



## Site Specific Flood Risk Assessment

submitted to KL&WN Council in connection with the Proposed refurbishment and extension to

Denning, 7 Marsh Lane, Burnham Norton

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# 9.SITE SPECIFIC FLOOD RISK ASSESSMENT

## 9.1 Introduction

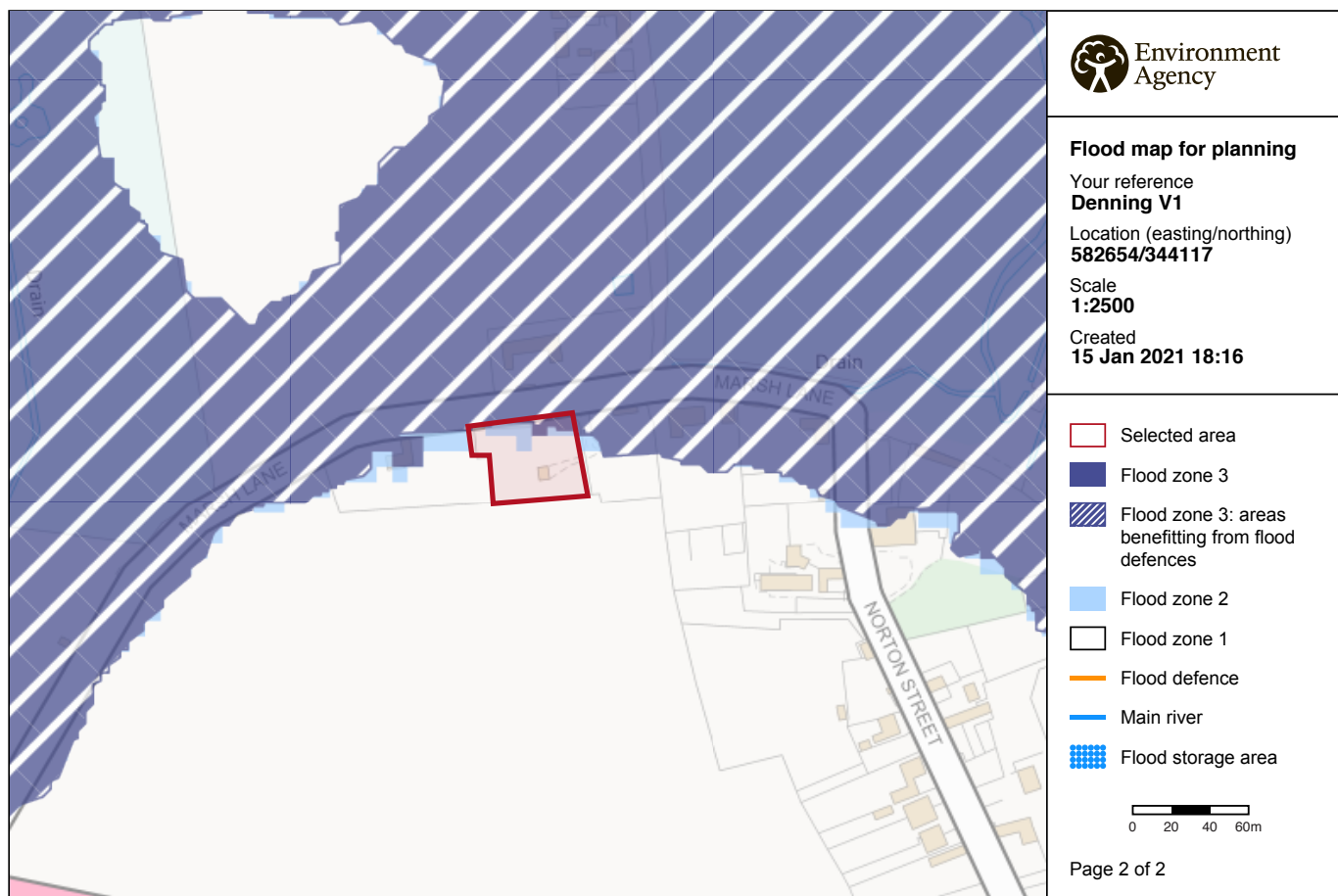
This flood risk assessment has been prepared by Cowper Griffith Architects in support of the planning application to refurbish and extend the existing dwelling at 7 Marsh Lane, Burnham Norton, known as 'Denning'.

