plan 2




Block Plan 1:1000




Section A - A 1:500

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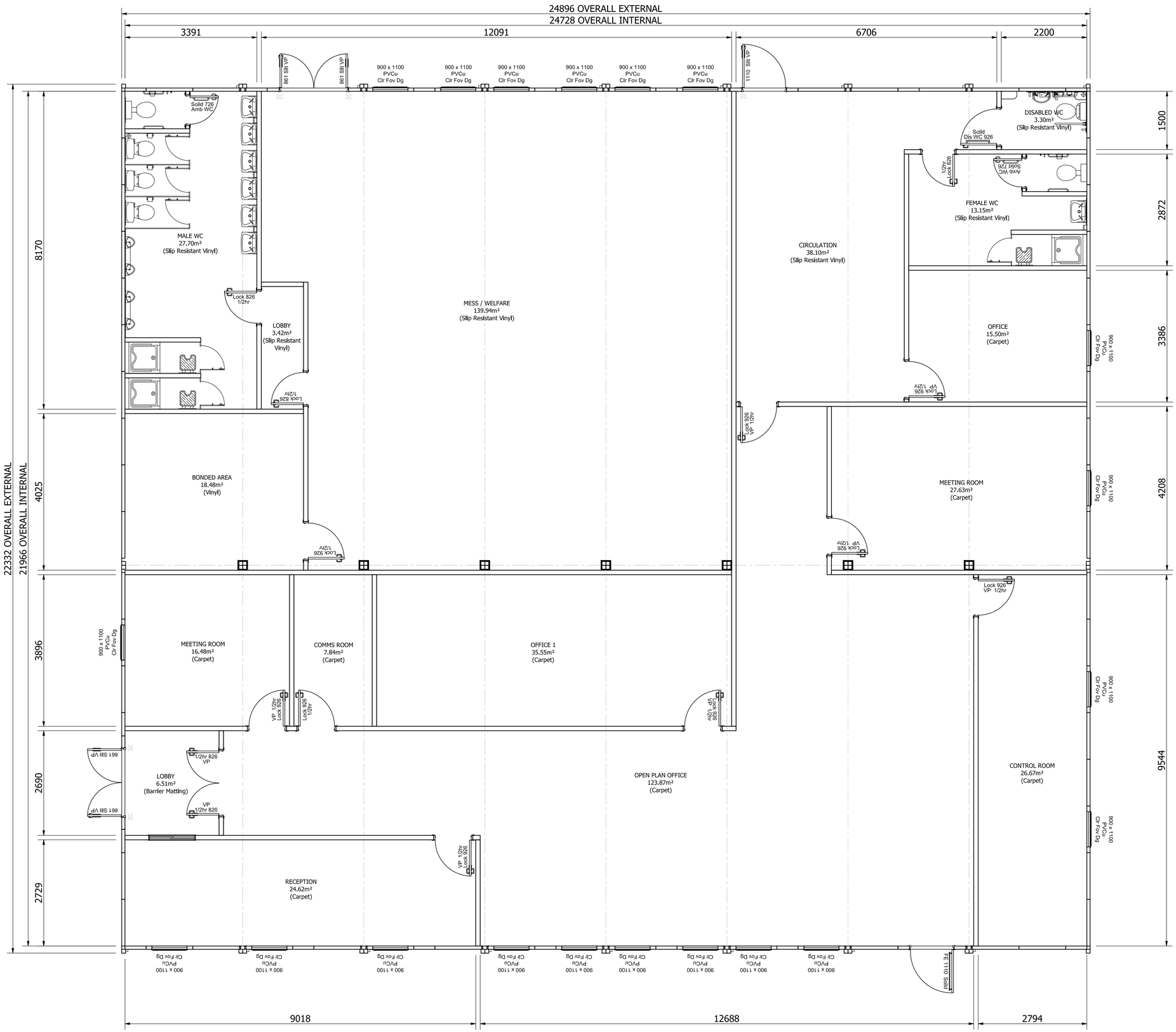
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Plan 3




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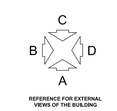
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Plan Layout

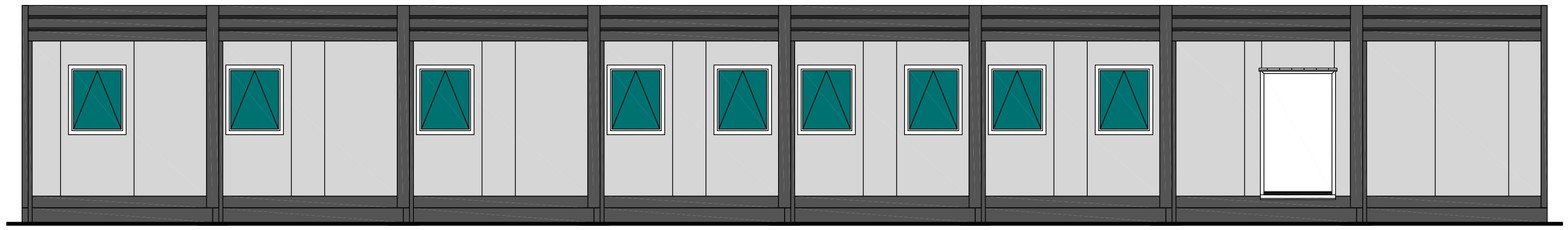
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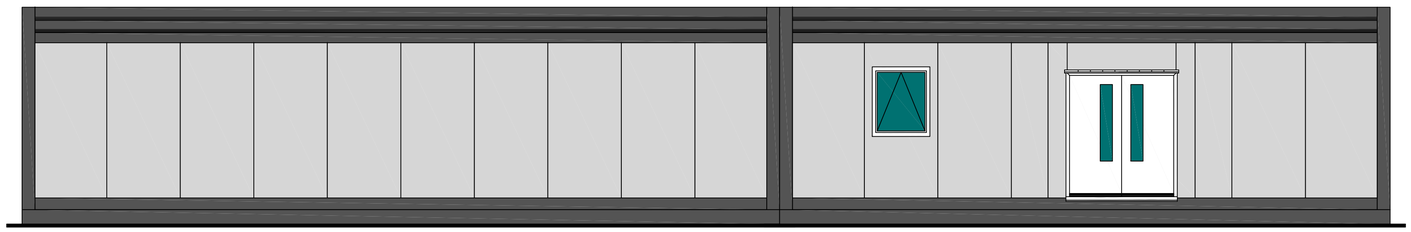

