PROPOSAL TO ERECT TWO NEW DWELLINGS ON LAND AT YONDER STREET, HOOE, PLYMOUTH

FLOOD RISK ASSESSMENT INCORPORATING FOUL AND SURFACE WATER DRAINAGE STATEMENT

J-972-Rev.03



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1.0 INTRODUCTION

Bailey Partnership are proposing to construct two new dwellings on land at Yonder Street, Hooe, Plymouth. The site is situated on the northern edge of Hooe, adjacent to Hooe Lake, as shown in **Figures 1 & 2** below.



Figure 1 – Location Plan



Figure 2 – Indicative Site Boundary

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Site Description

The site currently comprises unused land on the northern and southern side of Yonder Street, Hooe, Plymouth. The approximate Ordnance Survey Grid Reference for the site is SX 49872 52674.

The site has its main access via Yonder Street, which passes through the centre of the plot of land. The land situated on the northern side of Yonder Street has a minimum elevation of 2.88m AOD on its northern side, which is adjacent to Hooe Lake. The land on the southern side of Yonder Street has a minimum elevation of 3.43m AOD.

In the wider context, the Hooe Lake is located immediately to the north of the site. The land to the east of the site rises to a local high point of approximately 21m AOD around 100m from the site at Hexton Hill Road.

Existing Usage

The site is currently an unused plot of land situated at the western end of Yonder Street; the street straddles the site such that one area is located immediately to the north of the street and one area is located to the immediate south of the street.

Proposed Usage

The proposal is to construct two new dwellings on the portion of the land to the south of Yonder Street and parking spaces on the land to the north of Yonder Street.

Flood Risk Context

As part of the planning process it has become apparent that the site is located within or close to Flood Zone 3, as shown on the Environment Agency (EA) indicative flood map in **Figure 3**, below and **Appendix B**. Therefore, any application for planning permission should be accompanied by a Flood Risk Assessment (FRA).

Engineering and Development Solutions (EDS) have been commissioned to undertake an FRA for the site to assess the potential flood risks at the subject site. This report comprises the FRA for the proposed development, in line with the National Planning Policy Framework (NPPF), the Planning Practice Guidance (PPG) and the Plymouth City Council: Local Flood Risk Management Strategy.



Figure 3 – Environment Agency Flood Map for Planning Extract



2.0 FLOOD MECHANISMS

Several possible flooding mechanisms have been considered at the site and are discussed below.

Groundwater Flooding

The site is located adjacent to Hooe Lake, the groundwater level beneath the site is likely to be largely controlled by this waterbody, which would act as a sump to drain water in the ground away from the site. As such groundwater flooding is not considered any further in this report.

Overland Sheet Flow

The site is situated on the north side of Hooe, on the waterfront. Overland flows from upstream of the site would be intercepted by the surrounding drainage networks and conveyed away from the site towards the Hooe Lake to the west of the site. The EA map extract **Figure 4** below, shows the risk of surface water flooding for the site. It indicates that the site is at very low to low risk of flooding from surface water.

It is conceivable that the site may experience surface water flooding during extreme events, however given the proximity of the Hooe Lake and potential for tidal flooding, any mitigation measures against fluvial flooding would also relate to surface water flooding.



Figure 4 – Environment Agency Flood Risk from Surface Water Map Extract

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Fluvial (River) Flooding

Due to the large width of the Hooe Lake, it is deemed that this site is not at risk from fluvial flooding. The primary cause of flooding to this site is likely to be that of tidal flooding, especially when climate change allowances are considered. As such, the risk from fluvial flooding is not considered further in this report.

Tidal Flooding

The site is located on the waterfront, which is tidally influenced at this location. Due to the lowlying elevation of the site and the proximity to the coast, there is a risk to the site from tidal flooding. The EA provided present day tidal levels for this area, as outlined below:

- 1 in 200-year tidal level 3.49m AOD
- 1 in 1,000-year tidal level 3.64m AOD

The EA tidal flood levels do not account for sea level rise due to climate change; an allowance for climate change over the lifetime of the development (100 years for a residential property) should be undertaken. Information on climate change allowances has been outlined by the Environment Agency in the guidance entitled 'Flood risk assessments: climate change allowances'. When accounting for climate change over the lifetime of the non-residential development the net sea level rise is calculated to be approximately 1.10m over the next 100 years. Therefore, the undefended 1 in 200-year tidal level with an allowance for climate change is **4.59m AOD**.

The developable area of the site, on the southern side of Yonder Street, has a minimum elevation of 3.47m AOD. As such, a small portion of the site could experience flooding during a present day 1 in 200 year tidal event to a maximum depth of 0.02m. However, the large majority of the site is above 3.51m AOD and would be free from flooding during the present day 1 in 200 event. The site would experience flooding to depths of up to 0.17m during a present day 1 in 1000 year flood event. Therefore, the small area susceptible to the present day 1 in 200 year event would be considered to be within Flood Zone 3 and the remaining majority of the site would be considered to be located within Flood Zone 2. When taking into account sea level rise due to climate change, a 1 in 200-year tidal event could flood the site to depths of up to 1.12m.