The property is proposed to be extended by approximately 240 sq.m GIA and therefore is considered a "minor extension" according to the government's standing advice for flood risk assessments.

The northern part of the site is located within flood zone 3a, in an area benefiting from flood defences, as defined in the Planning Practice Guidance: Flood Risk and Coastal Change'. This means there is a greater than 1 in 200 annual probability of sea flooding. The Western and Southern parts of the site is located within flood zone 1, representing less than 1 in 1000 annual probability of flooding. These figures do not take flood defences into account. The diagram is shown at figure 1.

The proposal is for an extension and refurbishment of an existing dwelling which is categorised as "More Vulnerable" as defined in Table 2: Flood Risk Vulnerability Classification of the PPG. This classification combined with the 3a flood zone mean that an Exception Test is required to define whether a development may be suitable.

A search of the "detailed flood risk information" on the Government's Flood Warning Information Service indicates a low flood risk (1 in 100 to 1 in 1000 annual probability of flooding) using data which takes the flood defences into account. For planning purposes, this assessment discusses the existing flood defences but these are not taken into account when assessing the annual probability of flooding.



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Fig 1. Environment Agency Flood Risk Map showing the north east of the site in flood zone 3, and the development site to the west and the south of the site both in flood zone 1

## 9. SITE SPECIFIC FLOOD RISK ASSESSMENT

### 9.2 Broad Principles

The report reflects guidance in the current Strategic Flood Risk Assessment (SFRA), published in November 2018.

The basic underlying principle of The Proposals relative to flood risk is that new areas of Ground Floor accommodation will be set to match the existing house ground floor.

The new first floor areas provide a place of refuge at a sufficient elevation AOD.

Flood risk to the original house remains unchanged.

There is an expectation of an appropriate flood warning and evacuation procedure, which may be enshrined by condition at planning.

Thus the proposals combine additional ground floor space below the flood level of the 1:1000 flood event, in combination with a raised place of refuge.

### 9.3 Referenced Sources

The following data has been reviewed in compiling this document:

1. "Flood Map for Planning" service published by the Environment Agency
2. Flood Warning Information Service published by Gov.uk
3. Flood Defence Breach Hazard Map issued by the Environment Agency
4. Kings Lynn and West Norfolk Strategic Flood Risk Assessment (SFRA) by Bullen Consultants, published 2005
5. King's Lynn and West Norfolk Strategic Flood Risk Assessment (SFRA) by Faber Maunsell published 2008
6. Kings Lynn and West Norfolk Strategic Flood Risk Assessment (SFRA) by JBA Consulting, published November 2018
7. King's Lynn and West Norfolk SFRA: Annex to Level 1 by Entec Consulting, published October 2010
8. "Southern North Sea Stormsurge event of 5 December 2013: Water levels, waves and coastal impacts" by Spencer et al / Earth Science Reviews, published 2014.
9. UK Climate Change Projections by Defra / Met Office 2009
10. Site-specific Topographical Survey prepared by Plandescil Consulting Engineers

### 9.4 Sources of Flooding

The primary flood risk to the site at Burnham Norton is considered to be tidal flooding from the North Sea, based on proximity and previous flood events.

### 9.5 Records of Flooding

A total of 19 storm surges of varying severity are recognized by coastal authorities as having impacted the UK North Norfolk coast between November 1897 and

November 2007 (Cambridge Coastal Research Unit). The previous highest flood levels occurred in 1953, and were recently exceeded in 2013. A further notable occurrence was in 2007.

