

# Flood Risk Assessment

At:

Neptune Slipway,  
Pier Road,  
Greenhithe,  
DA9 9NS

For:

Denken Builders

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## 0 INTRODUCTION

This new development is to be called Neptune Slipway and comprises a total of 4 Houses (2 detached and one pair of semi-detached) on 2 stories over a ground floor car park and storage level.

The site is located on the south bank of the River Thames at Greenhithe, approximately 2.5km west of the Dartford Crossing and QE2 Bridge. It lies on the boundary between the old commercial centre of Greenhithe, to the east, and the new residential estate of Ingress Park to the west. A site location plan is included in *Appendix i*.

This report assessment has been carried out in accordance with guidance provided by the Environment Agency (EA) and as set out in Planning Policy Statement 25 (PPS 25). It has also been informed by the Strategic Flood Risk Assessment (SFRA) and advice provided by the Kent Thameside Delivery Board, Dartford Borough Council, the EA and Thames Water.

## **1.0 DEVELOPMENT DESCRIPTION AND LOCATION**

### **1(a) Proposals and location**

Location:

The proposed development site is located on the south bank of the River Thames off of Pier Road just north of the High Street in Greenhithe, Kent.

The site is currently derelict and its previous uses have been a dry dock and marine workshop.

Proposals:

The proposals are to build 4 being 2 detached and one pair of semi-detached as per drawings.

The ground floor level will have parking and storage facilities for residents and the aim is to incorporate a store for the Sea Scouts' equipment so they can benefit from the site.

Refer to Dwg No CS/NS/29 to clarify the finished floor levels of the proposals.

It can be seen from the above that the residential Finished Floor Level (FFL) is at 6.9m AOD. This is well above the Environment Agency predicted flood level of 6.6m AOD.

Architectural layouts and elevations of the site please refer to planning application Dwgs.

As detailed in the Greenhithe Riverside Urban Design Strategy, Supplementary Planning Guidance, the Old Boatyard lies within the Greenhithe Conservation Area.

Site setting:

The site at the Old Boatyard in Greenhithe is currently occupied by a single storey flat roofed building and a smaller, separate storage shed as well as a shallow dry dock.



Overview of site from north west corner.

The site is surrounded by a high wall and to the north this wall forms part of the flood defences for the area. There is a gate in the riverside wall which gives access to the Thames and this gate also functions as part of the flood defence. The walls also act as retaining structures on the north and west boundaries of the site.



Eastern boundary of site showing extent of flood defence.

The site is bordered on the west by Pier Road, which is the access road to the Boatyard. This is a narrow street with terraced cottages on its western side which terminates to the north at a slipway into the Thames.



Access to Pier Road from the High Street.

It can be seen from the photographs below that the road slopes steeply to the river bank. These levels are reflected in the site although some levelling of the site has been carried out in the past resulting in the retaining walls surrounding the property.



Pier Road looking south and access from the High Street.



Pier Road looking north towards the Thames.

There is a flood defence wall along the northern boundary of the site. There is a gate in this for access to the old dry dock located within the site and also at the slipway mouth.



North east corner of site shows high tide mark and flood gate with walled defences. To the east lies Ingress Park, a residential estate of 900 units set in parkland incorporating the historic Ingress Abbey which has been recently restored. The area immediately adjacent to the Old Boatyard contains a children's play area with some 100m of grassed area beyond that before the housing of Ingress Park commences.



Looking west from flood defence bund in Ingress Park towards the Old Boatyard and Pier Road slipway.



Looking east along flood defence bund in Ingress Park.



North of the site is an area of public space through which there is pedestrian and cycle access from Pier Road to Ingress Park. This space contains several trees that border the Old Boatyard and overhang its boundary.

The site slopes gradually down towards the river from approximately 6.00m to 4.50m AOD. The dry dock is considerably lower at 2.40m AOD at its lowest point at the gated access to the river.

Stormwater from the site drains directly to the dry dock in the site and then into the River Thames. Pier Road and existing houses opposite the site appear to drain to the storm water sewer in Pier Road. This sewer outfalls west of the site and is pictured below.



SW outfall into the Thames from Pier Road.

In addition to the above a detailed site topographical survey has been carried out of the site and this is included in *Appendix iii*.

