Mr & Mrs Bannister

Proposed Replacement Dwelling
97 High Street
Owston Ferry
Near Doncaster

Flood Risk Assessment

Prepared by EWE Associates Ltd
Final Rev0 November 2012

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CLIENT DETAILS

Isle Coaches
97 High Street
Owston Ferry
North Lincolnshire
DN9 1RL

FAO Mr & Mrs Bannister

CONTRACT

This report describes work commissioned by Mr & Mrs Bannister following written instruction dated 9th October 2012 by their representative Mr Danny Snow of Cadworx Ltd. Lea Favill of EWE Associates Ltd carried out the work.

Date: 18th November 2012

Prepared by: …… ……Lea Favill
Director

REVISION HISTORY

Draft Report Rev0 issued 11th November 2012 - 1No copy issued to Mr Danny Snow (Cadworx Ltd)
Final Report Rev0 issued 18th November 2012 - 1No copy issued to Mr Danny Snow (Cadworx Ltd)

EXECUTIVE SUMMARY

The site is located to the east of the centre of Owston Ferry. The site is presently part of an operational commercial development. The site includes a residential dwelling directly adjacent to the High Street which is proposed to be demolished as part of this development. The River Trent is approximately 140m to the east of the site with the Ferry Drain located approximately 650m to the south of the site. The Warping Drain is located 650m to the south of the site.

The land within the site boundary lies at a level of between 4.122mOD and 4.173mOD. The existing ground floor level of the residential dwelling is 4.268mOD. The proposed building within the site will be less than 150m² and the existing surface water system will be adopted for the new building. The proposal involves the construction of a single three bedroom unit with sleeping at first floor level only.

The whole of the development site is within Flood Zone 3, being the zone with risk of 1 in 100 year (1% AEP) or greater for river flooding and 1 in 200 year (0.5% AEP) tidal/coastal flooding. The centre of Owston Ferry village which is less than 200m north west of the site is located within Flood Zone 1, low risk, being the zone with risk of 1 in 1,000 year (0.1% AEP) or less for river flooding and tidal/coastal flooding.

As there are two sources of flood risk – River Trent and Ferry Drain/Warping Drain – it is necessary to determine flood water levels at the site for the desired return periods emanating from the two sources.

It is considered that during a 1 in 200 year and the 1 in 1,000 year event within the River Trent that the flood water will be maintained within the main channel and the site will not be flooded. However, during the 1 in 200 year plus climate change flood event the existing flood wall could be overtopped by 0.325m resulting in a hazard rating of "danger to some".

However, as the site is 140m from the River Trent it is considered that the site is located within an area which is danger to most if the defences were to breach. It is estimated that during a breach of the defences that the existing dwelling (4.268mOD) would remain dry, however, the adjacent High Street could be flooded to a depth of 0.350m (4.05mOD) and a velocity 0.77m/s which is considered to be 'danger to some'.

It is considered that the River Trent is the primary flood risk at the site and, as such, the impact of the Ferry Drain which is 650m south of the site is considered to be minor.

It is therefore recommended that the internal ground floor level of the proposed dwelling is elevated to the estimated breach flood level plus 600mm. Hence, a level of 4.65mOD. It is also recommended that a further 300mm of flood resilience measure are incorporated into the design for extreme flood events.

It is considered that during a 1 in 200 year and the 1 in 1,000 year flood event within the River Trent the defences will not be overtopped and the site and the access route from the site will remain dry. However, during the 1 in 200 year plus climate change flood event the existing flood wall could be overtopped by 0.325m resulting in a hazard rating of "danger to some".

During a breach of the defences a maximum depth of 0.35m could be experienced adjacent to the site. It is proposed that the ground floor level is elevated 600mm above the estimated breach flood level within the site (4.65mOD). As such, the building will be safe from the flood water during this event. Furthermore a first floor level will be provided within the dwelling which could be used during more extreme events. It is considered that the emergency services will be able to access the site even during extreme events.

It is concluded that there is a risk of flooding from the nearby River Trent, however; the mitigation measures recommended in section 5 of this report should provide betterment and ensure that the risk is reduced to an acceptable level.

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1. INTRODUCTION

Terms of Reference

This report was commissioned by Mr & Mrs Bannister to support a planning application for a proposed single residential dwelling to replace the existing dwelling within the site boundary. The site can presently be accessed from the south off the High Street. The location of the site is shown on Table 2-1.

The whole of the development site is within Flood Zone 3, being the zone with risk of 1 in 100 year (1% AEP) or greater for river flooding and 1 in 200 year (0.5% AEP) tidal/coastal flooding. The centre of Owston Ferry village which is less than 200m north west of the site is located within Flood Zone 1, low risk, being the zone with risk of 1 in 1,000 year (0.1% AEP) or less for river flooding and tidal/coastal flooding. The development site is within an existing developed area and is less than 1 hectare.

It is usual for the Agency to raise an objection to development applications within the floodplain or Zone 2 or 3 of the flood map until the question of flood risk has been properly evaluated. The Agency will also object to developments where the total site area is in excess of 1 hectare until suitable consideration has been given to surface water runoff.

Approach to the Assessment

As there are three sources of flood risk – River Trent, Ferry Drain/Warping Drain and surface water runoff – it is necessary to determine flood water levels at the site for the desired return periods emanating from the three sources. Consideration has also been given to the site flooding from either overland flow or ponding of localised rainfall within the site.

The River Trent is Main River; the Environment Agency does have modelled flood data which may assist in predicting the design flood level for the river adjacent to the proposed development site.

The Ferry Drain/Warping Drain is Main River; the Environment Agency does not have modelled flood data which may assist in predicting the design flood level for the river adjacent to the proposed development site.

The proposed development is for a single three bedroom dwelling which will utilise the footprint of an existing building. The existing building is supported by roof drainage which is believed to discharges to soakaways. As such, it is considered that the proposed development will not increase the overall impermeable area within the site and therefore the runoff will not be increased. Therefore, no further consideration will be given to this mechanism.

A walk over of the site was conducted by Mr Lea Favill, a senior river engineer on 18th October 2012; during the visit a photograph survey of the site and adjacent watercourses was undertaken. A spot level survey of the site, calibrated to OS datum was undertaken by EWE Associates Ltd during the site visit. These surveyed levels have been utilised within this report.

The requirements for flood risk assessments are generally as set out in NPPF and technical guidance. The detail and complexity of the study required should be appropriate to the scale and potential impact of the development. For the purposes of this study, the following have been considered:-

- Available information on historical flooding in the area.
- Site level information.
- Details of structures, which may influence hydraulics of the watercourse and consideration of the effect of blockage of structures.
- Estimates of design levels, equivalent to a 200-year (coastal/tidal) and a 100-year (fluvial) return period flood event.
- Allowances for increased flows resulting from the effects of climate change.
- Allowances for sea level rise resulting from the effects of climate change.

Assess the existing runoff characteristics and the potential impact the proposed development will have on the runoff.

Further guidance is also provided in the CIRIA Research Project 624 "Development and Flood Risk: Guidance for the Construction Industry".

Application of Sequential & Exceptions Test

The development site lies partly within Zone 3 of the Environment Agency Flood Map (version 2.8.2), being the zone with risk of 1 in 200 year (0.5% AEP) or greater for tidal/coastal flooding. The proposed development is residential and, as such, considered to be more vulnerable.