1. 31st January – 1st February 1953 – Inshore wave heights approx. 5.5m, max water level recorded 5.49 metres (recorded at Burnham Overy Staithe)
2. 8th-9th November 2007 – max water level recorded 4.66m, with potential increase to 5.22 m (At King's Lynn)
3. 5th-6th December 2013 – Inshore wave heights 2.9m, max water level recorded 5.52metres (recorded at Burnham Overy Staithe)

The 2008 SFRA by Faber Maunsell includes information of a storm surge on the 8/9th November 2007. The Environment Agency's tide recorder at King's Lynn recorded a peak water level of 4.66 OD, occurring before the lunar high tide. Subsequent analysis showed that had the surge coincided with the high tide, the water level would have reached 5.22 metres AOD

The highest recorded flood levels occurred in December 2013, when the sea wall was partially breached. The report by Spencer et al concludes that the higher sea levels in 2013 were responsible for over-topping and breaching earthen bank defences, while more highly-engineered defences remained intact. Both the 1953 and 2013 storms approximately coincided with high tide times, exacerbating the flooding. It is acknowledged that impact of the flooding in 2013 may have been worse if the waves had been as high as the 1953 storm, or if the high waves had lasted longer. Properties in Burnham Norton were not badly affected despite the very high water levels in 2013, because the flood waters began to recede before they could reach the village. Had the flood lasted longer, or if wave action was more intense, it is likely the existing cottage would have flooded.

The 2013 sea level recorded at Burnham-Overy Staithe, of 5.52 metres AOD is the highest recorded over the past 100-years.

There is no specific recorded information describing the extent or severity of flooding to the property during the 1953 event, though a recent study for No 5 suggested an ultimate water level of around 5.1m AOD. The level of the existing ground floor at Denning is approximately 4.83m AOD. perimeter of the site, to prevent repetition of this event.

### 9.6 Climate Change

Climate change is expected to increase sea levels, increase the frequency and intensity of flooding and increase maximum wave heights over the next century. Projected sea level rise data has been published by the DEFRA UK Climate Projections website, which provides

## 9. SITE SPECIFIC FLOOD RISK ASSESSMENT

projected changes with respect to 1990 levels. Specific to the Burnham Norton area, (19833 grid cell ID) sea levels are expected to rise by 234 – 742mm by 2100, with a medium projected value of 488mm.

Based on the UK as a whole, wave height is expected to increase by 10% above the 1990 average figures by the year 2115, and rainfall intensity is expected to increase by 30% over the same period. Both of these factors could exacerbate the resultant flooding of a future storm surge in the next 100 years.

### 9.7 Site Topography

The verge across the site frontage meets the carriageway at a minimum of 4.13m AOD. However, the existing house is significantly elevated at 4.83m AOD and the area of mature trees immediately to its East is consistently well over 5.0m AOD.

The entire site then slopes consistently up towards the South via a series of terraced lawns and banks, achieving a maximum elevation of 7.27m and 7.40m AOD at its South West and South East corners respectively.

The southern and western parts of the site (including the development site) are located in flood zone 1, representing the lowest risk of flooding.

### 9.8 Flood Defences

The site benefits from the protection of flood defences put in place to protect against tidal flooding. The most recent information on the location and condition of these is included in the 2018 SFRA (appendix D area 25) and the relevant map extract is shown in figure 2 below. The most relevant flood defences to the site are in good or fair condition and all are embankment type defences. The design standard of protection for these is consistent at 10% Annual Exceedence Probability (AEP)

The Hunstanton and Kelling Hard Shoreline Management Plan (SMP 5) has a policy to “Hold the Line” until 2105 for Burnham Norton. This means that the strategy is to retain and maintain the sea defences in their existing locations. This strategy of maintenance suggests that the flood defences will be kept in good working order, however this would be based on available funding.