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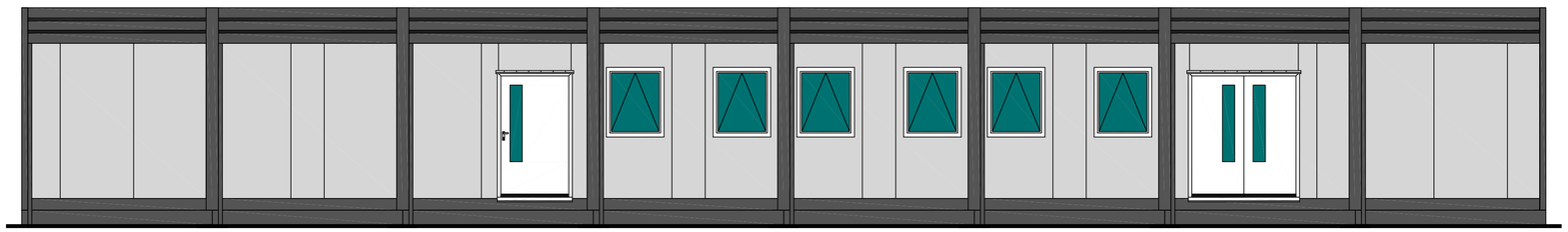




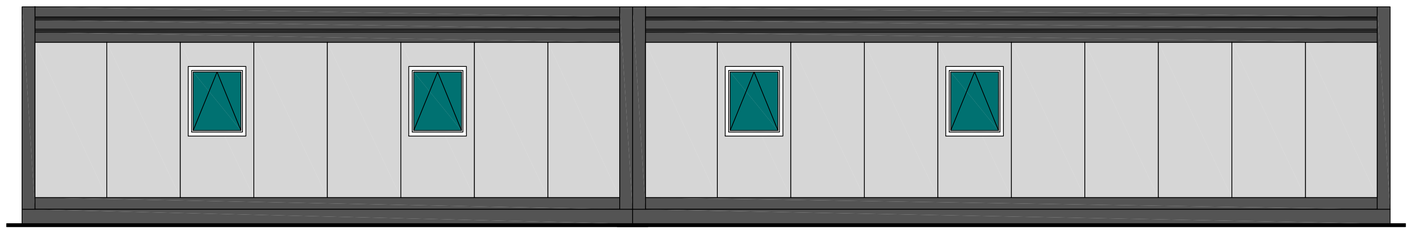
ELEVATION
A



ELEVATION
B



ELEVATION
C



ELEVATION
D

C
B D
A

REFERENCE FOR EXTERNAL VIEWS OF THE BUILDING

Elliott are members of

| Rev | Description | By | Date | Chk | Date |
|---|---|---|---|---|---|
| A | First Issue | - | - | - | - |

Revision History

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Project:
Elliott Steelplan Multi
8 No. 12.0mx3.112m & 8 No. 9.6mx3.112m
2.5m Ceiling Height

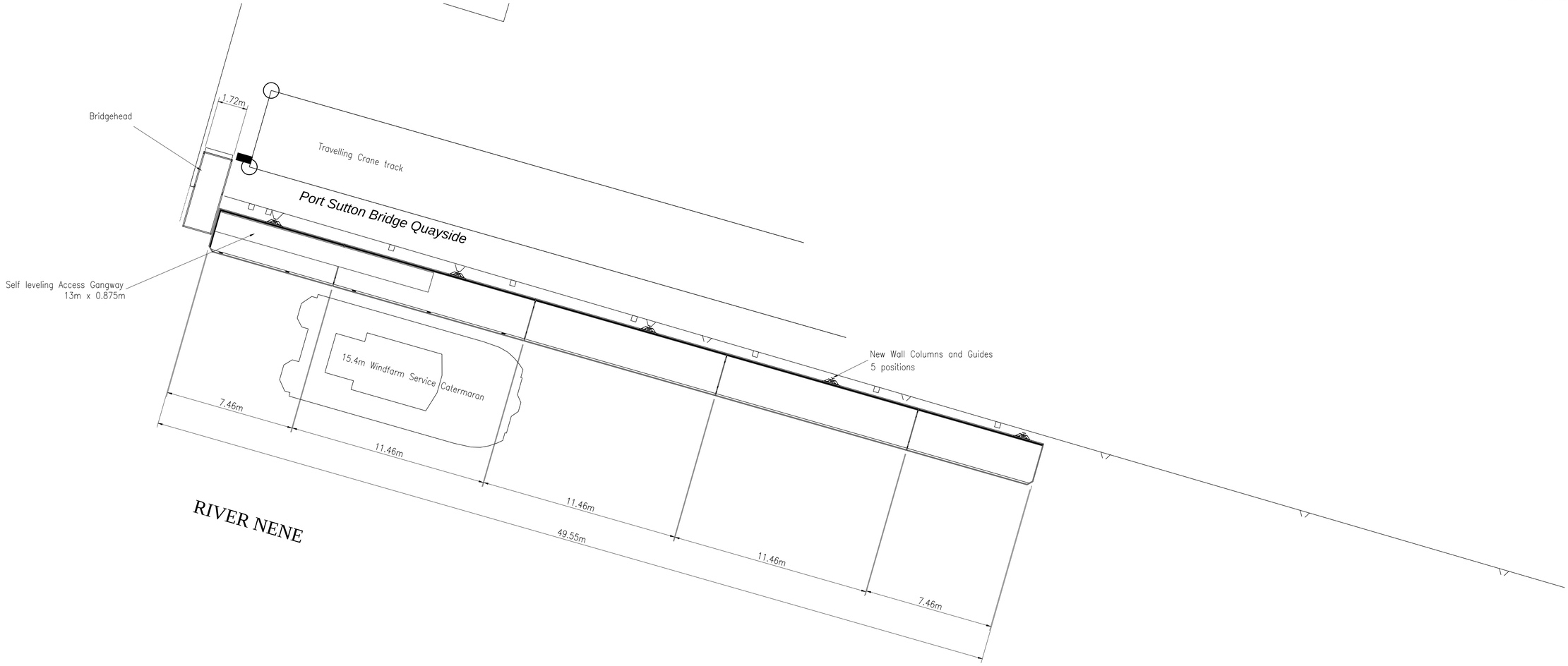
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| CNM | 09.03.11 | GH | 09.03.16 |