Table 1-1: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b	Exception Test required	✓	×	×	×

✓ Development is appropriate

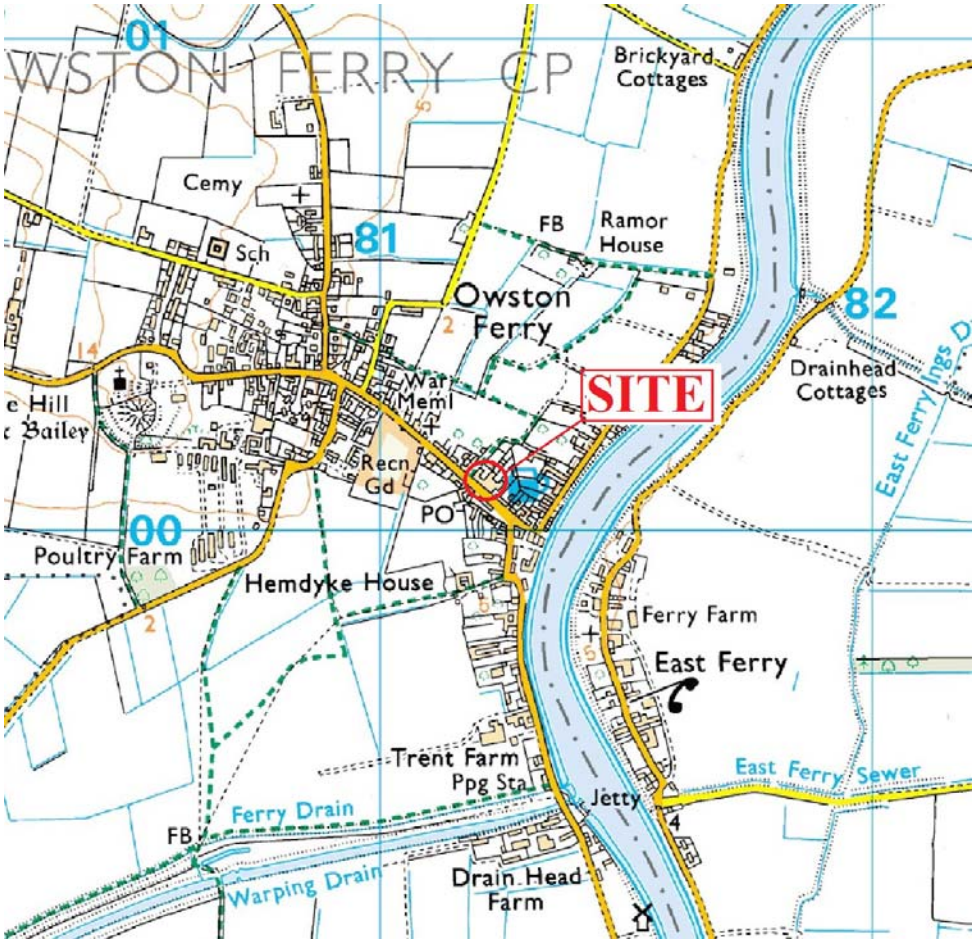
× Development should not be permitted

The proposed development is for a replacement dwelling. The existing dwelling will be demolished and the new dwelling will be sited in an area currently occupied by a commercial building. As such, it is considered that the level of occupancy and land use category will not be altered due to the proposed development. It is therefore considered that the development is exempt from the exceptions and sequential test.

2. DETAILS OF THE SITE

Site Location

Table 2-1: Location Plan



Ordnance Survey Licence no.: WL1005160

Site Details

Table 2-2: Site Details	
Site Name	97 High Street, Owston Ferry
Existing Land Use	Residential Dwelling
Proposed Development	Residential Dwelling
Grid Reference	SE 81208 00093
County	England
Local Planning Authority	North Lincolnshire Council
Internal Drainage Board	Axholme Internal Drainage Board
Post Code	DN9 1RL
Others	Not Applicable

Site Description

The site is located to the east of the centre of Owston Ferry. The site is presently part of an operational commercial development. The site includes a residential dwelling directly adjacent to the High Street which is proposed to be demolished as part of this development. The River Trent is approximately 140m to the east of the site with the Ferry Drain located approximately 650m to the south of the site. The Warping Drain is located 650m to the south of the site.

The existing site is shown below in the aerial photograph in Figure 2.1. The extent of the original commercial building is shown at Appendix A of this report. The proposed footprint of the new dwelling is also shown on the drawing.

The land within the site boundary lies at a level of between 4.122mOD and 4.173mOD. The existing ground floor level of the residential dwelling is 4.268mOD. The proposed building within the site will be less than 150m² and the existing surface water system will be adopted for the new building. A plan of the site showing ground levels is provided at Appendix A.

The proposal involves the construction of a single three bedroom unit with sleeping at first floor level only. The layout plans are provided at Appendix B of this report.

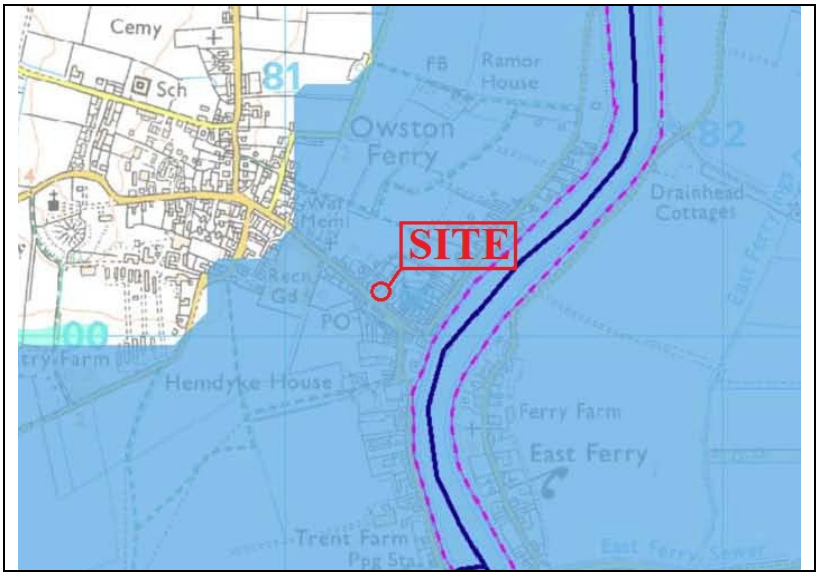
Site Photographs

Figure 2.1: Aerial Photograph of the Existing Site.

3. INITIAL ASSESSMENT

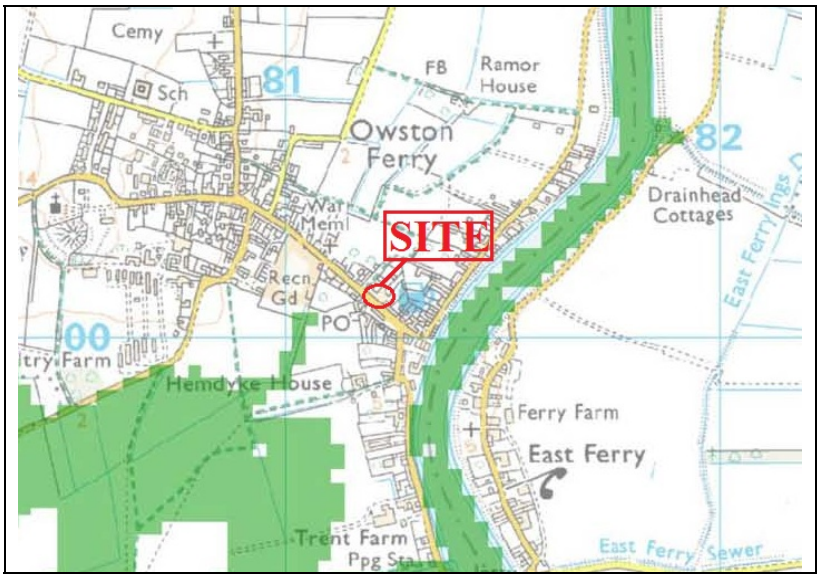
Environment Agency Flood Map

Figure 3.1: Environment Agency Flood Zones



Environment Agency Reservoir Flood Map

Figure 3.2: Environment Agency Reservoir Flood Map



Past Flooding History

A search on the British Hydrological Society Chronology of British Hydrological Events website[1] found no records of past flooding within the Owston Ferry area.

Undertaking an internet based search for flooding in the area found no records of past flooding within the Owston Ferry area. However, it is local knowledge that prior to the flood defence improvements that the village would regularly flood.

SFRA Flooding History

The SFRA contained no references to the site being flooded.

Environment Agency Flooding History

The Environment Agency did not provide any historical flood information for the area local to the site. The 1947 flood event did not flood Owston Ferry.