## 1(b) Vulnerability Classification

As can be seen from tables D1, D2 and D3 of PPS 25 below, dwelling houses, such as proposed for the Old Boatyard, are in the More Vulnerable flood risk vulnerability classification which is appropriate for Flood Zone 3a providing the Exception Test is applied.

|   |   |
|---|---|
| <p><b>Zone 2 Medium Probability</b></p> <p><b>Definition</b><br/>This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.</p> <p><b>Appropriate uses</b><br/>The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone.<br/>Subject to the Sequential Test being applied, the highly vulnerable uses in Table D.2 are only appropriate in this zone if the Exception Test (see para. D.9.) is passed.</p> <p><b>FRA requirements</b><br/>All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.</p> <p><b>Policy aims</b><br/>In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.</p> | <p><b>Essential Infrastructure</b></p> <ul style="list-style-type: none"> <li>Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.</li> </ul>   |
| <p><b>Zone 3a High Probability</b></p> <p><b>Definition</b><br/>This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (&gt;1%) or a 1 in 200 or greater annual probability of flooding from the sea (&gt;0.5%) in any year.</p> <p><b>Appropriate uses</b><br/>The water-compatible and less vulnerable uses of land in Table D.2 are appropriate in this zone.<br/>The highly vulnerable uses in Table D.2 should not be permitted in this zone.<br/>The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test (see para. D.9) is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.</p> <p><b>FRA requirements</b><br/>All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.</p>   | <p><b>Highly Vulnerable</b></p> <ul style="list-style-type: none"> <li>Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding.</li> <li>Emergency dispersal points.</li> <li>Basement dwellings.</li> <li>Caravans, mobile homes and park homes intended for permanent residential use.</li> <li>Installations requiring hazardous substances consent.<sup>19</sup></li> </ul>   |
|   | <p><b>More Vulnerable</b></p> <ul style="list-style-type: none"> <li>Hospitals.</li> <li>Residential institutions such as residential care homes; children's homes, social services homes, prisons and hostels.</li> <li>Buildings used for dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels.</li> <li>Non-residential uses for health services, nurseries and educational establishments.</li> <li>Landfill and sites used for waste management facilities for hazardous waste.<sup>20</sup></li> <li>Sites used for holiday or short-let caravans and camping, <b>subject to a specific warning and evacuation plan</b>.</li> </ul>                 |
|   | <p><b>Less Vulnerable</b></p> <ul style="list-style-type: none"> <li>Buildings used for shops, financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in 'more vulnerable'; and assembly and leisure.</li> <li>Land and buildings used for agriculture and forestry.</li> <li>Waste treatment (except landfill and hazardous waste facilities).</li> <li>Minerals working and processing (except for sand and gravel working).</li> <li>Water treatment plants.</li> <li>Sewage treatment plants (if adequate pollution control measures are in place).</li> </ul> |

PPS25 Extracts

## 1(c) Local Development Documents

The site is not allocated for development in the local plan and therefore, following the guidance in PPS25, the Sequential Test will need to be considered by the Local Planning Authority informed by the SFRA carried out for the area. At the time of writing the Sequential Test documentation has been submitted to the council for approval.

## 1(d) SEQUENTIAL TEST AND EXCEPTION TEST

### SEQUENTIAL TEST

Kent Thameside Delivery Board has produced a Strategic Flood Risk Assessment

for this area and this document forms the basis of applying the Sequential Test.

The Old Boatyard has been assessed in supplementary planning guidance, Greenhithe Riverfront Urban Design Strategy, as an area on which development is allowed with certain restrictions.

The Sequential Test document is included in *Appendix iv* and, at the time of writing, is being reviewed by the Planning Authority.

## EXCEPTION TEST

PPS 25 defines the exception test in the following manner:

### The Exception Test

For the Exception Test to be passed:

- a) it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage – see Figure 4 of PPS12: *Local Development Frameworks* – the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;
- b) the development should be on developable<sup>23</sup> previously-developed land or, if it is not on previously developed land<sup>24</sup>, that there are no reasonable alternative sites on developable previously-developed land; and
- c) a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

a) The proposed development will improve the local flood defences by removing the old, disused and derelict flood gate and replace this with a permanent structure. The development will also aid the local house meet their housing quotas and provide much needed homes to the local community as well as providing improved facilities to the local Sea Scout group.

b) The proposed site is previously developed and the proposed is for a redevelopment of this.

c) This FRA demonstrates that the development is safe and does not increase flood risk elsewhere.

In view of the above the Exception Test can be seen to be passed.

## 2.0 DEFINITION OF THE FLOOD HAZARD

### 2(a) Sources of Flooding

The possible sources of flooding affecting the site are discussed in detailed below. The site is located fairly close to the mouth of the River Thames therefore, the river at the location of the site is tidal and extreme water levels are dictated by the high tide levels at the river mouth rather than fluvial flow rates.

The Strategic Flood Risk Assessment undertaken for this area highlights that the site is within Zone 3A. The ground level rises sharply across the site and is clear of the predicted flood levels at the southern boundary.

The predicted flood level for the area has been confirmed by the EA to be 6.6m AOD and minimum Finished Floor Levels are to be 6.9m AOD for Residential. EA correspondence relating to the flood levels is included in *Appendix v*.