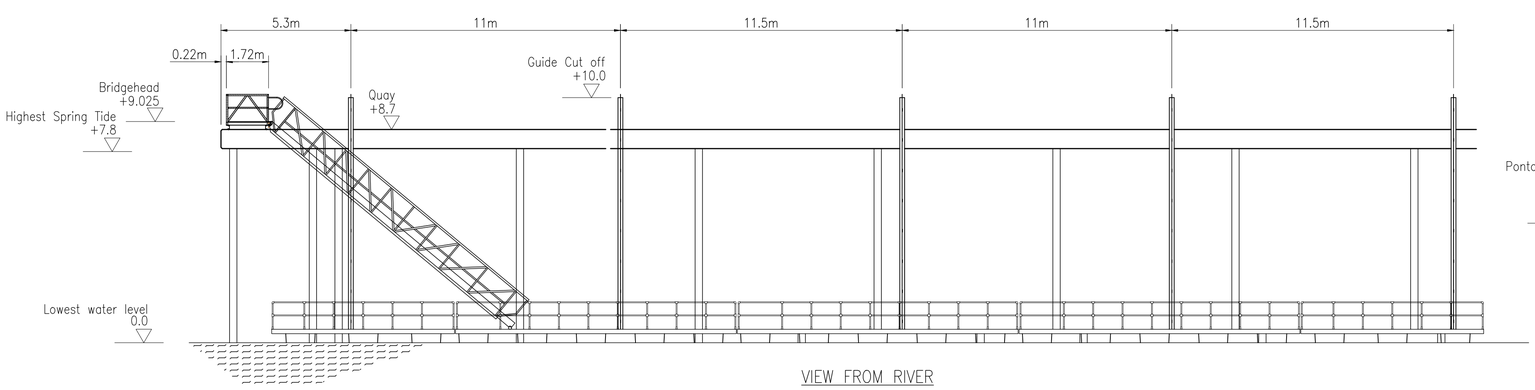
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| 1:50 | A1 | 1 of 1 |

Drawing Title:
CREL Sutton Bridge
Windfarm Base
Elevations

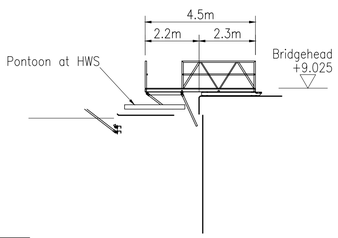
| Drawing Number: | Revs: |
|---|---|
| EG11325-311 | A |

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VIEW FROM RIVER




VIEW FROM DOWNSTREAM

ALL DIMENSIONS IN MILLIMETRES

| REV. | BY | DATE | DESCRIPTION |
|---|---|---|---|
| J | MD | 23/02/16 | PONTOON LAYOUT MODIFIED |
| H | P.V | 30/09/11 | 5 ADDITIONAL WALL COLUMNS POSITIONED |
| G | M.N. | 04/06/11 | WALL COLUMN DIMENSIONS ADDED |
| F | M.N. | 28/07/11 | LAYOUT REVISED |
| E | M.N. | 22/07/11 | LIGHTS REPOSITIONED |
| D | M.N. | 21/07/11 | LAYOUT REVISED |
| C | M.N. | 07/07/11 | LAYOUT REVISED |
| B | C.W | 10/06/11 | ADDED MESH PANEL DETAILS |
| A | MD | 20/05/11 | SERVICES MODIFIED |
| | | | Drg. No. WAS Q4555/002 |

CLIENT

PORT SUTTON BRIDGE, LANCS

TITLE

PROPOSED PONTOON REINSTALLATION 2016

| DRAWN | CHECKED | DATE | SCALE |
|---|---|---|---|
| MD | | 09/02/11 | 1:125 |

WALCON
Segensworth West, Fareham, Hampshire PO15 5SR
Telephone: 01489-579977
Facsimile: 01489-579988

ORDER NUMBER. | CAD PATH.