Reservoir Flood Risk

The site is not located within an area which is at risk from reservoir breach failure.

Possible Flooding Mechanisms

As there are two sources of flood risk – River Trent and Ferry Drain/Warping Drain – it is necessary to determine flood water levels at the site for the desired return periods emanating from the two sources.

The first is from the River Trent which is to the east of the proposed development. The River Trent is defended by earth embankments which extend above the natural ground level. As such, consideration will need to be given to overtopping and breach failure of the defences.

The second is from the Ferry Drain/Warping Drain which is to the south of the proposed development. The drain is defended by earth embankments which extend above the natural ground level. As such, consideration will need to be given to overtopping and breach failure of the defences.

Information on groundwater flooding is limited within the North Lincolnshire Council area. The SFRA provided no further information. In addition, reference to the Groundwater Vulnerability Map and Source Protection Zones produced by the Environment Agency indicate that district is not underlain by an aquifer and are therefore unlikely to be source of significant flood risk.

Severn Trent Water is the statutory water undertaker and is responsible for the public sewer systems within the Owston Ferry area. Severn Trent Water maintains a register of historical sewer flooding events (DG5 Register) within the area. There are no report incidents close to the site. The SFRA provided no further information.

[1] http://www.dundee.ac.uk/geography/cbhe/

[3] Development and Flood Risk Guidance for the Construction Industry, CIRIA C624, London 2004

4. FLOOD RISK ASSESSMENT

Requirements of the Environment Agency

The Environment Agency, as part of its development control procedures, generally require finished floor levels to be set above the 1% AEP plus 20% for climate change flood water level at the site. The development is residential in nature, as such, it is considered that access and egress from the development site will be essential during times of extreme floods.

River Trent

The River Trent is defended by floodwalls, which are 140m to the east of the proposed development site. The Environment Agency provided estimated flood water levels for the River Trent adjacent to the site. The 1 in 200 year flood level has been estimated at 5.95mOD. The crest of the flood embankment is at a level of 6.400mOD in line with the site. As such, the flood water will be maintained within the channel and the site will remain safe during this event.

Increase in Estimated Flood Level due to Climate Change

NPPF states that *'…Flood risk assessment should be carried out to the appropriate degree at all levels of the planning process, to assess the risks of all forms of flooding to and from development taking climate change into account. The future users of the development must not be placed in danger from flood hazards and should remain safe throughout the lifetime of the plan or proposed development and land use*.'

As the proposed development includes residential land use, consideration has therefore been given to take into account the potential effects of climate change over the next 100 years in accordance with NPPF. Adopting the recommended contingency allowance for net sea level rise as detailed in Table B.1 of PPS25 the following increase in sea level rise should be adopted as detailed below in .

Table 4-1: Net Sea Level Rise (mm/year) Relative to 1990			
1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
4mm	8.5mm	12mm	15mm

Climate change increase will need to be considered for the present day plus 100 years, hence the year 2112. As such, the adjustment for climate change will need to be made from the year 2012 to the year 2112. Apply the net increases shown above in the estimated increase is 1.1m.

However, the site is located approximately 24 kilometres upstream of the confluence of the River Trent and the Humber Estuary. A further 21 kilometres upstream of Owston Ferry is the village of Torksey where the Environment Agency considered that there is no tidal influence on the River Trent flood levels. As such, increasing the River Trent 1 in 200 year flood level at Owston Ferry by 1.1m is likely to give an over estimate of the 1 in 200 year plus climate change flood level. The 1 in 200 year level at the confluence of the River Trent and the Humber Estuary of 5.625mOD has been adopted. Increasing the estimated flood level by 1.1m gives an estimated flood level of 6.725mOD.

Therefore, the estimated 1 in 200 year plus climate change flood level in 2112 is 6.725mOD. The crest level of the flood embankment is 6.4mOD, therefore during the 1 in 200 year plus climate change flood event the flood defences will be overtopped by approximately 0.325m.

Adopting the simple approach as recommended in DEFRA report FD2320/TR2 and utilising table 12.1 of that report, the danger classification is considered to be within the 'danger for some' zone, as the site is 140m from the land side of the flood defences and the head above crest is approximately 0.325m. The table is below at Table 4-2.

Table 4-2 Danger to people from overtopping relative to distance from defence

Distance from breach(m)	Head above crest level(m)			
	0.5	1	2	3
100				
250				
500				
1000				
1500				
2000				
2500				
3000				
3500				
4000				
4500				
5000				

Danger for some
Danger for most
Danger for all

Note: Table copied from Table 12.1, Section 12, FD2320/TR2

Therefore the impact of the 1 in 200 year plus climate change flood event on the proposed development is considered to be "danger for some". As such, it is considered that the able bodied and the emergency services would not be able to safely access the site during a 1 in 200 year plus climate change flood event.

Breach Failure of the defences

Consideration has been given to a breach failure during a 1 in 200 year plus climate change event on the River Trent. However, as the current flood defences provide less than the 1 in 200 year plus climate change standard of defence (6.725mOD) the current crest level of the flood defence will be considered as the breach level (6.4mOD). This scenario would require the river level to be equivalent to the top of the flood embankment directly in line with the site. The likelihood of this flood event occurring is considered to be less than 0.5%. This flooding mechanism requires a failure of the flood embankment to also occur simultaneously with the high water level. As the floodwalls are regularly inspected and well maintained the likelihood of this is considered to be low. The landward side of the defences is approximately 140m from the proposed development site.

Therefore, the risk of breach failure has been initially assessed by adopting the simple approach as recommended in DEFRA report FD2320/TR2 and utilising table 12.2 of that report, the danger classification is considered to be "danger for all" as the site is 140m from the river and the flood water depth at the site is approximately 2.132m (6.4 – 4.268 existing floor level). The table is shown overleaf at Table 4-3.

Table 4-3 Danger to people from breaching relative to distance from defence

Distance from breach(m)	Head above floodplain(m)						
	0.5	1	2	3	4	5	6
100							
250							
500							
1000							

Danger for some
Danger for most
Danger for all

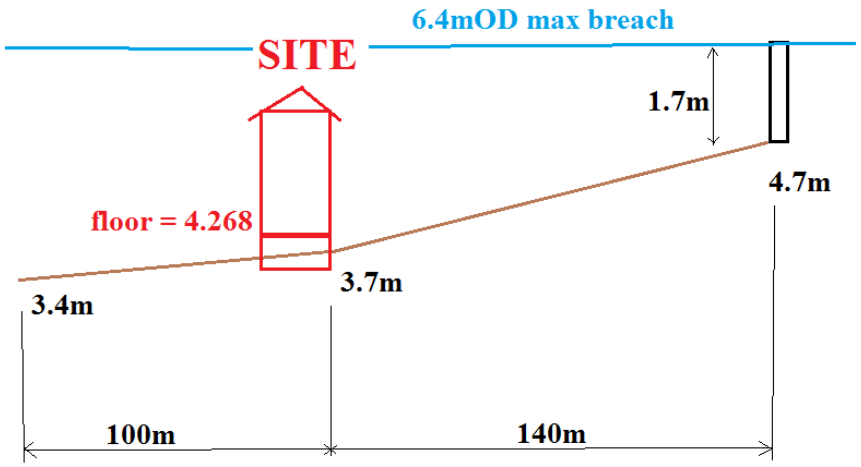
Note: Table copied from Table 12.2, Section 12, FD2320/TR2

Danger for all classification includes the emergency services. The 1 in 200 year breach flood level for the area adjacent to the site is estimated by the Environment Agency at 3.5mOD (Tidal Trent Flood Risk Management Strategy). The Environment Agency also provided a breach map for the River Trent which includes the 1 in 75 year, 200 year and 1,000 year breach envelopes. During the survey a spot level was taken along the flood envelope boundary for the 1 in 200 year breach envelope. The spot level was estimated at approximately 4mOD.

