

**FLOOD RISK ASSESSMENT
FOR RESIDENTIAL DEVELOPMENT
AT 189 THE DROVE, BARROWAY DROVE,
DOWNHAM MARKET, NORFOLK**

FINAL REPORT

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**GCB/NORFOLK
ARCH.DESIGN**

DISCLAIMER

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Fig 1 - Plans & Details as Existing –
Norfolk Architectural drg. no. 1139-01

Fig 2 - Outline Plans & Details as Proposed –
Norfolk Architectural drg. no. 1139-02

Fig 3 - Environment Agency Flood Map for Planning

Fig 4 - Environment Agency Product 8 Tidal Hazard Mapping –
Depth, Hazard & Velocity of 1 in 200 year event plus
climate change – 135003

Fig 5 - Downham & Stow Bardolph Internal Drainage Board
District Plan

1.0 INTRODUCTION

- 1.1 An outline planning application is to be submitted by Norfolk Architectural Design Services Ltd on behalf of Mr Clive Shuttleworth for proposed residential development at The Duck Nest, 189 The Drove, Barroway Drove, Norfolk.
- 1.2 Planning approval requires a Flood Risk Assessment to accompany the application for approval by the Environment Agency and meet the requirements and general principles contained in the Planning Practice Guidance to the National Planning Policy Framework (NPPF).

The site, as situated is shown within Flood Zone 3 benefitting from defences of the Environment Agency Flood Map for Planning. The latest Agency Map has been created as a tool to raise awareness with the public and partner organisations such as Local Authorities, Emergency Services and Drainage Authorities. The Map takes into account existing flood defences.

The site is also shown in tidal Flood Zone 3 and within the present day Hazard Zone of the Kings Lynn & West Norfolk Borough Council's Level 1 Strategic Flood Risk Assessment Maps (2009).

The site is also located in the Downham & Stow Bardolph IDB drainage district.

- 1.3 Geoff Beel Consultancy was appointed on 15th July 2022 to undertake a Flood Risk Assessment.

2.0 LOCATION

- 2.1 The development site is located at The Duck Nest, 189 The Drove, Barroway Drove. The National Grid Reference of the central point of the site is TF56650300.
- 2.2 The position and extent of the site are shown on Fig 1 – Plans & Details as Existing at the end of the document.
- 2.3 The site, located within the Downham & Stow Bardolph IDB district is shown within Flood Zone 3 benefitting from defences as detailed on the Environment Agency Flood Map for Planning. It is also shown in tidal Flood Zone 3 and within the present day Hazard Zone of the Council's Level 1 Strategic Flood Risk Assessment Maps (2009).

3.0 THE SITE AND SEQUENTIAL TEST

- 3.1 The site is at 189 The Drove, Barroway Drove.
- 3.2 The area of development is approximately 0.15 hectare.
- 3.3 The proposed site layout consists the construction of 2 two-storey dwellings after demolition of existing property and buildings at 189 The Drove.
- 3.4 The site is an existing bungalow with outbuildings and site land level at minus 0.735m aOD.

3.5 Sequential Test

Initially it is required that other sites for development must be considered in the area that may offer a reduced flood risk, however, it is noted that no sites within a 5.0km radius of the River Great Ouse defences were outside the Zone 3 category and the Sequential Test was therefore passed. There are no other sites in Barroway Drove at a lower risk of flooding.

However to ensure compliance these further consideration has been applied as under the requirements of NPPF. From the Environment Agency Flood Map for Planning it shows that the site is within Zone 3 benefitting from defences and Category 3 Tidal Flood Risk as detailed on the BCKLWN Level 1 SFRA maps and it is Zone 3 an area protected to 1 in 100 years for fluvial events and 1 in 200 years for tidal events; the area as it is protected to this degree can be considered to be a passive flood plain. The development therefore complies with the Appropriate Uses required in the table but is required to pass the Exception Test.

Exception Test

Therefore applying the Exception Test shows that:

- a) the development provides wider sustainable economic benefits by utilising an already developed area
- b) the FRA demonstrates that the development will be safe and will not increase flood risk elsewhere nor detrimentally affect any other property

The site is compliant with a) and b).

4.0 EXISTING FLOOD ALLEVIATION MEASURES

- 4.1 The site is within a defended floodplain, as defined in Appendix 1 of the Environment Agency's 'Policy and Practice for the Protection of Floodplains' and is considered to be passive until such time as a flood greater than that for which the defences were designed occurs. The likelihood of flooding due to overtopping or failure of a flood defence embankments is considered to be small.
- 4.2 The site is located within the Downham & Stow Bardolph Internal Drainage Board district, which is protected by the Great Ouse Tidal and Sea Defences against a minimum flood return period of up to 1 in 200 years. The nearest 'main drain' is located 375 north west of the site with site land level at minus 0.735m and the carriageway level of The Drove at zero datum.
- 4.3 The Downham & Stow Bardolph IDB drainage system at present achieves a target standard of protection to residential properties of 1 in 100 years return period with a minimum freeboard of 900mm elsewhere in the district to lowest agricultural land levels.