### 2(b) Flood Event Analysis

## TIDAL FLOODING

The site is defended locally by concrete retaining structures and flood gates from immediate inundation. The top level of these defences is in the region of 7m AOD. *Appendix vii* shows the data received showing the detailed top levels of the defences in the local area from Dartford Borough Council.

The risk of flooding at the site is from breach of these flood defences, ie, if a flood gate is left open. An analysis has been undertaken in the SFRA adjacent to the site and this is included in *Appendix vi* for reference. This models a breach upstream of the site.

There is a flood gate at the slipway adjacent to the site and if this is breached then the car park level of the development will be directly affected by the flood water.

Finished floor levels of the property are well above the predicted flood levels and EA recommended minimum FFL`s to be safe for residents.

## FLUVIAL FLOODING

As discussed previously, the water levels in the Thames are driven by tidal levels at the river mouth in the vicinity of the site. Therefore fluvial flooding and tidal flooding are combined. Other than the River Thames there are no other water courses affecting the site.

## SEWER FLOODING

Southern Water have confirmed that there is no history of sewer flooding in the local area.

The site will be tide-locked at times of extreme water levels therefore consideration will need to be made for on-site surface water storage during these times prior to discharge into the local network.

Foul water drainage capacities will need to be checked prior to construction with Southern Water and suitable agreements made to upgrade the local network if required.

#### 2(c) Existing storm drainage arrangements

Due to the extent of hard surfacing on the site all the storm runoff from the site drains to the River Thames.

There appears to be no link into the storm water sewer in Pier Road from the site.

### **3.0 PROBABILITY**

#### 3(a) Flood Zone

The site is located on a river bank and, according to the Environment Agency flood map, within Flood Zone 3a.

The EA have confirmed that the design flood level for the property to be 6.6m AOD predicted for 2110. The correspondence with the EA is included in *Appendix v*.



### 3(b) Strategic Flood Risk Assessment

The Kent Thameside Delivery Board have commissioned a Strategic Flood risk Assessment (SFRA) for the Kent Thameside area. The SFRA does not specifically refer to the development site in question. Although flood and residual risk maps do cover the area of the development and are included in *Appendix vi*.

The residual risk map shows the site to be in a thin band of high residual risk directly adjacent to the river. This correlates to the low lying ground levels directly behind the flood defences at the river bank.

The residential portion of the proposed development is located above the flood level and has access to land outside the residual risk area.

### 3(c) Probability

PPS25 states that Flood Zone 3 '... comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (> 1%) or 1 in 200 or greater annual probability of sea flooding (>0.5%) in any year.'

The probability of breach, or flood gates being left open is difficult to quantify. Current flood defences are all above or at the predicted design flood levels given by the EA of 6.6mAOD. These levels can be seen in *Appendix vii*.

### 3(d) Existing runoff rates

As the site is 100% hard surfaced the existing storm water runoff rate will be 6.5l/s assuming a 50mm per hour rainfall event. Existing off site foul water flows will be very small (circa 0.1l/s) due to the nature of the previous uses on the site and the limited facilities.

## 4.0 CLIMATE CHANGE

4(a) Climate change will affect the site by increasing rainfall levels and volumes in the future; rising sea levels are likely to have an impact on the site due to its frontage on the river.

Risk to the site will be from increased depth of flooding in event of a breach, the likelihood of a breach, as well as increased sewer flooding as rainstorm increases due to climate change.

Storm water drainage will need to be designed to take into account the increased storm water flows that could occur within the lifetime of the development.

## 5.0 DETAILED DEVELOPMENT PROPOSALS

5(a) *Appendix ii* shows the detailed development proposals for the site including plans and elevations.

It can be seen from the ground floor plan that the entire ground floor is car parking with space for changing rooms and Sea Scouts store. It is proposed that this level will be constructed in a flood resilient manner to allow the building to recover quickly in event of a flood or breach close to the site.

Finished floor levels for the residential above are 6.9m AOD. This locates the residential portion of the development well clear of the predicted flood level for the local area and well above the minimum FFL recommended by the EA.

Drainage of the property will be discharged via the existing drainage connections from the site. Foul drainage capacity will need to be confirmed with the sewerage provider.

Non return valves will be provided to the foul drainage within the low level to prevent sewerage backing up into the car park area. Storm water run off from the property will be limited to match that of the existing situation and a storage tank will be provided in order to attenuate any additional storm water run off.

The site will also be tide locked in a flood event and therefore provision should be made to accommodate any storm runoff during this period to prevent surcharging the existing system.

As per EA requirements, storm should be designed for a 1 in 100 year storm with a 20% allowance made for climate change.