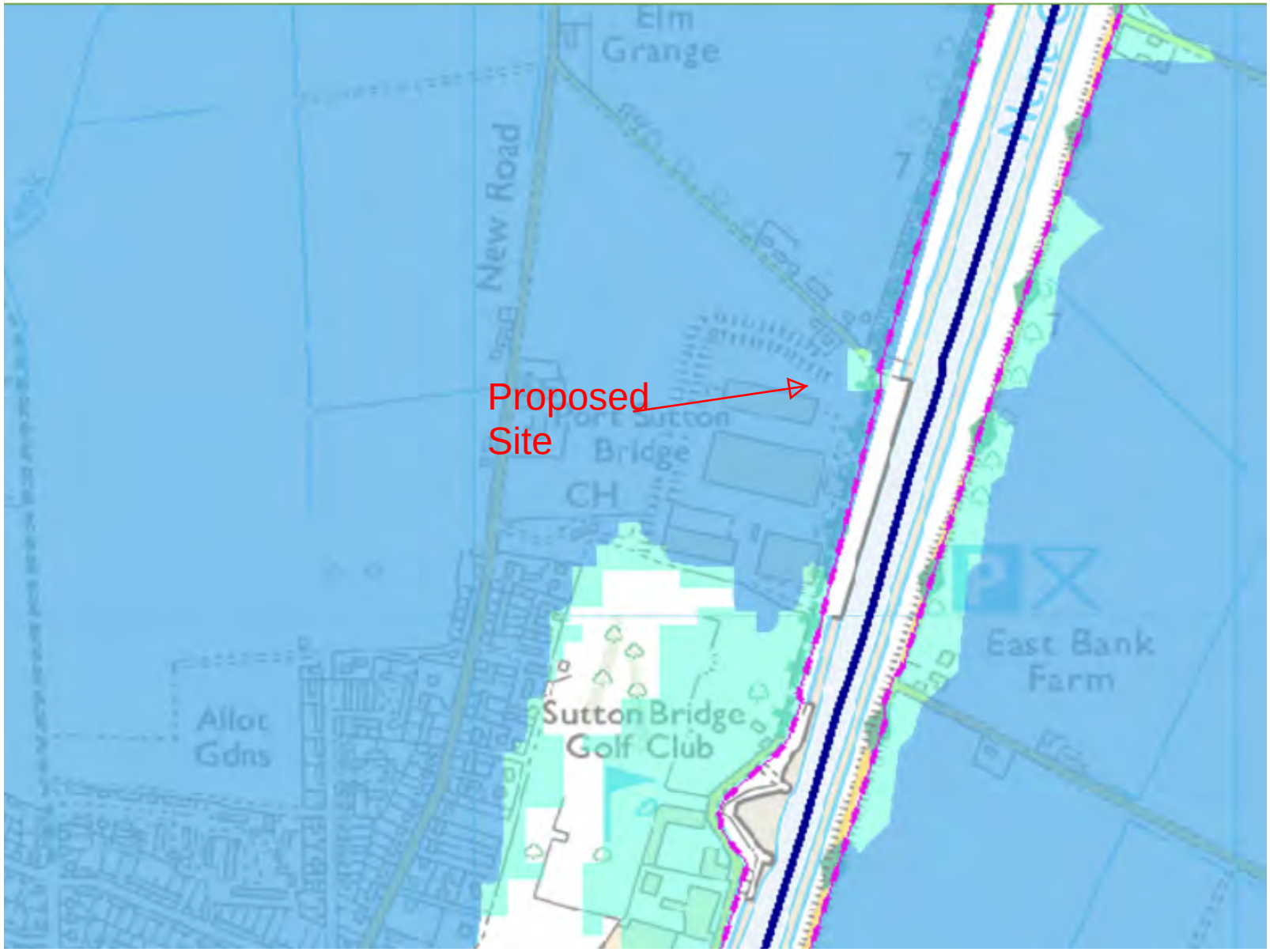
DRAWING NO. M3433-002 | REV. J

# Flood Map centred on Port Sutton Bridge

Environment Agency

**Legend**

- Flood Map - Defences
- Areas Benefiting from Flood Defences
- Flood Map - Flood Storage Areas
- Flood Map - Flood Zone 3
- Flood Map - Flood Zone 2




N
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S

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Map 1

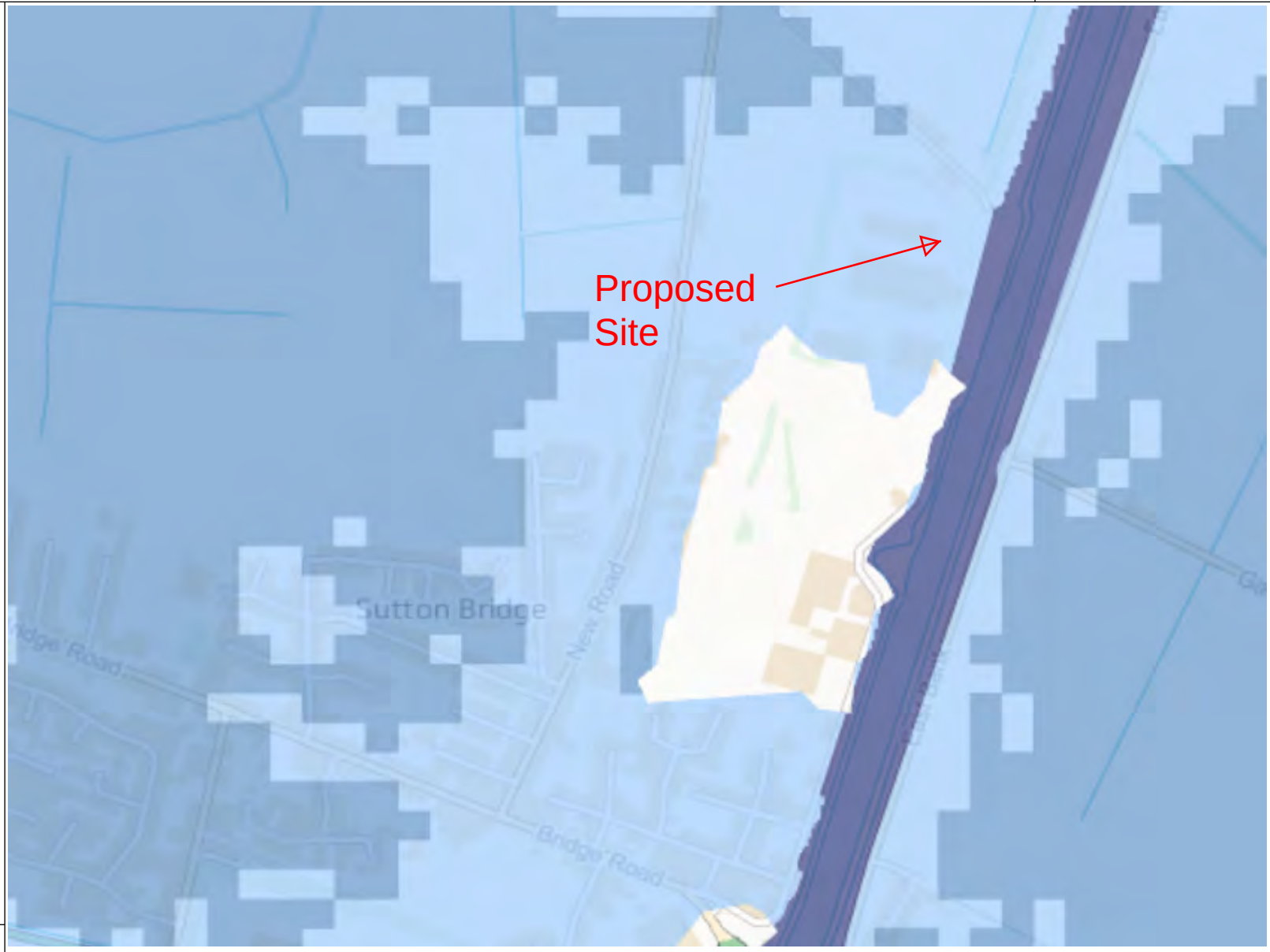
# NaFRA Map centered on Port Sutton Bridge.