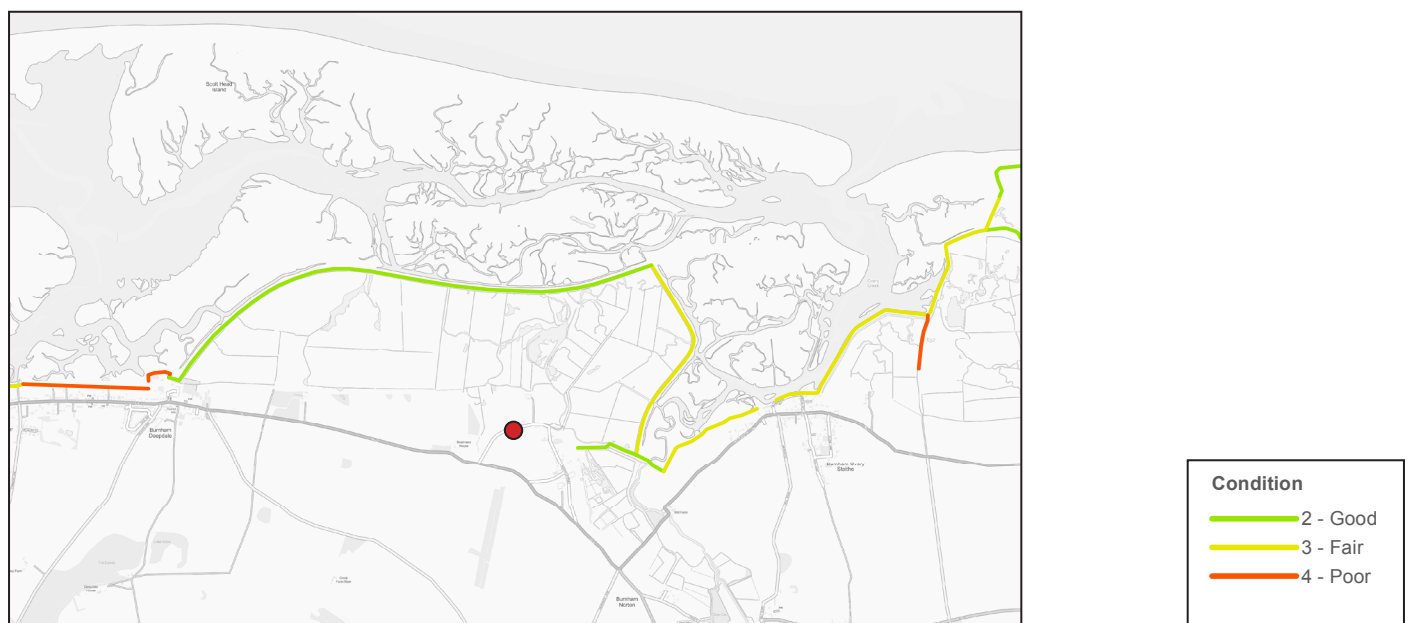


Fig 2 Condition of local flood defences, extract from SFRA 2018

## 9. SITE SPECIFIC FLOOD RISK ASSESSMENT

### 9.9 Coastal Modelling

The most up-to-date information available for flood risk levels is from the 2018 ENS coastal modelling, provided by the Environment Agency. Data is available for two scenarios: where the flood defences are maintained and where these are breached. The worst-case-scenario figures reflecting a breach of flood defences have been used to inform the level of a place of refuge within the building. The figures are summarised in figure 3 below.

### 9.10 Strategic Flood Risk Assessment 2018

The SFRA 2018 by JBA Consulting provides the most up to date guidance on developments within flood zones. Finished floor level guidance, prepared in conjunction with the EA is defined within the report:

*"Minimum finished floor levels for development should be above whichever is higher of the following:*

- a minimum of 600mm above the 1% AEP fluvial event plus an allowance for climate change.
- a minimum of 600mm above the 0.5% AEP tidal event plus an allowance for climate change.
- 300mm above surrounding ground levels

*A 300mm freeboard is only applicable where detailed modelling is available which is deemed to be reliable...*

*Safe access and egress to a locally identified refuge area will need to be demonstrated at all development sites."*

As reliable coastal modelling has been conducted for the area by ENS in 2018, a 300mm freeboard is considered suitable above the 0.5% AEP tidal event plus the allowance for climate change. This represents 300mm above 6.71m AOD, at 7.01m AOD. New First Floor areas are set at 7.45m AOD (see drg 2028 P 110).

### 9.11 Proposed Internal Floor Levels

The ground floor level of the proposed extension has to be considered in terms of the following:

1. Relationship to the existing cottage (4.83m AOD)
2. Relationship to the heights of neighbouring dwellings
3. Provision for disabled access throughout the dwelling and extension
4. Flood risk
5. The visual impact and practicality of raising the ground floor above the flood levels to 7.01m AOD.