Once the flood water from the breach has distributed across the flood compartment the ponded level achieved is likely to be in the region of 4mOD. However, due to the close proximity of the flood defences to the site (approx 140m) it is considered that this is an underestimate. It is however, considered an over estimate if the 1 in 200 year plus climate change flood level of 6.725mOD is simply applied as the breach level at the site. When a flood embankment initially breaches the flood water will weir through the breach resulting in lower water levels on the landward side of the flood bank. As such, it is considered that the breach water level at the site lies between 4mOD and 6.725mOD.

As such, a more detailed assessment of the breach will be required. The more detailed assessment will assume that there are no buildings or infrastructure between the river defences and the site which could absorb or deflect breach flood flows away from the site. Hence, a worst case scenario will be analysed. The section through the flood embankment in line with the site is shown below in Figure 4.1.

Figure 4.1: Cross Section through Flood Embankment and site.



An indication of the flood risk area can be made by a simple breach analysis. Assuming that flow through a breach can be represented by the broad-crested weir equation:

$$Q = C_d B h^{1.5}$$

Where: Q = flow through the breach (m^3/s)

B = width of the breach (m)

h = depth of water through the breach (m)

Cd = coefficient (usually between 0.5 and 1.7)

The crest level of the flood defences adjacent to the proposed development are considered to be 1.7m above existing ground level to the rear of the flood wall (4.7mOD), hence the maximum breach height would be 1.7m and h has therefore been taken as 1.7m, Cd has been assumed to be a conservative 1.5. Putting these values into the weir equation indicates that flows of $83.12m^3/s$ for a breach of 25m wide, which is considered to be appropriate width for tidal river walled defences by the Environment Agency.

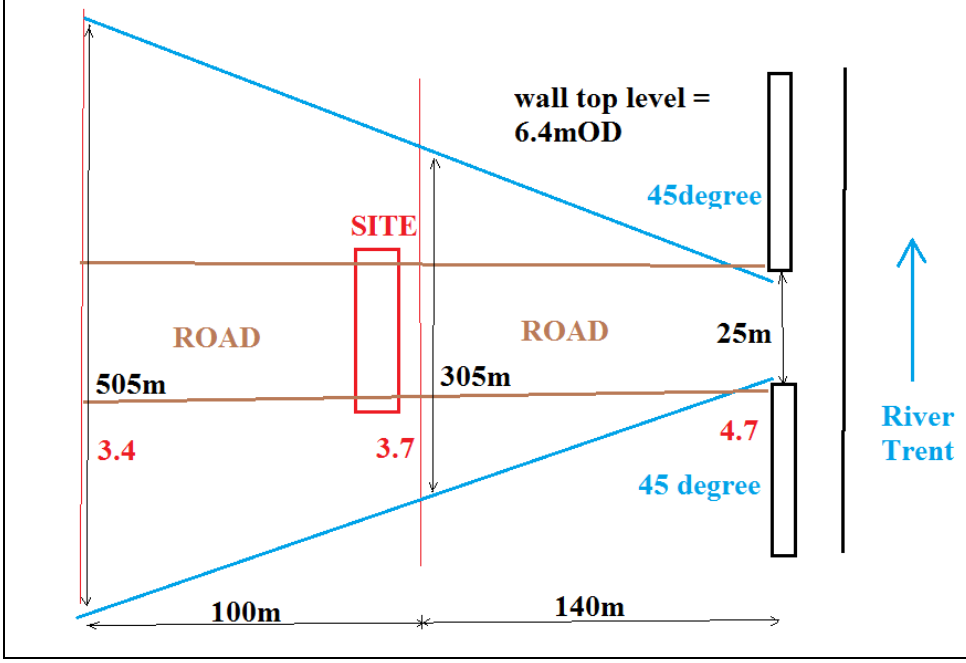
The depth of flooding such flows would generate are dependent on many factors, but a simple assumption based on trigonometry is that the maximum width of flow (w) a distance (a) from the breach is reached when w = Q. This gives the critical distance from the breach where flow depth would be significant as:

$$a = (Q - b) / 2$$

Using this equation, the critical distances for flooding from a breach of 25m is 29m. The site is approximately 140m from the River Trent defences. Given the conservative nature of these calculations, this indicates that the site is outside the point where the flood depth and the flood velocity would be significant; hence the site is potentially not within the rapid inundation zone.

The proposed building is located at least 140m from the landward side of the flood embankment. As the flood water moves inland from the breach it will disperse in all direction reducing the flood depth. As the water travels across the ground the friction losses will reduce the velocity. A simplified model is shown below in Figure 4-2. The model assumes that the flood water will disperse at a 45 degree angle from the breach; therefore, once the flood water reaches the site which is 140m from the flood embankment the width of the flood flow will be 305m.

Figure 4-2: Plan through Flood Embankment and site.



In order to evaluate the impact of the breach on the site an assessment of the water depth and velocity at the site need to be made. This has been done by simply constructing three cross sections with a HEC RAS version 4.0 hydraulic model. The first cross section represents the breach in the flood embankment and the second is at the site. The third section is 100m to the west of the site towards the centre of Owston Ferry. The section of land between the site and the river is generally a road and therefore a Manning's value of 0.03 has been conservatively assumed. The long section and the results for the 1 in 200 year plus climate change breach events are provided at Appendix D of this report.

The model estimates that during a maximum breach event the flood depth at the site would be 0.35m (4.05mOD) within the High Street and the velocity would be 0.77m/s. It is estimated that the existing dwelling (4.268mOD) would not be flooded.

Table 4-4 Danger to people from different combinations of depth and velocity

Velocity (m/s)	Depth of flooding (m)						
	0.05	0.1	0.2	0.3	0.4	0.5	0.6
0.00							
0.10							
0.25							
0.50							
1.00							
1.50							
2.00							
2.50							
3.00							
3.50							
4.00							
4.50							

Danger for some
Danger for most
Danger for all

Note: Table copied from Table 13.1, Section 12, FD2320/TR2

Therefore the impact of a breach on the proposed development is considered to be "danger for some". It should be appreciated that the peak flood depth of 0.35m and velocity of 0.77m/s will be achieved immediately following a breach and may only be sustained for several minutes as the flood water on the landside of River Trent ponds thus reducing the flood velocity and depth. It is considered that as the flood water fills the flood cell a general level of 4mOD will be achieved and eventually evacuated via local drainage system.

Overtopping of the defences during 1 in 1000 year plus climate change event

Consideration has been given to the extreme flood event and its likely impact on the site and its occupants. The site is defended to the 1 in 200 year standard. The 1 in 1,000 year flood level was not provided. Due to the large flood depth increases applied for future climate change over the next 100 year it is considered that the impact of the extreme flood will be less than that of the 1 in 200 year plus climate change event as described earlier in the report.

Ferry Drain/Warping Drain

The Warping drain is defended by a flood bank which comprises of a 4m wide berm at approximately 3.1mOD and a 3m wide main flood bank at approximately 3.9mOD. The drain is approximately 650m south of the proposed development site. The Environment Agency does not have any flood level data for the Warping Drain, however, the Agency consider that the drain provides a 1 in 30 year standard of defence.

Historically the Warping Drain discharged into the River Trent at Owston Ferry via pointing doors, which were dependent upon low tide conditions within the River Trent. The Warping Drain was embanked on both left and right banks to such a level to give sufficient storage to accommodate flows during periods of the pointing doors being closed and no discharge possible.

During 1976 a pumping station was constructed adjacent to the pointing doors at Owston Ferry. The new pumping station allowed discharge from the Warping drain during high tides within the River Trent. The pumping capacity is considerably larger than required.

During the 1980's all maintenance works to the Warping drain were ceased as the banks are considered by the Environment Agency to be surplus to requirement as the pumping station is capable of discharging flows.

5. MITIGATION MEASURES

Raising Floor Levels/Land Raising

It is considered that during a 1 in 200 year and the 1 in 1,000 year event within the River Trent that the flood water will be maintained within the main channel and the site will not be flooded. However, during the 1 in 200 year plus climate change flood event the existing flood wall could be overtopped by 0.325m resulting in a hazard rating of "danger to some".