Environment Agency

**Legend**

**National Flood Risk Assessment (NaFRA)**

- Very Low
- Low
- Medium
- High




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Map 2

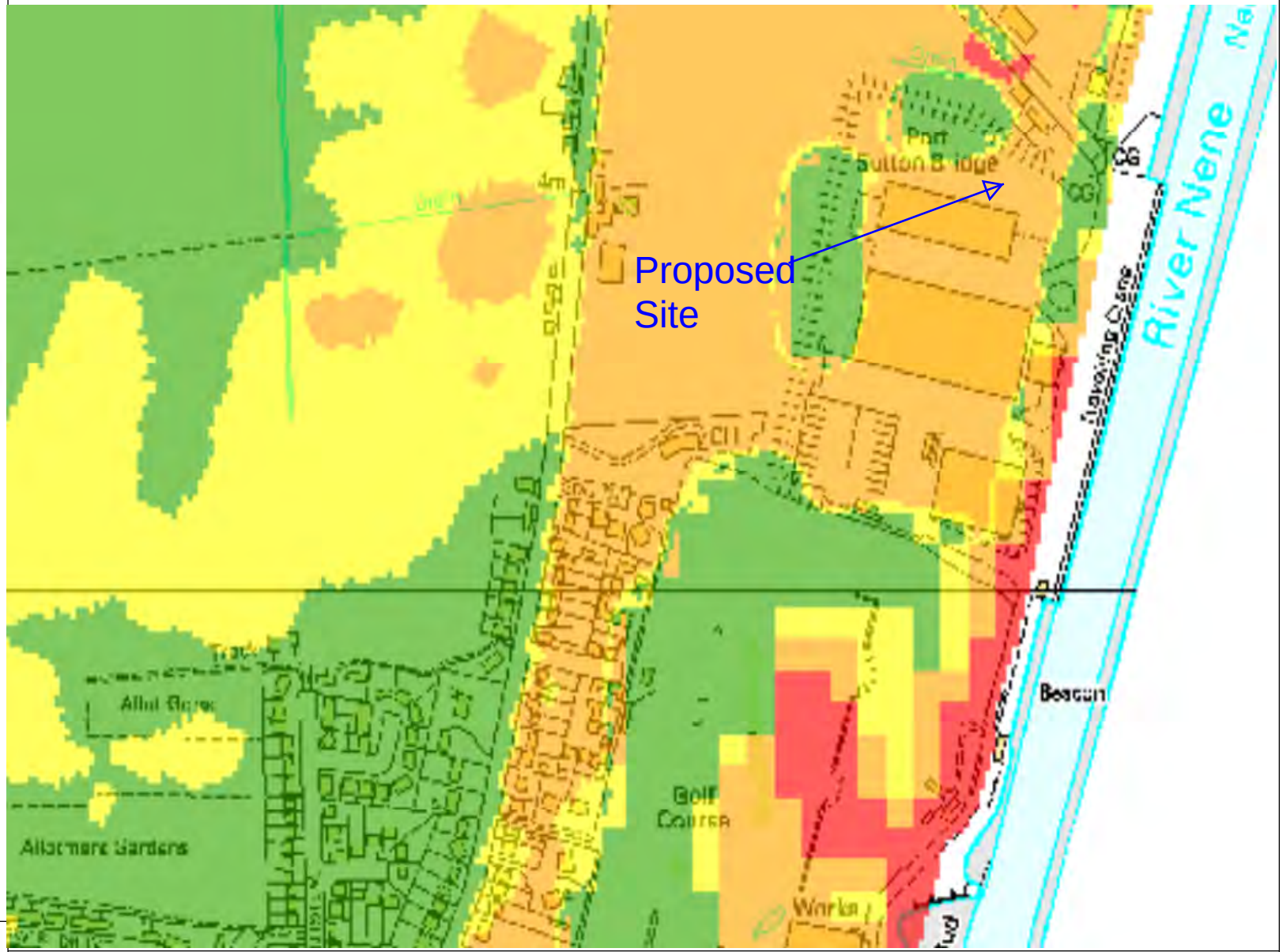
# Residual Flood Hazard Present Day 0.1% Event Sutton Bridge