Historic Flooding

The Environment Agency have provided information regarding historic events of flooding within this area of Plymouth. There are no recorded historic flood events at the site.

Flooding as a Result of Development

Developments have the potential to increase flood risk to properties down slope of the proposed development through the introduction of impermeable areas on previously permeable areas. In this case, the proposed dwellings will be sited on land that is currently permeable. As such, the impermeable area of the site would increase and the surface water runoff from the site would increase. However, there site is located directly on the tidal waterfront, with no third-party properties downslope.

Wave Action

There is limited potential for wave action at the site from a north-easterly wind over the open water of Hooe Lake.

Guidance given in the Floods and Reservoirs Handbook published by the Institution of Civil Engineers has been used to assess wave heights as this method is suitable for a sheltered Engineering and Development Solutions Ltd

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environment of this type. Using this guidance, predicted significant wave height for a 1 in 1year northerly wind event is 0.126m. This is a trough to crest height and as such would elevate water surface levels by 0.063m. The peak wave height during such an event would be 0.21m, which would elevate water levels by 0.105m.

Given the potential for tidal flood and the limited effect of wave action on the maximum level of flooding, wave action is not considered further within this report.

Flood Summary

From the information provided above and based on the location of the site, it is predicted that the primary flood risk to the site is from tidal flooding. The minimum ground level of the developable area of the site is **3.47m AOD**. During a present day 1 in 200-year tidal flood event, the maximum flood level would be **3.49m AOD**. As such the developable area of the site would be susceptible to flooding to a maximum depth of 0.02m. However, this is a small area of the front of the site, the majority of the site is above 3.51m AOD and would be free from flooding during this event. **Figure 5** below, shows the extent of the present day 1 in 200 year flood event (Flood Zone 3) in a red hatch. During a present day 1 in 1000 year tidal flood event, the maximum flood level would reach **3.64m AOD**. The maximum depth of flooding on the site would be 0.17m during this event. A small portion of the northern area of the developable part of the site is below the present day 1 in 200 year tidal flood level and would be considered to be in Flood Zone 3. However, the majority of the site is free from flooding during the 1 in 200 year event, but at risk of flooding during the 1 in 1000 year event, the remaining majority of the site can be considered to be located within Flood Zone 2.

During a 1 in 200-year tidal flood event when accounting for sea level rise due to climate change, the maximum flood level would be **4.59m AOD**. In this scenario, the maximum flood depths on the site would be up to 1.12m.



Figure 5 Topographic Survey of the Existing Site with the Approximate Flood Extents for the Present Day 1 in 200 Year Event (Red), 1 in 1000 Year Event (Blue) and the 1 in 200 Year Event with an Allowance for Climate Change (Pink)

Information presented in **Section 3.0** of this report will show how flood risks for the site can be reduced and managed.



3.0 ACCESS/EGRESS

The main access and egress for the site will be retained via Yonder Street along the northern side of the southern plot of land. The road outside of the proposed properties has a minimum elevation of 3.43m AOD and would be at risk of flooding during the present day 1 in 200-year flood event.

During a flood event, occupants would need to exit the site on its northern side and travel in a westerly direction for approximately 5m along Yonder Street; maximum flood depths along the access in Yonder Street would be 0.06m for present day extreme flood events.

The road then heads in a southerly direction for approximately 10m before reaching dry ground (Shown in red on **Figure 6**, below). The elevation of Yonder Street by this point is around 4.20m AOD, which is above the present day 1 in 200 year and 1 in 1000-year flood events.

Due to the depth of flooding possible to the areas of the site, it is recommended that any vehicles associated with the operation of the site should be removed from site to higher ground if a tide in excess of 2.8m AOD is predicted to occur. Tidal patterns are predictable and such occurrences should be foreseeable well in advance, allowing adequate prior planning to be undertaken.

Pedestrian movement along the lower areas of the access road may not be safe at times of flooding. If it is not safe to evacuate the site, residents on the site may choose to remain at in the property above the level of flooding over the duration of the flood (estimated to be a maximum of 3 hours before dry conditions returned).



Figure 6 Access and Egress Route

The rear (southwestern) side of the site could provide access onto a higher section of Yonder Street which is set an elevation of approximately 4.20m AOD (Shown in purple on **Figure 5**, above). If access could be provided at this point, there would be safe and dry access and egress from the site during the present day 1 in 200 year event. Flooding of this area could still occur **Engineering and Development Solutions Ltd**

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during a 1 in 200 year flood event when accounting for the effects of climate change over the lifetime of the development. During this event, flood depths at this area of the Yonder Street would be up to 0.39m AOD. The road rises in elevation to the south such that just 5m south from this point would be free from flooding during all events considered. During a flooding event, if access is not available it is recommended to stay within the property at a level greater than 4.59m AOD until the flooding has subsided.