A design level of 4.83m AOD has been adopted for the ground floor level of the proposed extension in order to provide level access between the extension and existing cottage, and to minimise the proposed roof heights in the Burnham Norton Conservation Area.

The first floor of the existing cottage is at approximately 7.10m AOD, so already represents a safe refuge point for inhabitants of the cottage, albeit at the very threshold of acceptability.

It would be impractical to raise the ground floor of the extension to 7.01m AOD based on the surrounding topography, the visual impact on the conservation area and the need to provide a connection to the existing cottage. Therefore it is acknowledged that the ground floor is at risk of flooding as shown in fig. 3, and this will be managed by a flood management plan and alert and evacuation procedures.

This does not represent an increase in risk for inhabitants in comparison to the current scenario. The pre existing raised place of refuge at 7.10m AOD and further areas at 7.45m AOD maintain and improve the safety for the inhabitants of the cottage in the event of an extreme flood event.

Flood Event / Return Period	Defended On-site flood levels (m AOD)	Flood depths within the building (m) using proposed FFL of 4.83m AOD	Undefended On-site Flood levels (m AOD)	Flood depths within the building (m) using proposed FFL of 4.83m AOD
5% (1 in 20) annual probability	n/a	No flooding	4.23	No flooding
5% (1 in 20) annual probability plus climate change	5.85	1.02	6.00	1.17m
0.5% (1 in 200) annual probability	n/a	No flooding	4.84	0.01m
0.5% (1 in 200) annual probability plus climate change	6.41	1.58	6.45	1.62m
0.1% (1 in 1000) annual probability	n/a	No flooding	5.30	0.47m
0.1% (1 in 1000) annual probability plus climate change	6.65	1.82	6.71	1.88m

Fig. 3 Local data from ENS 2018 coastal modelling report

## 9. SITE SPECIFIC FLOOD RISK ASSESSMENT

### 9.12 Proposed Mitigation Measures

1. Retention of a safe refuge point above the 0.1% flood event, when adjusted for climate change
2. Additional first floor areas at enhanced AOD above the 0.1% flood event
3. Designed to minimize water entry (water exclusion strategy) in the event of a higher than expected flood level
4. Building materials considered in relation to their resilience to water penetration, drying ability and retention of pre-flood dimensions
5. Structural calculations to be undertaken on the floor to ensure that it has the necessary strength to withstand uplift forces without excessive deformation or cracking.
6. Materials including insulation, concrete slab, masonry and mortar will all be given careful consideration at design stage to ensure a robust and resilient detailed design, adopting best-practice measures for flood resilience.

### 9.13 Flood Management

The site is located within a flood alert zone, managed by the Environment Agency. The owners of the new dwelling will be encouraged to sign up to receive flood warnings. The "Norfolk Prepared" local resilience forum contains further relevant information. A community resilience plan has not been registered for Burnham Norton, but two are registered for the nearby towns of Burnham Overy Staithe and Burnham Market.

An evacuation procedure and route will be established, in conjunction with the emergency planning officer at the council. Because the dwelling will be situated on the very edge of flood zone 3, a dry egress route naturally occurs to the south across open fields, where levels rise up away from the sea.

In the event of rescue from the raised place of refuge, a variety of generous windows will assist access by emergency services.

### 9.14 Conclusion

- The proposed development is not expected to have any impact on the risk of flooding elsewhere
- The development will not impact the existing flood defences
- The proposed extension is no more vulnerable than the existing cottage, and improves safety for the existing dwelling by incorporating additional and enhanced places of refuge
- The place of refuge is raised above the 0.1% flood level, with a finished floor level of 7.45m AOD, representing a significant improvement for flood risk in comparison with the existing dwelling which is itself already compliant at 7.11-7.12m AOD.
- Design mitigation measures and an evacuation procedure have been considered and will be further developed at the technical design stage
- The proposal makes good use of a developed site within an established settlement boundary and with the above factors taken into account, the overall flood risk and impact is considered to be low.