Environment Agency

## Map Legend

**Peak Hazard**

- Low
- Moderate
- Significant
- Extreme
- Functional Floodplain
- South Holland District Boundary




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# Residual Flood Hazard 2115 0.1% Event Sutton Bridge

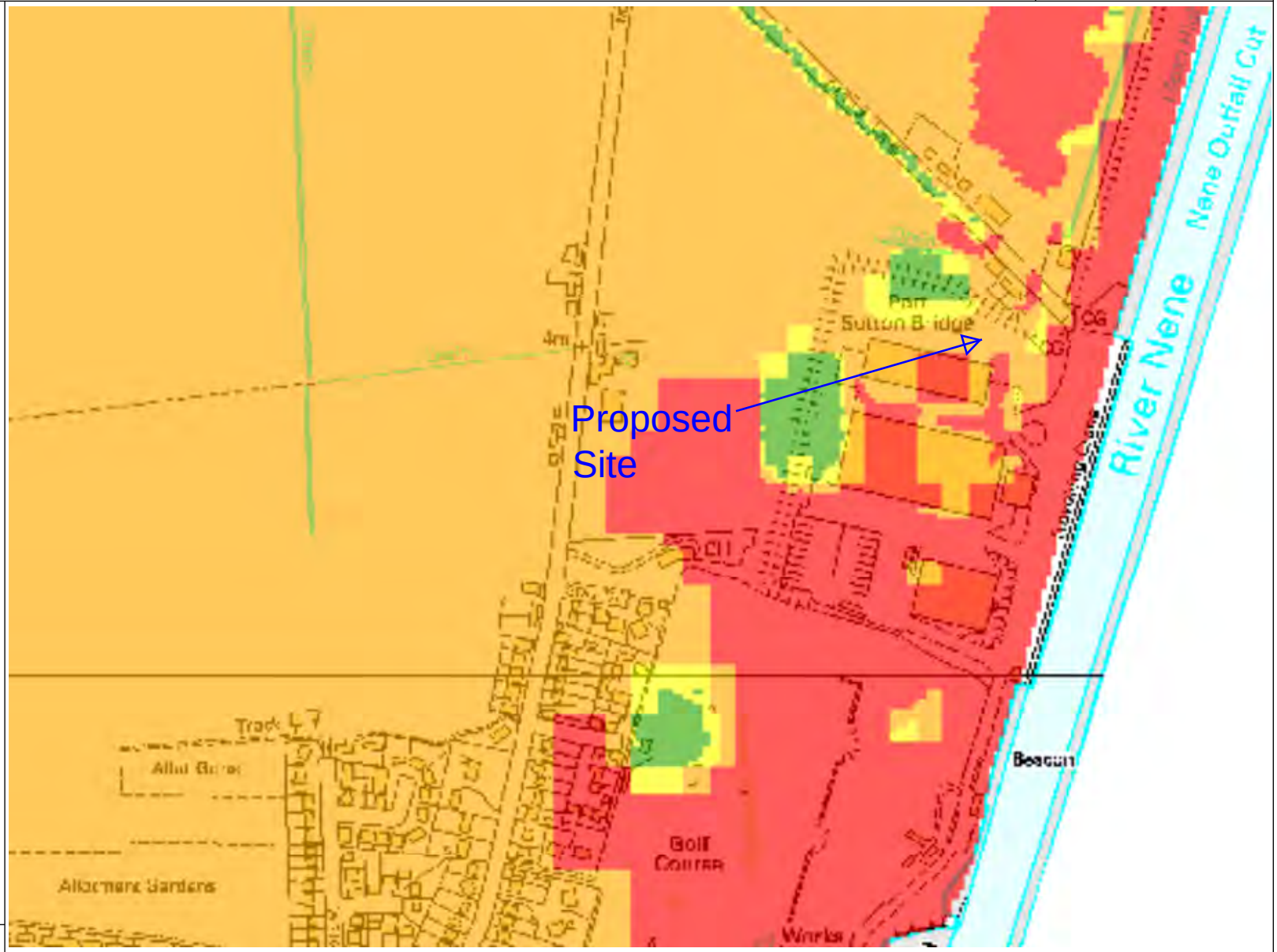
Environment Agency

## Map Legend

**Peak Hazard**

- Low
- Moderate
- Significant
- Extreme

- Functional Floodplain
- South Holland District Boundary




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Extract from South Holland SFRA 2010