However, as the site is 140m from the River Trent it is considered that the site is located within an area which is danger to most if the defences were to breach. It is estimated that during a breach of the defences that the existing dwelling (4.268mOD) would remain dry, however, the adjacent High Street could be flooded to a depth of 0.350m (4.05mOD) and a velocity 0.77m/s which is considered to be 'danger to some'.

It is considered that the River Trent is the primary flood risk at the site and, as such, the impact of the Ferry Drain which is 650m south of the site is considered to be minor.

It is therefore recommended that the internal ground floor level of the proposed dwelling is elevated to the estimated breach flood level plus 600mm. Hence, a level of 4.65mOD. It is also recommended that a further 300mm of flood resilience measure are incorporated into the design for extreme flood events.

Emergency Access & Egress

It is considered that during a 1 in 200 year and the 1 in 1,000 year flood event within the River Trent the defences will not be overtopped and the site and the access route from the site will remain dry. However, during the 1 in 200 year plus climate change flood event the existing flood wall could be overtopped by 0.325m resulting in a hazard rating of "danger to some".

During a breach of the defences a maximum depth of 0.35m could be experienced adjacent to the site. It is proposed that the ground floor level is elevated 600mm above the estimated breach flood level within the site (4.65mOD). As such, the building will be safe from the flood water during this event. Furthermore a first floor level will be provided within the dwelling which could be used during more extreme events. It is considered that the emergency services will be able to access the site even during extreme events.

Flood Resilience Measures

Consideration should be given to flood proofing the building to a level equivalent to the proposed ground floor level plus 0.3m to reduce the residual damages if an extreme flood was to occur. Flood proofing is a technique by which buildings are designed to withstand the effects of flooding. There are two main categories of flood proofing, which are dry proofing and wet proofing.

Dry proofing methods are designed to keep water out of the building, and wet proofing methods are designed to improve the ability of the property to withstand the effects of flooding once the water has entered the building. Both would be required in this case, due to the possible failure of the dry proofing methods.

Where wet proofing is required it is important that a flood response plan should be prepared and practised regularly, so that any contents of the building can be moved to design flood level if required or are built to withstand immersion in water or are designed to be easily replaceable.

The differential pressures across load bearing walls and the flotation effect that will occur during flood events should be taken into account when considering dry proofing techniques. For most existing properties this means that dry flood proofing should only be considered if the expected flood depth is under 0.5m, which in this particular case is expected to be less than 0.5m depth and as such dry proofing is likely to be successful. It is therefore considered that flooding in excess of 0.5m will cause some damage to the building; however, this is considered to be acceptable.

The table overleaf summarises the recommendations for flood proofing measures which can be incorporated within the design of buildings[3].

Feature	Considerations To Improve Flood Proofing
External Walls	Careful consideration of materials: use low permeability materials to limit water penetration if dry proofing required. Avoid using timber frame and cavity walls. Consider applying a water resistant coating. Provide fitting for flood boards or other temporary barriers across openings in the walls.
Internal Walls	Avoid use of gypsum plaster and plasterboards; use more flood resistant linings (e.g. hydraulic lime, ceramic tiles). Avoid use of stud partition walls.
Floors	Avoid use of chipboard floors. Use concrete floors with integrated and continuous damp proof membrane and damp proof course. Solid concrete floors are preferable; if a suspended floor is to be used, provide facility for drainage of sub-floor void. Use solid insulation materials.
Fitting, Fixtures and Services	If possible, locate all fittings, fixtures and services above design floor level. Avoid chipboard and MDF. Consider use of removable plastic fittings. Use solid doors treated with waterproof coatings. Avoid using double-glazed window units that may fill with flood water. Use solid wood staircases. Avoid fitted carpets. Locate electrical, gas and telephone equipment and systems above flood level. Fit anti-flooding devices to drainage systems.

Flood Warning

This area of Owston Ferry is covered by the Environment Agency's general early alert to possible flooding, known as Flood Watch. It is highly recommended however, that occupants of the commercial development register their interest in receiving flood warnings from the Environment Agency's Floodline Warnings Direct Service.

This service enables the Environment Agency to send a flood warning message direct to people at home or at work by telephone, fax or pager using an Automatic Voice Messaging (AVM) Service. The aim is to give two hours' notice of flooding, either day or night, to enable people to take the necessary action to protect themselves and their properties.

The Environment Agency also provides the Floodline 0845 988 1188 service, where occupants can listen to recorded flood warning information for the area or speak to an operator for advice 24 hours a day.

Should a flood event reach the level where the site is at risk of inundation, then the Environment Agency will issue a Severe Flood Warning.

Flood Evacuation Plan

For health and safety reasons there is a preference to evacuate, as failure to do so, would put the occupants and others (e.g. rescuers) at risk of injury. Therefore, it is highly recommended that the occupiers of the building prepare a flood evacuation plan, in order to ensure that occupants are relocated to a safe area above the flood water.

The centre of Owston Ferry village which is less than 200m north west of the site is located within Flood Zone 1, low risk, being the zone with risk of 1 in 1,000 year (0.1% AEP) or less for river flooding and tidal/coastal flooding.

6. CONCLUSION

It is concluded that there is a risk of flooding from the nearby River Trent, however; the mitigation measures recommended in section 5 of this report should provide betterment and ensure that the risk is reduced to an acceptable level.

Appendix A: - Existing Ground Levels

All construction information should be taken from figured dimensions only.
All dimensions to be verified on site.

Revisions

Cadworx ltd
Architectural design and 3d visualisation

The Mooring - West Butterwick rd
Belloft - Nr Doncaster - DN9 1NE
Tel 01724 783571 Mob 07834 337550
e : danny@3dcadworx.com