Danger to occupants can be assessed using flood hazard, expressed as a combination of flood depth and velocity (**Figure 7**). The potential access and egress route for the property on the southwestern side of the property onto Yonder Street is at risk of flooding to depths of up to 0.39m during a 1 in 200 year tidal event with an allowance for climate change. When tidal flooding occurs, flow velocities are likely to be very low (<0.25m/s).



Figure 7 Extract from Defra/EA R&D Technical Report FD2320/TR2 – Table 13.1

Using the table above taken from FD2320/TR2, the worst-case resultant during a 1 in 200-year + climate change tidal event is 'Danger for Some', such as children and the elderly. In this scenario access / egress would be available to the general public and emergency services.

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4.0 MITIGATION MEASURES

The following mitigation measures are recommended to ensure the risk of flooding to the development is minimised.

- 1. The minimum Finished Floor Level should be raised as high as reasonably practical. Raising the finished floor levels (FFL) for the proposed dwelling to 4.89m AOD (1 in 200-year tidal level with an allowance for climate change and inclusive of 300mm of freeboard) would not be appropriate, given the site's setting near numerous historic listed buildings.
- 2. If floor levels are set below 4.89m then the building should be defended to this level using flood resistant construction and de-mountable defences.
- 3. Any new construction works carried out below 4.89m AOD (1 in 200-year tidal event + climate change + 300mm freeboard) is recommended to be carried out using flood resistant materials where possible such as:
 - Floor finishes The ground floor of the building is provided with a hard floor finish to allow easy drying out and clearance following a flood event. No wood or chipboard to be used in the flooring.
 - Wall finishes internally and externally will be Parex acrylic render or similar which is resistant to flood damage.
 - Woodwork Door frames, timber studs, staircase etc. to be appropriately treated for resistance to decay and swelling in accordance with BS5268: Part 5:1989 for structural timber and BS1186 Part 1:1991 for joinery.
 - Insulation Wall insulation in cavities to be closed cell insulation material.
 - Service entry points Entry points are to be installed as high as reasonably practical. Where entry points are provided at low level these will be fully sealed.
- 4. All future electrical circuitry and apparatus should be installed at or higher than this level. Alternatively, ground based electrical installations should be designed to withstand flooding.

Further advice on flood resilient construction is available from Improving Flood Resilience of New Buildings which is available at:

http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

- 5. An emergency access and egress route serving both properties, which exits onto Yonder Street at the most south-westerly point of the site, should be included to ensure that safe access and egress is available during all present day tidal events considered.
- 6. The residents of the dwelling should sign up to the Environment Agency flood warning system. The Environment Agency operate a countrywide flood warning system that covers both river and tidal flooding. In Perranporth, the system will provide warning of an extreme flood event which may present a risk to the area.

The flood warning system is free, and residents should sign up to the system as soon as the dwelling is occupied. Flood warnings can be issued by phone, text or email. Registration to receive warnings can be either by phone on 0345 988 1188 or online at www.gov.uk/sign-up-for-flood-warnings.

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It is recommended that residents/inhabitants/workers of any proposed development on the site should be connected to the EA's flood warning system for the area, this will ensure prior warning of a possible flood event and allow adequate time for site staff to prepare for flooding. EA standing advice is reproduced below:



FLOOD ALERT

Flooding is possible. Be prepared.

- Monitor flood warnings and advice issued by the Environment Agency, Council, the emergency services and News channels.
- Prepare a flood kit of essential items

Flooding is expected. Immediate action required.

- Continue to monitor flood warnings and advice
- Move family, pets and valuables to a safe place
- Turn off gas, electricity and water supplies if safe to do so
- Put flood protection equipment in place



FLOOD WARNING

Severe flooding. Danger to life.

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- Evacuate building immediately to higher ground
- Return to building only when advised to do so by Emergency Services

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5.0 FLOOD RISK POLICY

The large majority of the developable area of the site where the dwellings are proposed at Yonder Street have been shown to be located within Flood Zone 2. In accordance with PPG Table 2, a development of this type '*Buildings used for dwelling houses*' is classified as 'More Vulnerable'. Referring to Table 3 of PPG (**Figure 8**, below), a 'More Vulnerable' development within Flood Zones 2 would be deemed appropriate.



Figure 8 – Planning Practice Guidance (PPG) Table 3

Developments within Flood Zone 2 are normally subject to the Sequential Test. NPPF Paragraph 158 states the following:

"The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding."

As stated above, the aim of the Sequential Test is to steer developments from high and medium flood risk zones to areas which are designated as low risk from a flooding perspective.

Depending on the geographical extent to which the Sequential Test would be applied, there are many other sites in Devon which could provide this type of development. However, few of these sites would lie within a similar distance to the associated sustainability benefits that this site provides.

Therefore, the development may be subject to the Exception Test to ascertain if there are wider sustainability benefits to the area that outweigh the flood risk. NPPF Paragraph 159/160 states the following:

"159. If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in national planning guidance.

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