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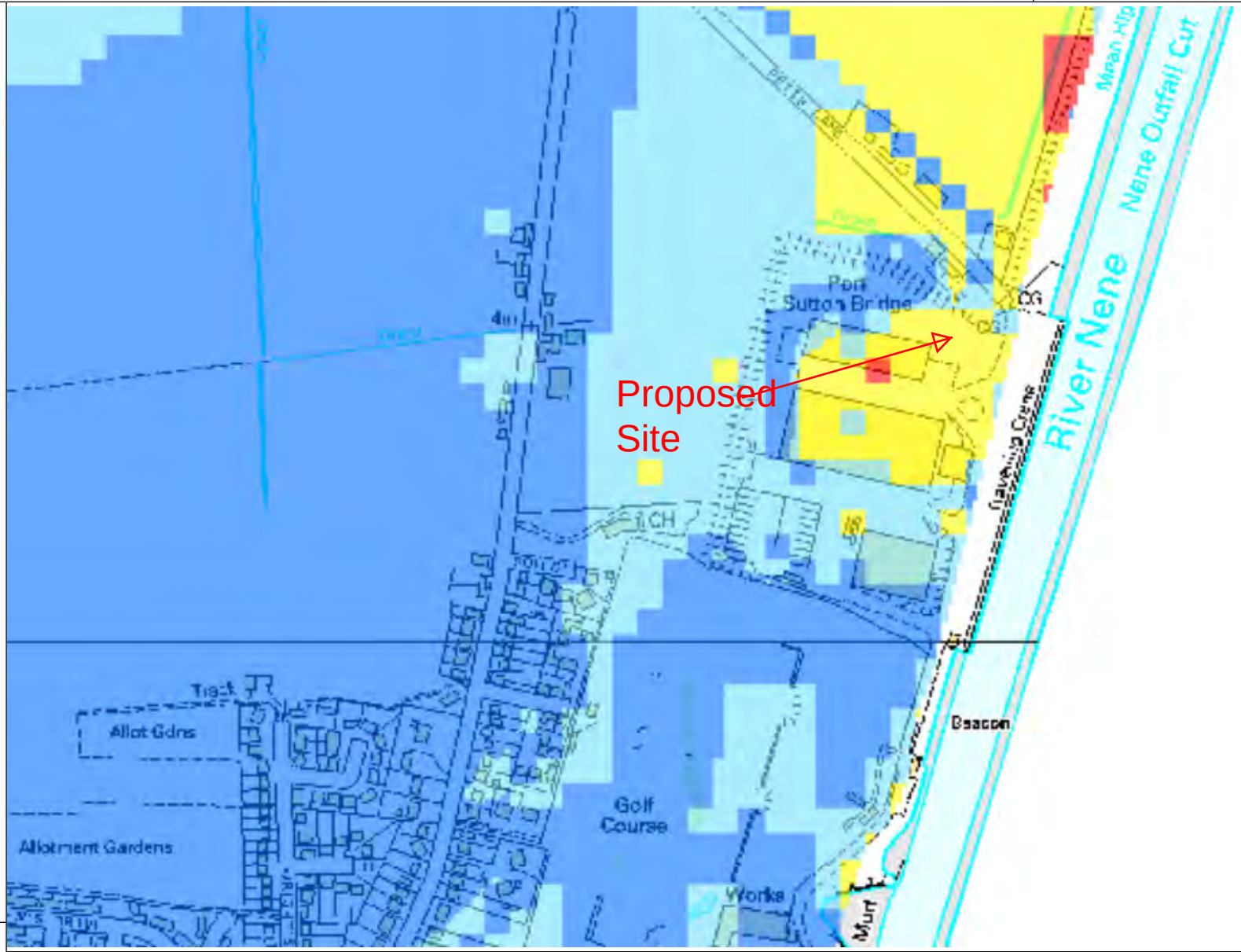
# Residual Peak Depth Present Day 0.1% Event Sutton Bridge

Environment Agency

## Map Legend

**Peak Depth**

- 0m - 0.5m
- 0.5m - 1m
- 1m - 1.5m
- >1.5m
- Functional Floodplain
- South Holland District Boundary




Extract from South Holland SFRA 2010.

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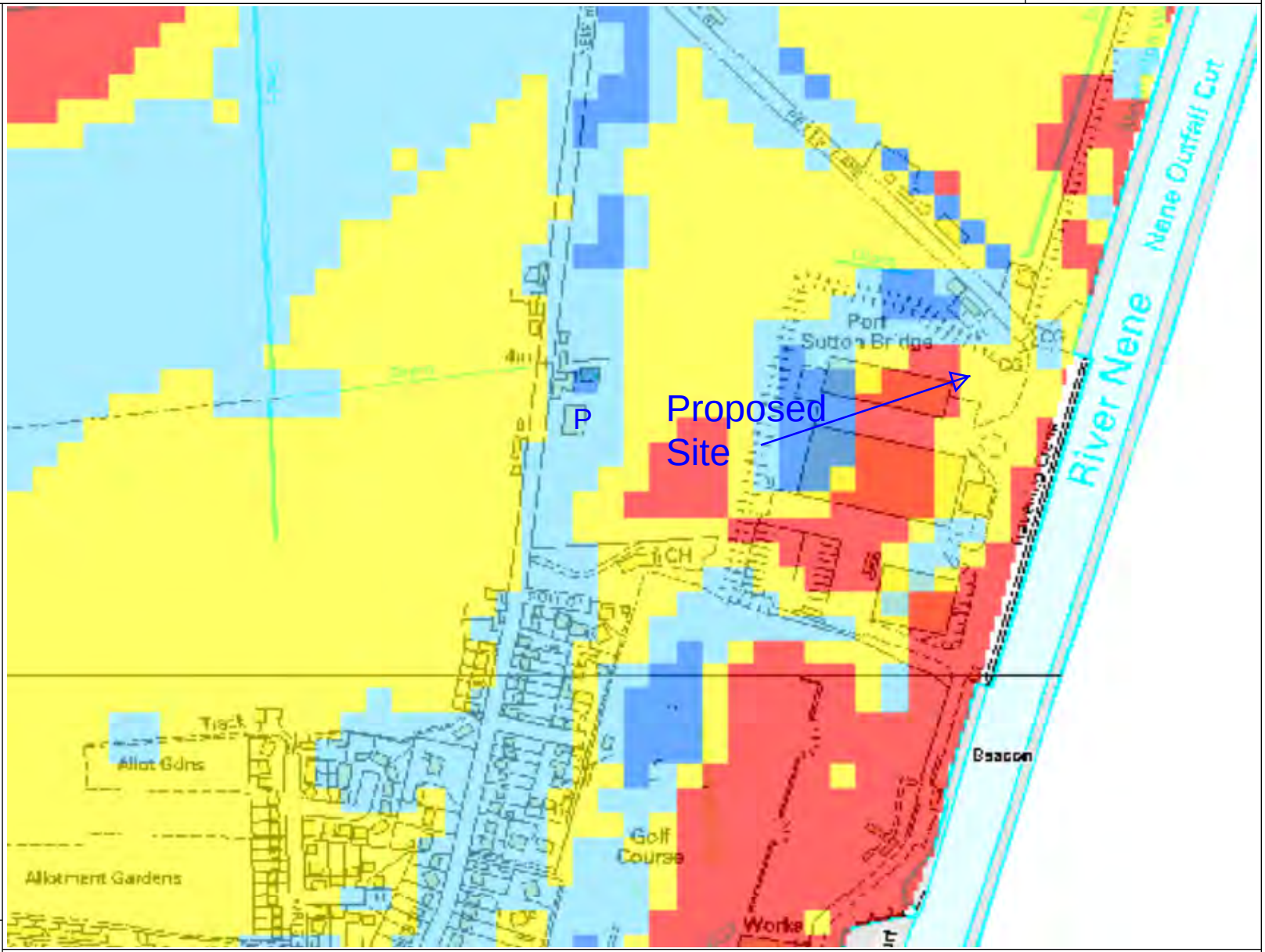
# Residual Peak Depth 2115 0.1% Event Sutton Bridge