- 4.4 The site and surrounding land drains by gravity in a generally northerly direction to the Stow Bardolph Pumping Station.
- 4.5 The site is also protected by the Middle Level Main Drain, a highland water embanked channel located 3.00kms north-west of the site which flows to St. Germans Pumping Station to discharge into the tidal River Great Ouse.

The Middle Level Commissioners have completed a Strategic Drainage Study in recent years to safeguard against the 1 in 100 year fluvial return period event and the St. Germans Pumping Station has recently been replaced with a new construction to meet the required standards.

- 4.6 Current maintenance standards within the Downham & Stow Bardolph Internal Drainage Board, the Middle Level Commissioners and the Environment Agency for tidal defences are generally good.

During the operation and maintenance of its pumping stations, associated structures and channel systems, particularly those that could affect property, the Board seeks to maintain a general standard capable of providing flood protection to its district. A routine maintenance programme is in place to ensure that the Boards assets are commensurate with the standard of protection that is sought. However, bank slips, blocked culverts etc. may occur from time to time and these matters are usually dealt with promptly.

5.0 POTENTIAL SOURCES OF FLOODING

- 5.1 Six potential sources of flooding have been identified as a result of this assessment:

- a) local blockages to existing IDB main drain system
- b) storm return period of 1 in 100 years being exceeded
- c) failure of Stow Bardolph Pumping Station
- d) overtopping and breaching of the River Great Ouse tidal defences
- e) failure of St Germans Pumping Station
- f) overtopping and breaching of the Middle Level Main Drain

- 5.2 The probability of flooding from source a) is low due to the maintenance standards already achieved and managed by the IDB.

The probability of flooding from b) is also low due to the Downham & Stow Bardolph IDB main drain design standard incorporating a minimum 900mm freeboard to the lowest land level which provides adequate storage in events greater than 1 in 100 years. Flooding of some agricultural land would occur but no properties.

- 5.3 Failure of Stow Bardolph Pumping Station may occur due to long term mechanical breakdown or power supply being disrupted. However, in these circumstances, if conditions were such as to put properties and land at risk of flooding, the Downham & Stow Bardolph IDB would take emergency action to maintain the drainage level of service by utilising temporary pumping equipment. The probability of such an occurrence is also considered to be small.

- 5.4 The site is shown to be within Flood Zone 3 benefitting from defences of the River Great Ouse as detailed on the Environment Agency Flood Map for Planning. The existing defences are the tidal defences to the west embankment of the River Great Ouse improved after the 1978 tidal surge event. It is also shown in tidal Flood Category 3 and within the present day Hazard Zone of the Council's Level 1 Strategic Flood Risk Assessment Maps (2009) as Barroway Drove is not one of the settlements considered within the Council's Level 2 Strategic Flood Risk Assessment.(2019)
- 5.5 The recorded tide level at Kings Lynn was 5.92m aOD in 1978 since which improvements to 6.30m aOD for hard defences and 7.00m aOD for soft defences have been carried out. The Kings Lynn defences were designed to a 1 in 100 year return period plus freeboard of 1.1m. The more recent tidal surge of 5th December 2013 reached a level of 6.17m aOD and the town and surrounding areas were protected by the improved defences.

A more recent report prepared by Consulting Engineers for the Environment Agency has confirmed that the defences would withstand a 1 in 200 year return period still water level of 6.14m aOD (estimated). NPPF states that development should be safe from flooding for its lifetime of 100 years; after taking into account sea level rise due to climate change the predicted 1 in 200 year tide level at Kings Lynn would be 7.16m aOD. This would overtop existing hard defences by 0.86m and soft defence level by 0.16m.

Overtopping of existing defences between Wiggshall St.Germans and Downham Market could affect the development site. The Middle Level Main Drain acts as a highland water carrier across the fenland area with embankments at a minimum of 2.50m aOD.

More recent updated hydraulic modelling carried out by the Environment Agency since the surge event of 5th December 2013 has produced Tidal Hazard Mapping as shown in Fig 4. The 2015 Tidal Hazard Mapping merged model extents provided by the Environment Agency have also been used to estimate the maximum flood water level as a result of a breach of the defences at 0.10m aOD. The site is potentially shown as affected by floodwaters from a breach of the River Great Ouse tidal defences to a depth varying between 1.00-2.00m.

Proposed finished floor level has been raised 0.935m above existing ground level at 0.20m aOD with flood resistant construction up to 300mm above finished floor level. Other mitigation measures will be incorporated into the design and construction of the new dwellings to accord with the Design Guidance Protocol agreed between the Council and the Environment Agency.

- 5.6 Failure of St Germans Pumping Station may occur due to long term mechanical breakdown or power supply being disrupted. However, in these circumstances, if conditions were such as to put properties and land at risk of flooding, the Middle Level Commissioners would take emergency action to maintain the drainage level of service by utilising temporary pumping equipment. The probability of such an occurrence is also considered to be small.