The existing flood defences are to be modified as part of the proposed redevelopment. The existing flood gate, which has fallen into disrepair, is to be removed and replaced with a permanent reinforced concrete wall that will tie-in to the existing flood defence wall. Any modification to the flood defences and development near to existing structures will need the consent of the EA and Dartford Borough Council and discussions with these Authorities should be entered into regarding the proposed building and improvements to the flood defence wall.

5(b) All residential and habitable rooms are located above the predicted flood level.

Accommodation and stores in the low level car park will be constructed in a flood resilient manner.

## **6.0 FLOOD RISK MANAGEMENT MEASURES**

6(a) The high FFL ensures that residents are well clear of the predicted flood water level should a breach occur.

Storm water drainage from the site will be limited to that of the existing situation preventing any impact from the development in the local area. Storm water storage provision will need to be made for a tide locked event due to the low lying nature of the car park.

Foul water discharge from the site will be increased. The 4 houses on site will generate 0.27L/sec foul water flows when utilising the Sewers For Adoption 4,000L/unit/day rate, this is a minimal increase of flow rates although capacity of the local sewer system should be checked with Thames Water prior to construction. The sewerage undertaker is duty bound to provide foul drainage to the property and therefore any sewer upgrades necessary are deemed outside the scope of this report.

The ground floor will be finished and constructed in a manner that is flood resilient, i.e. all electrics will be watertight with tiled or concrete floors and walls to enable the building to return to operational status as quickly as possible in the unlikely event of a flood.

The floodable lower levels also provide mitigation for any loss of flood water storage due to development on the site. Routes from these low levels to safe areas above the flood zone will be clearly marked and free from obstructions to allow dry egress and avoid entrapment.

Existing flood defences include the flood wall on the eastern boundary of the site and the flood wall and gate along the river frontage. These defences are maintained by the EA and will require Flood Defence Consent prior to refurbishment and modification.

The existing flood gate has been poorly maintained which has led to the deterioration of the seal at the foot of the structure. Water leaks into the dock



facility of the site during high tides and this severely compromises the continuity of the flood defences in this area of Greenhithe.

The proposals are to remove this gate and provide in its place a continuous reinforced concrete structure that will tie-in with the existing flood wall and riverside apron. This will provide the requisite height of flood defence with a permanent and upgraded barrier that will be an improvement to the existing situation. Although detailed structural design is beyond the scope of this FRA, outline proposals for the location and construction of the modified flood defence can be seen in *Appendix viii*.

The EA have stipulated that a 6 metre margin on the landward side of the flood defence be kept clear of any permanent structure to ensure unrestricted access to the flood defence for maintenance and inspection purposes.

Written consent is also required under the EA's Land Drainage and Sea Defence Byelaws 1981 for any works between the low water mark and fifteen metres of the landward toe of the flood defence.

Architectural proposals show that the 6 metre margin for permanent structures is preserved by utilising demountable balconies that ensure access can be provided to plant and machinery for maintenance purposes. Architectural drawings should be consulted for further details of these features.

The greatest risk of flooding arises from extreme tides combined with stormy conditions which could cause overtopping or a breach of the flood defences. Weather and flood warnings, issued by the Met Office and the EA, should provide a reasonable timeframe in which to prepare for a possible flood event at the site.

Purchasers of the flats will be provided with a flood emergency pack at time of sale containing an exit route plan and be signed up to the EA Floodline to ensure that all residents have adequate warning of any flood event.

Measures to limit the effects of a flood would include removing vehicles and property from the lower car park level and ensuring that evacuation routes were unobstructed. Vehicles could be parked further south of the site where there is a car park available in Eagle Road and plenty of on street parking at levels outside of the flood risk zone.

The above mitigation measures will mean that the site will be safe for the lifetime of the development and will not adversely affect the properties in the local area.

## **7.0 OFF SITE IMPACTS**

7(a) The floodable lower level of the development will prevent any loss of flood water storage, due to the development, in event of a flood defence breach.

7(b) Due to the attenuation provided on site and the additional capacity in this for

climate change, there will be no off site impact as a result.

## **8.0 RESIDUAL RISKS**

8(a) There is always a risk when building in a flood zone. However, the proposals for the site will limit the residual risk to possible flooding of the car park in the event of a breach of the existing river wall.

Anybody in the car park at the time of the breach will be able to access the terrace level and evacuate via the safe access route.

8(b) A management company will oversee the communal areas of the property during the lifetime of the development. They will also be responsible for maintaining the safe dry access to the development.

## **9.0 CONCLUSION**

The proposed development includes provision for safe dry access to the development in event of a flood.

The car park at low level ensures that there is no loss of effective flood water storage in event of a breach in the local flood defences.

The low level areas will be constructed in a flood resilient manner to reduce the costs of restoring the lower floor to an operational status.

The residential FFL`s are well above both the predicted flood levels and minimum recommended by the EA.

In light of the above it is felt the development will be safe and not adversely affect others for the life of the development.