Environment Agency

## Map Legend

**Peak Depth**

- 0m - 0.5m
- 0.5m - 1m
- 1m - 1.5m
- >1.5m
- Functional Floodplain
- South Holland District Boundary




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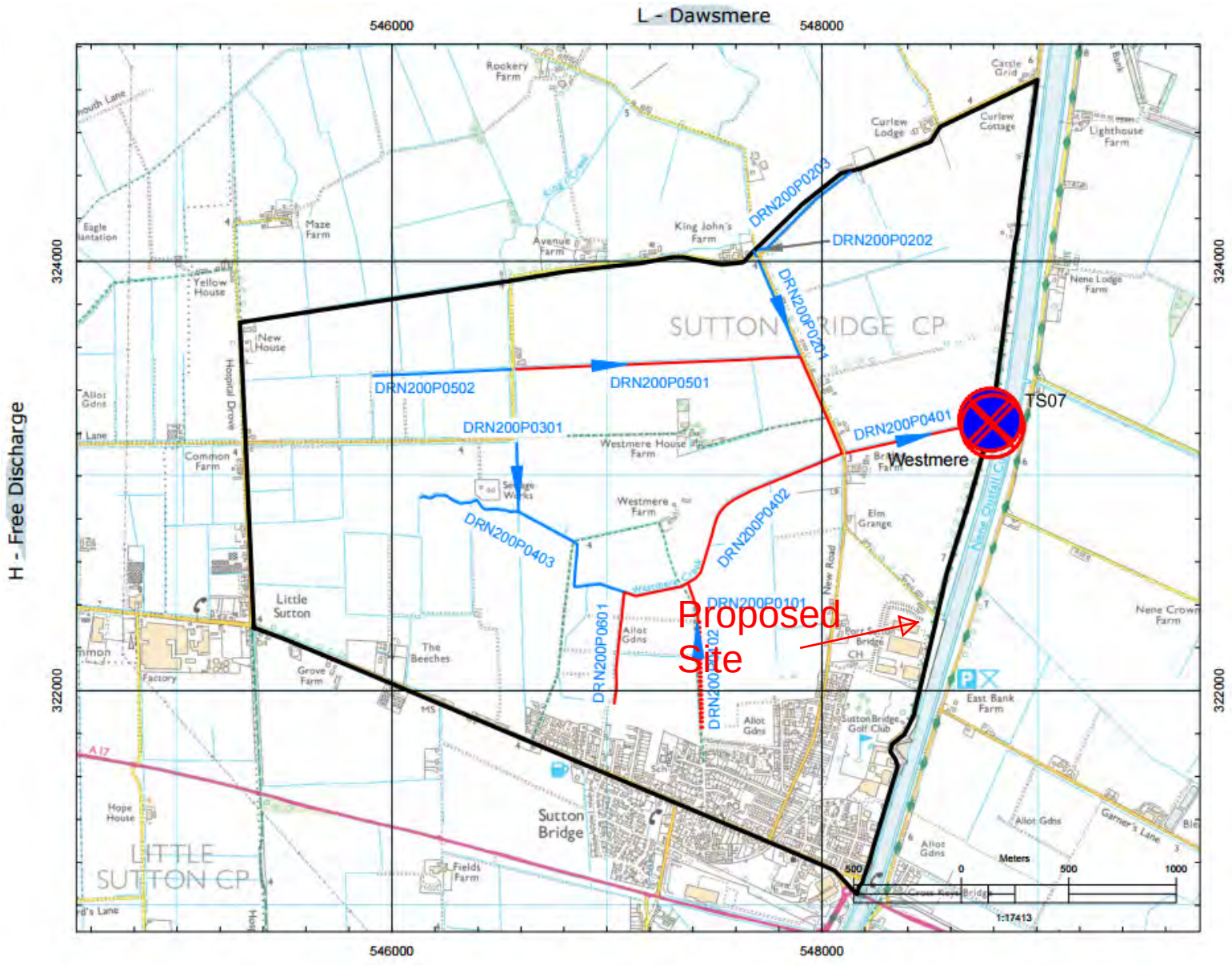
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# South Holland IDB Drainage Map

## LEGEND

- Catchment Boundary
- High Priority Watercourse
- IDB Ordinary Watercourse
- High Priority Pipeline
- Ordinary Pipeline
- Water Control Structure
- Pumping Station
- Inland Sluice
- Tidal Sluice




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