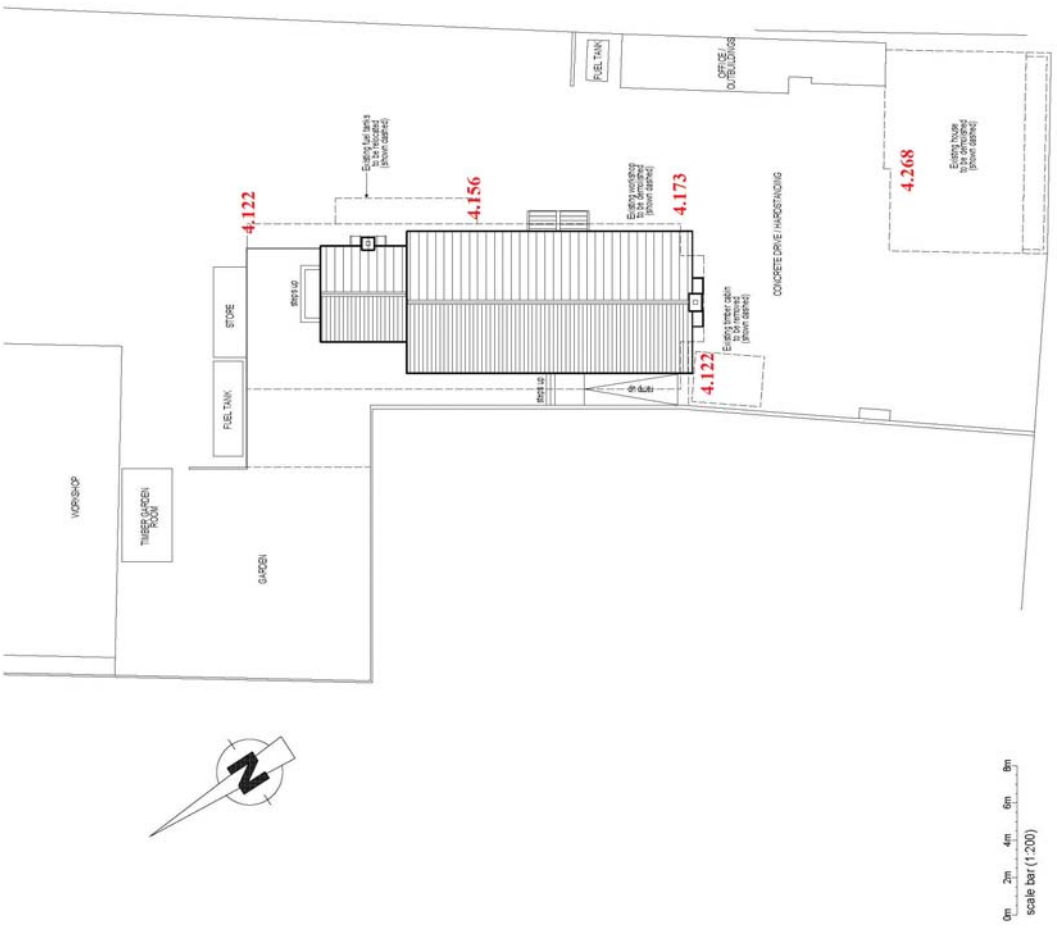
Project: New Dwelling

Title: Proposed site plan

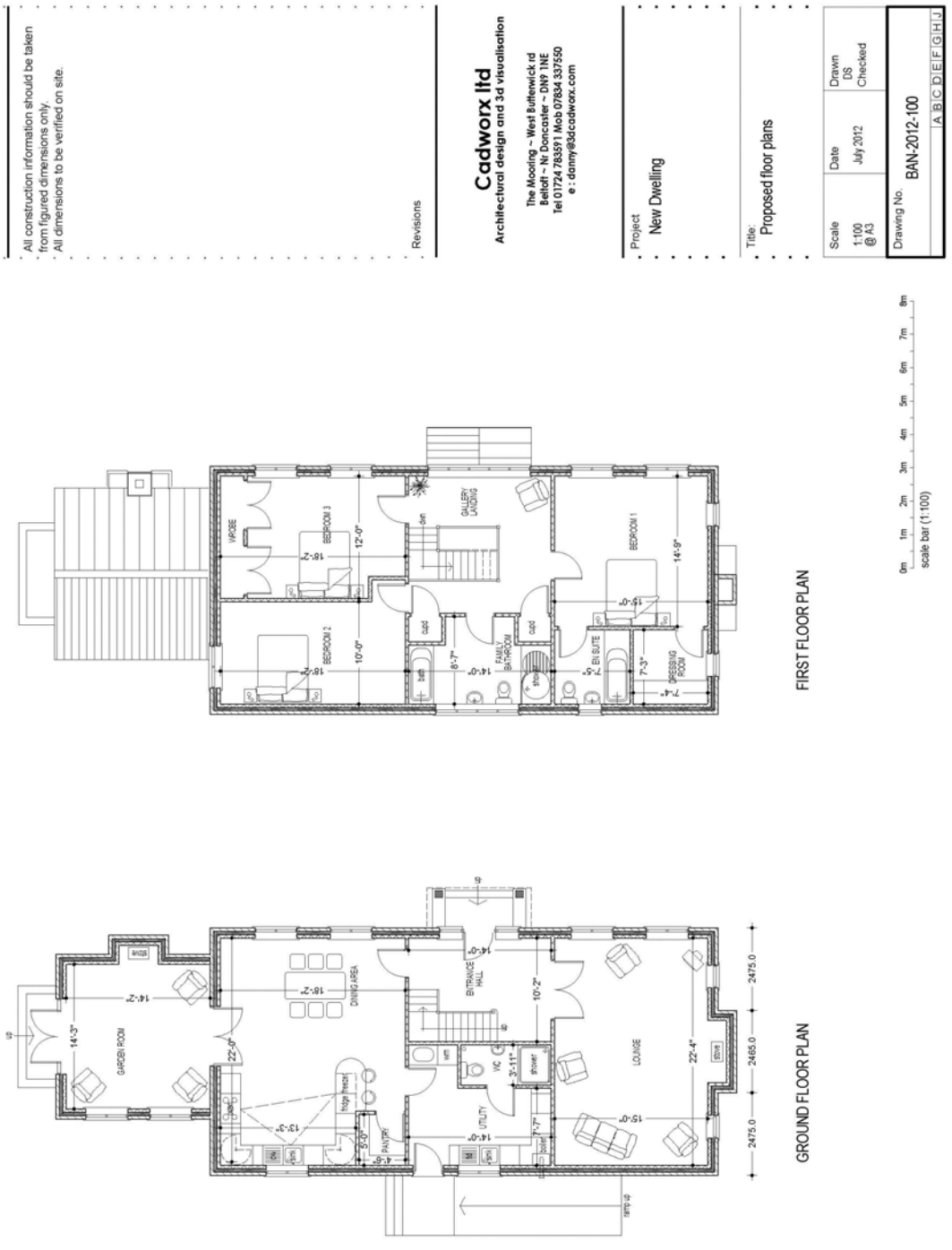
Scale	Date	Drawn / Checked
1:200 @ A3	July 2012	DS /

Drawing No. BAN-2012-104

A B C D E F G H J



Appendix B: - Proposed Layout



Appendix C: - Environment Agency Flood Data

Ref: ER3385

The following information, including the modelled extents mapping, has been produced including the effect of any local defences.

Modelled Information

Node Point Reference	Location	50% (1 in 2 year) modelled level (mAOD)	20% (1 in 5 year) modelled level (mAOD)	10% (1 in 10 year) modelled level (mAOD)	4% (1 in 25 year) modelled level (mAOD)
Trent29300	SK 81546 99342	5.50	5.68	5.76	5.85
Trent26490	SE 82719 01092	5.49	5.66	5.75	5.83

Source: Tidal Trent Strategy, Black & Veatch, April 2005

Node Point Reference	Location	2% (1 in 50 year) modelled level (mAOD)	1.33% (1 in 75 year) modelled level (mAOD)	1% (1 in 100 year) modelled level (mAOD)	0.5% (1 in 200 year) modelled level (mAOD)
Trent29300	SK 81546 99342	5.89	5.91	5.92	5.95
Trent26490	SE 82719 01092	5.87	5.89	5.90	5.93

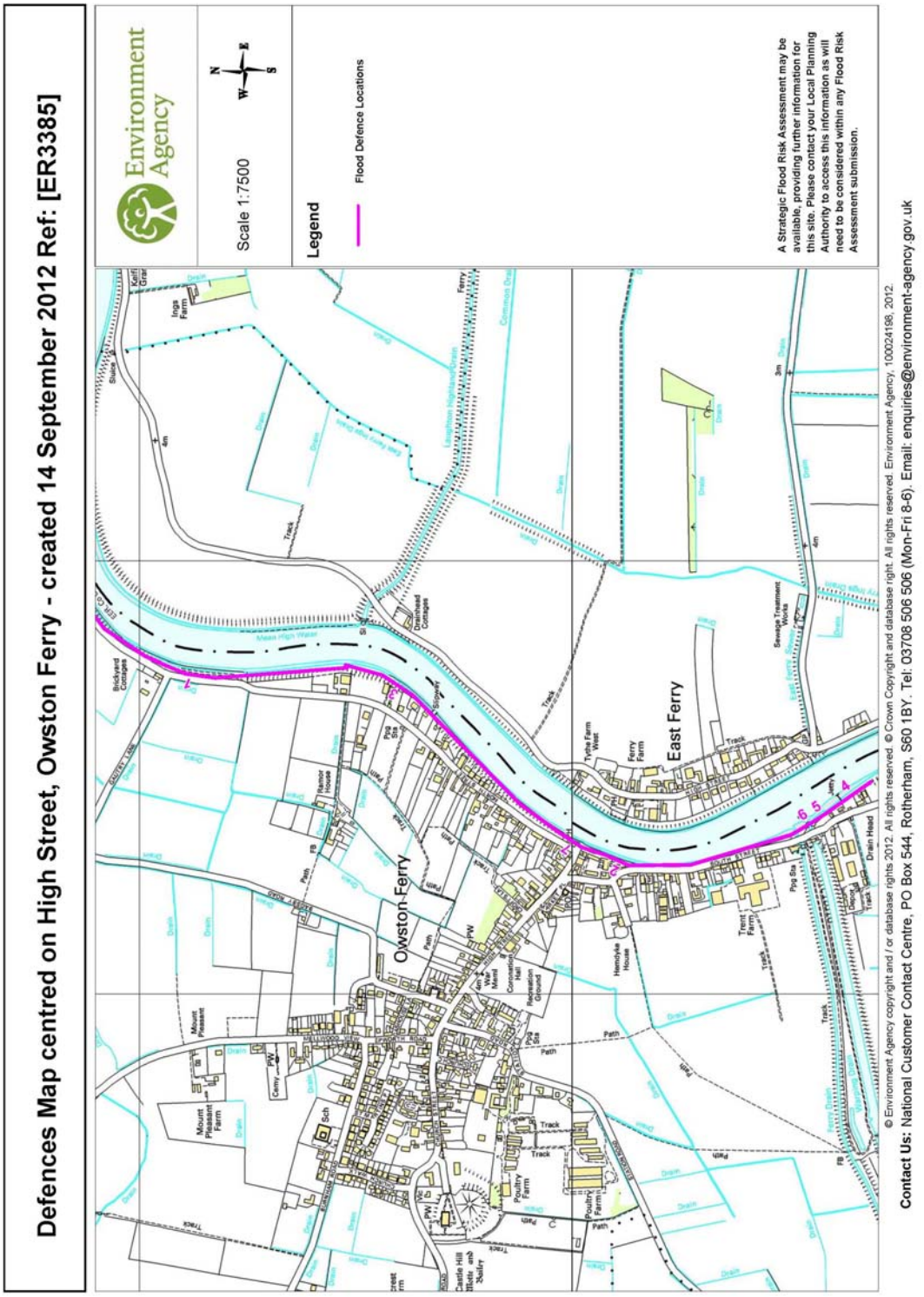
Source: Tidal Trent Strategy, Black & Veatch, April 2005