- 5.7 The Middle Level Main Drain and St. Germans Pumping Station offer protection against the 1 in 100 year fluvial return period flood with allowance for climate change during the next 100 years. The Middle Level Main Drain has been analysed by consulting engineers as a result of the recent construction of the new pumping station. Typical cross sections and longitudinal section show the existing 1 in 100 year event at 0.56m aOD compared with the 1 in 100 year event plus climate change at 0.21m aOD as against bank levels of the Main Drain between 2.67m aOD and 1.60m aOD.

The likelihood of overtopping and/or breaching of the Middle Level Main Drain embankments is considered to be very remote.

- 5.8 Safe access and egress to and from the site prior to any flood warning being received would be onto Barroway Drove and hence in a northerly direction to West Head. Alternatively in a south-westerly direction via Barroway Drove to the A1122 road and Outwell village where land is also in Flood Zone 1.

6.0 EXTENT OF KNOWN FLOODING

- 6.1 During the preparation of this assessment, no evidence was discovered of the site being flooded or of any adjoining properties within the last 100 years.

7.0 PROBABILITIES AND TRENDS OF FLOODING

- 7.1 The probability of this development flooding from localised drainage systems is very low. The nearby main drain provides adequate standard of protection for up to 1 in 50 years return period plus freeboard to lowest land levels.
- 7.2 The probability of the site flooding with water from the tidal River Great Ouse main river is between 0.5% and 1%. If the trend of climate change anticipated to occur continues over the next 100 years, without any further improvements to the main river tidal defences, there is a small risk of overtopping at the 1 in 200 year return period event which could potentially lead to a breach of the defences.
- 7.3 If under very extreme events, levels of floodwater from main river or arterial systems rose to such an extent that the site was affected, the situation would not be sudden. It is very probable that sufficient time would be available to take precautionary actions to limit the extent and potential impact of flooding.
- 7.4 The water levels in the drainage channels will also tend to rise as a result of the impacts of climate change. However the existing systems and defences together with the proposed development of the site with floor level raised 0.935m above existing ground level to 0.20m aOD with a further 300mm of flood resistant construction above floor level and above The Drove carriageway level will be appropriate for the design life of the development (i.e. 100 years).

8.0 IMPACTS OF FLOODING

- 8.1 No significant impacts of flooding are anticipated due to the existing standards of tidal defence, however a precautionary approach has been adopted to protect against the possibility of overtopping or a tidal breach occurring to the tidal defences.
- 8.2 The developer should ensure that the occupiers of the dwellings are sufficiently aware of the risk of flooding, and the standard of the existing defences. The Environment Agency provides a Flood Warning Service which includes Flood Warning Codes and uses direct warning methods where the risks and impacts of flooding are high. Indirect warnings are provided to all flood risk areas, even those at low risk of flooding. The main method is media broadcasts via local radio and also by television.

In addition to direct and indirect flood warnings, the Environment Agency operates a 24 hour a day Floodline Service providing advice and information on flooding, contact tel no: 0345 988 1188 and the occupiers of the new dwellings should register with the Floodline Direct Warnings Service to receive any future flood warnings.

9.0 RESIDUAL RISK – EXTREME EVENTS

- 9.1 The residual risk from extreme fluvial events is low on this site, because of the existing standard of drainage provided by the Downham & Stow Bardolph IDB. The discharge of surface water from the development will be to BRE365 requirements and approved as part of Building Regulations.
- 9.2 Although within tidal Flood Zone 3 benefitting from defences according to NPPF classification, the site actually has a low risk of flooding due to the current standards of drainage and flood defence and land levels. The site is not located within a Functional Flood Plain of any 'main river' or 'main drain'. The Environment Agency Flood Map for Planning has been produced taking into account existing flood defences and standards of protection.

10.0 CONCLUSIONS AND RECOMMENDATIONS

10.1 As a result of the assessment, the following conclusions have been reached:-

- The proposed development is not in a Functional Floodplain. It is in a Passive Floodplain of the tidal River Great Ouse and the Middle Level Main Drain.
- Although the site is in tidal Flood Zone 3 benefitting from defences, the actual risk of the site flooding from tidal main river is very low at less than 0.5%. Similarly from the Middle Level Main Drain with a level of protection of 1%.
- Although the site is located within Downham & Stow Bardolph Internal Drainage District with a minimum standard of drainage of 1 in 50 years, this accords with Defra guidelines for rural development. Freeboard to design water level of 900mm to lowest land level is available for events greater than 1 in 50 years.
- Land levels at the site are at minus 0.7350m aOD and safeguard against the risk of tidal defences being overtopped or breached. Finished floor level of the dwellings has been raised 0.935m above existing ground level at 0.20m aOD. There will be no sleeping accommodation at ground floor. Flood resistant construction will be incorporated up to 300mm above the finished floor level.
- All surface water drainage from the development will be to BRE365 design requirements and Building Regulations approval.