Historic Information

Map Reference	Flood Event Code	Name	Start Date	End Date	Source of Flooding	Cause of Flooding
1947	EA034_FEG_4030_MAR1947	Tidal Trent March 1947	01/03/1947	31/03/1947	main river	channel capacity exceeded (no raised defences)

Defence Information

NFCDD_ID	Asset Reference	Design Standard	D/S Crest Level (mAOD)	U/S Crest Level (mAOD)	Overall Condition Grade
1	0341740030204L04	100	6.40	6.40	3
2	0341740030204L01	100	6.40	6.58	2
3	0341740030204L05	100	6.40	6.40	3
4	0341740030205L01	100	6.60	6.60	2
5	0341740030205L11	100	6.58	6.58	2
6	0341740030204L02	100	6.38	6.58	2
7	0341740030204L06	100	6.40	6.40	2


Defences Map centred on High Street, Owston Ferry - created 14 September 2012 Ref: [ER3385]
Environment Agency
Scale 1:7500
N
E
S
W
Legend
Flood Defence Locations
A Strategic Flood Risk Assessment may be available, providing further information for this site. Please contact your Local Planning Authority to access this information as will need to be considered within any Flood Risk Assessment submission.
Owston Ferry
East Ferry
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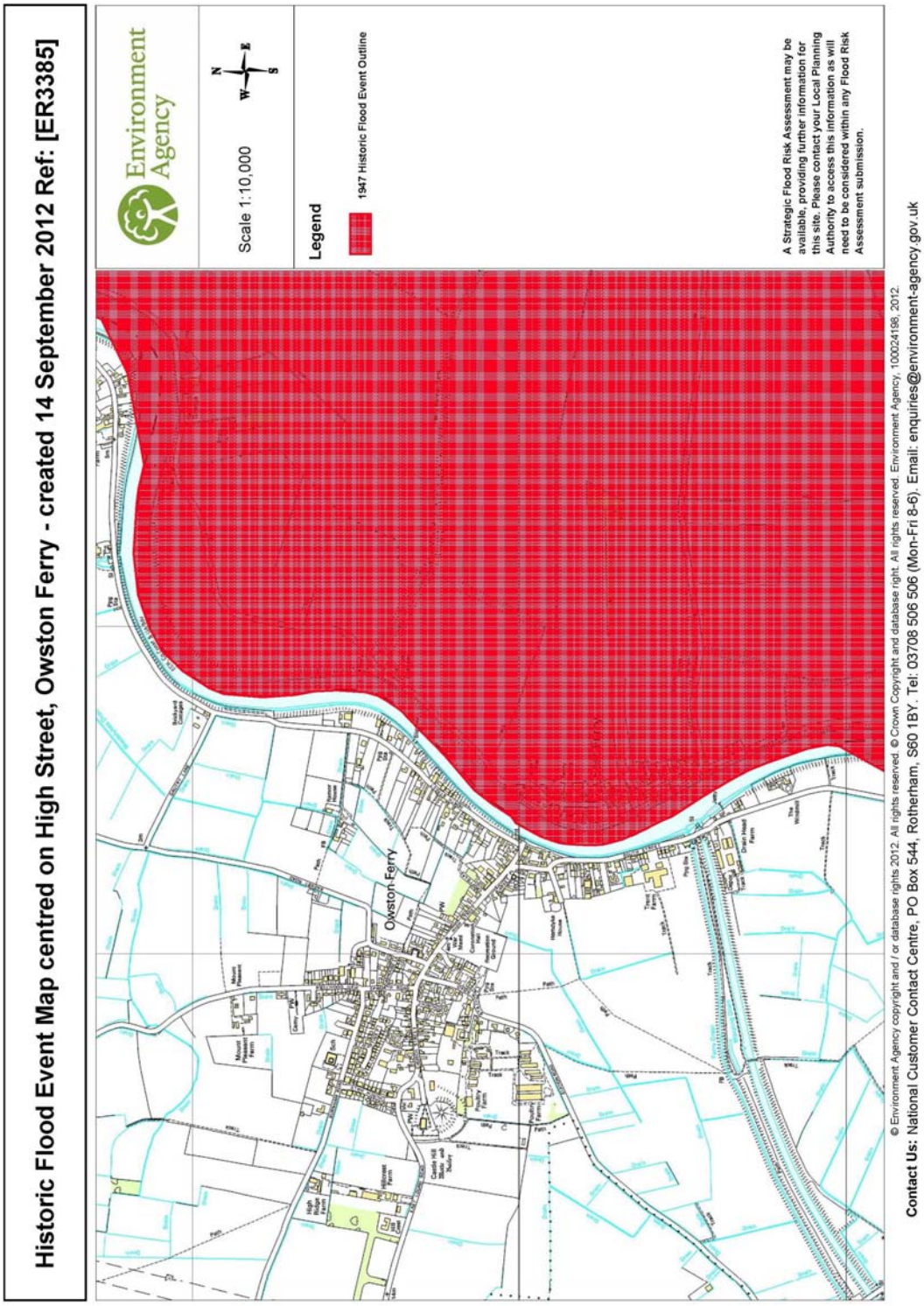
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk


Historic Flood Event Map centred on High Street, Owston Ferry - created 14 September 2012 Ref: [ER3385]
Environment Agency
Scale 1:10,000
N
W
E
S
Legend
1947 Historic Flood Event Outline
A Strategic Flood Risk Assessment may be available, providing further information for this site. Please contact your Local Planning Authority to access this information as will need to be considered within any Flood Risk Assessment submission.
Owston Ferry
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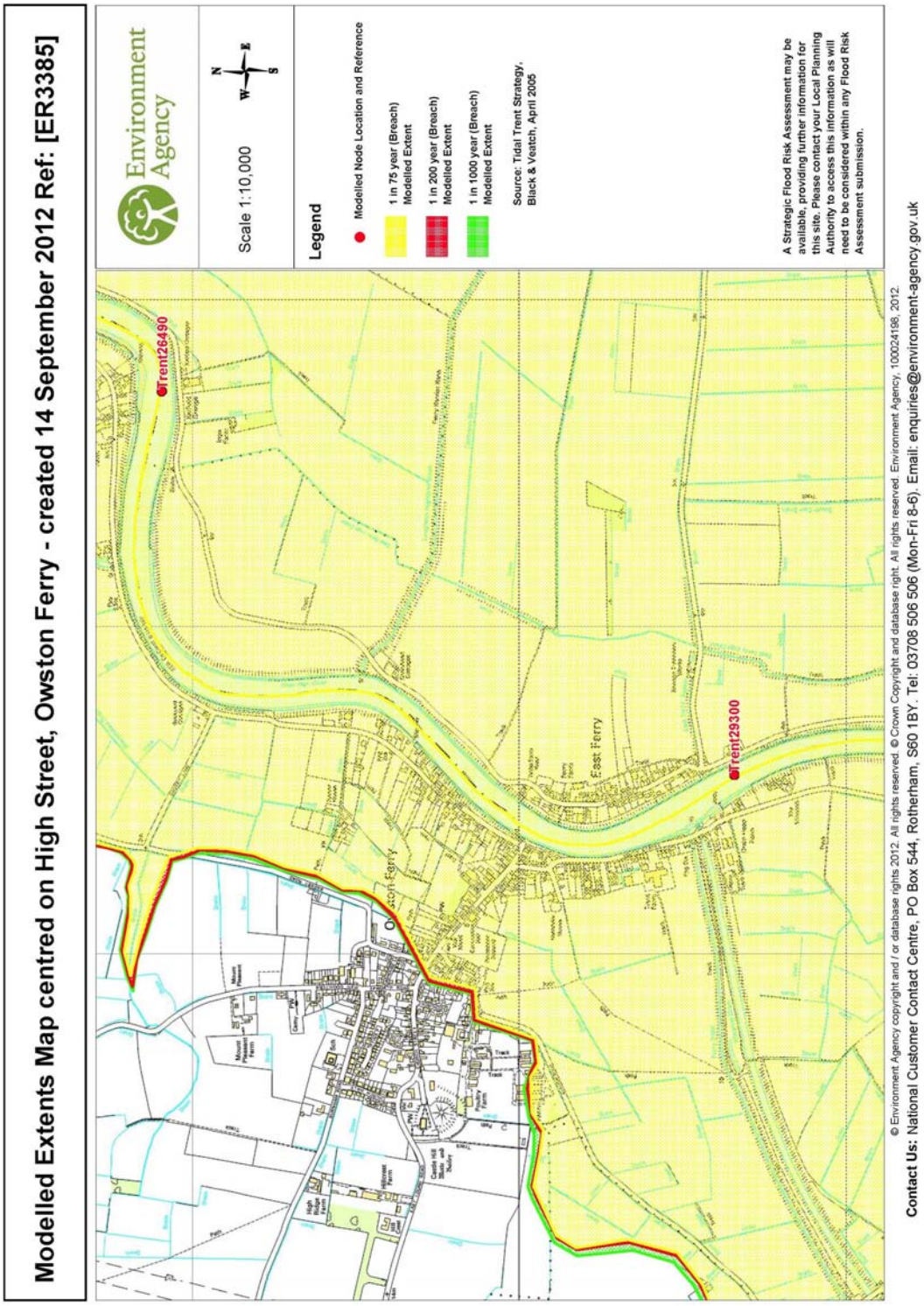
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk


Modelled Extents Map centred on High Street, Owston Ferry - created 14 September 2012 Ref: [ER3385]
Environment Agency
Scale 1:10,000
N
E
S
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Legend
Modelled Node Location and Reference
1 in 75 year (Breach) Modelled Extent
1 in 200 year (Breach) Modelled Extent
1 in 1000 year (Breach) Modelled Extent
Source: Tidal Trent Strategy, Black & Veatch, April 2005
A Strategic Flood Risk Assessment may be available, providing further information for this site. Please contact your Local Planning Authority to access this information as will need to be considered within any Flood Risk Assessment submission.
Trent26490
Trent29300
Owston Ferry
East Ferry
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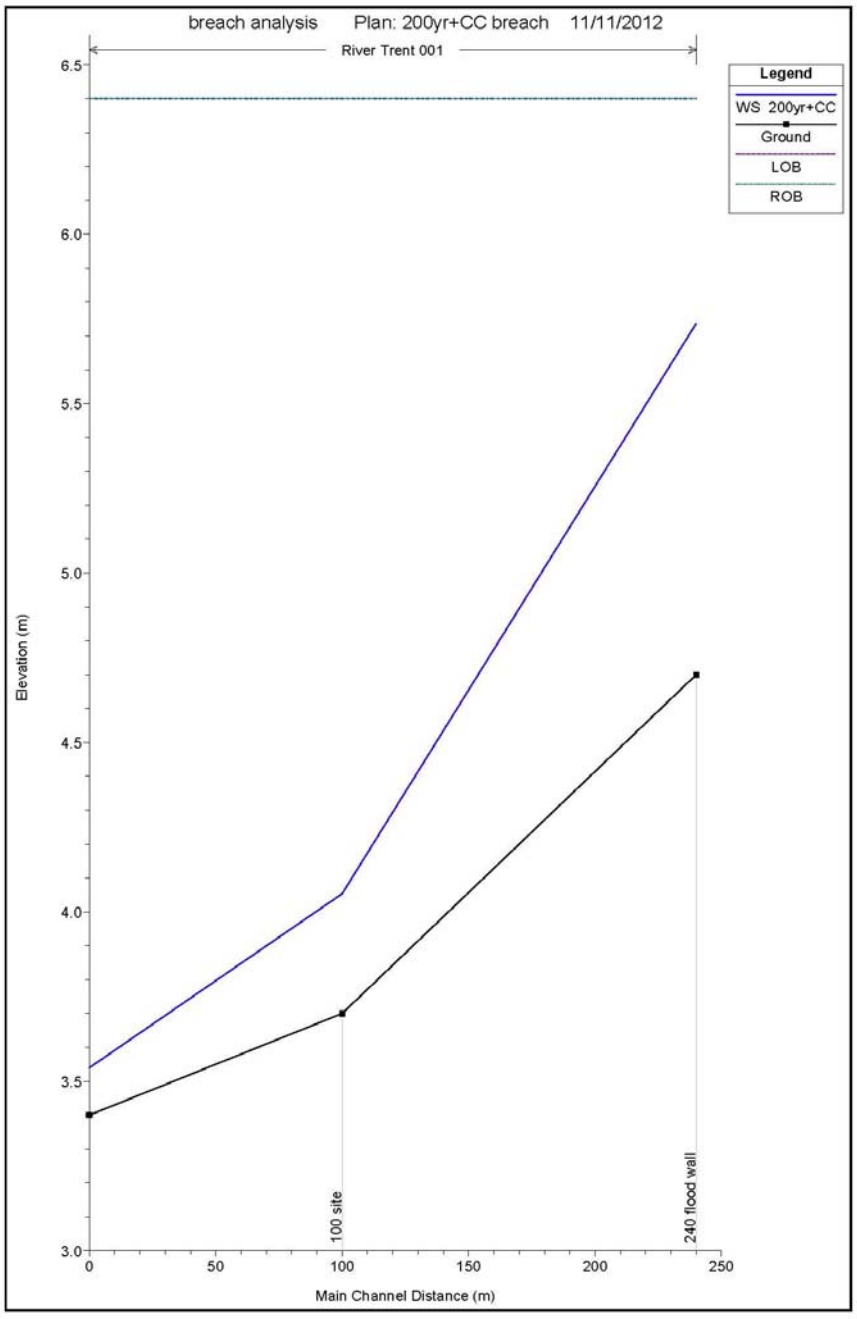
Appendix D: - Breach Model Data



HEC-RAS Plan: 200yr+CC breach River: River Trent Reach: 001 Profile: 200yr+CC

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
001	240	200yr+CC	83.12	4.70	5.74	5.74	6.26	0.009813	3.21	25.92	25.00	1.01
001	100	200yr+CC	83.12	3.70	4.05	3.90	4.08	0.002144	0.77	107.86	305.00	0.41
001	0	200yr+CC	83.12	3.40	3.54	3.54	3.61	0.017215	1.18	70.59	505.00	1.01