



Client: Redbridge Estates Ltd

Flood Risk Assessment for the
Proposed Development at High
Knocke Farm, Dymchurch, Kent

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1 Background and Scope of Appraisal

Flooding is a major issue in the United Kingdom. The impacts can be devastating in terms of the cost of repairs, replacement of damaged property and loss of business. The objectives of the Flood Risk Assessment (FRA) are therefore to establish the following:

- whether a proposed development is likely to be affected by current or future flooding from any source
- whether the development will increase flood risk elsewhere within the floodplain
- whether the measures proposed to address these effects and risks are appropriate
- whether the site will pass Part B of the Exception Test (where applicable)

Herrington Consulting has been commissioned by Redbridge Estates Ltd to prepare a Flood Risk Assessment (FRA) for the proposed development at **High Knocke Farm, Dymchurch, Kent, TN29 0PU**.

This appraisal has been undertaken in accordance with the requirements of the National Planning Policy Framework (December 2023) and the National Planning Practice Guidance Suite (August 2022) that has been published by the Department for Communities and Local Government. The *Flood Risk and Coastal Change* planning practice guidance included within the Suite represents the most contemporary technical guidance on preparing FRAs. In addition, reference has also been made to Local Planning Policy.

To ensure that due account is taken of industry best practice, this FRA has been carried out in line with the CIRIA Report C624 'Development and flood risk - guidance for the construction industry'.

2 Development Description and Planning Context

2.1 Site Location and Existing Development

The site is located at OS coordinates 609689, 128807 off Dymchurch Road in Dymchurch, Kent. The site covers an area of approximately 6.3 hectares and currently comprises undeveloped farmland. The location of the site in relation to the surrounding area and the coastline is shown in Figure 2.1.

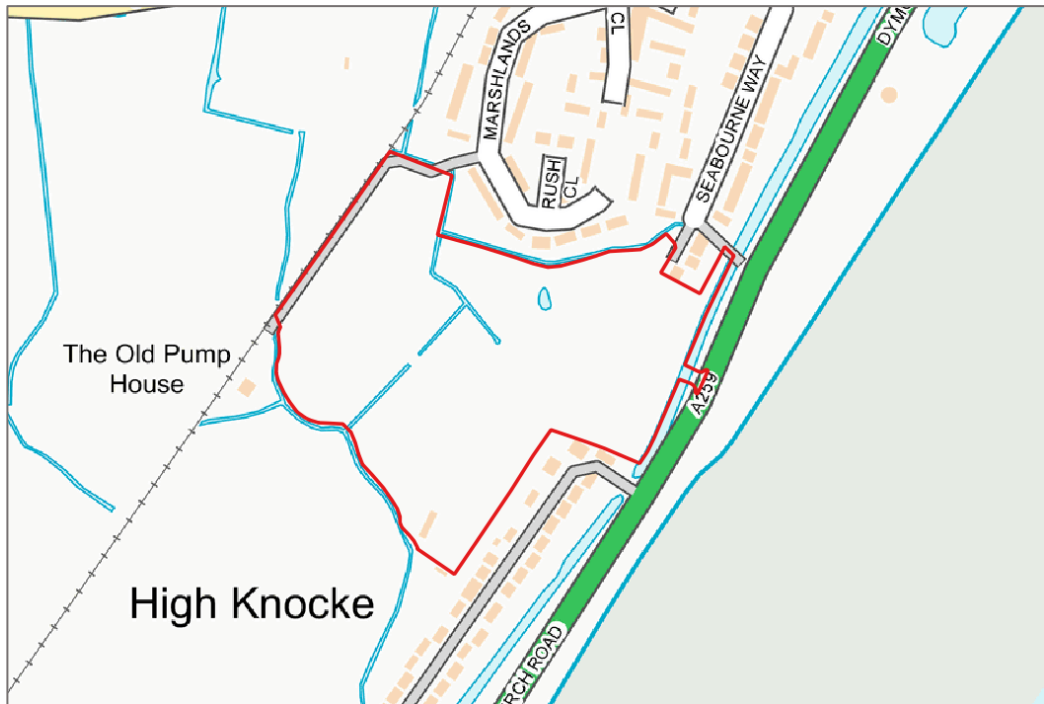


Figure 2.1 – Location map (contains Ordnance Survey data © Crown copyright and database right 2024).

The site plan included in Appendix A.1 of this report provides more detail in relation to the site location and layout.

2.2 Proposed Development

This report has been prepared to accompany an outline application for the development of 125 residential dwellings (Figure 2.2).



Figure 2.2 – Proposed site layout plan.

Drawings of the proposed scheme are included in Appendix A.1 of this report.

2.3 The Sequential Test

The National Planning Policy Framework (NPPF) requires the Sequential Test to be applied at all stages of the planning process and generally the starting point is the Environment Agency's (EA) 'Flood Map for Planning' (Figure 2.3). These maps and the associated information are intended for guidance and cannot provide details for individual properties. They do not take into account other considerations such as existing flood defences, alternative flooding mechanisms and detailed site-based surveys. They do, however, provide high level information on the type and likelihood of flood risk in any particular area of the country. The Flood Zones are classified as follows:

Zone 1 – Low probability of flooding – This zone is assessed as having less than a 1 in 1000 annual probability of river or sea flooding in any one year.

Zone 2 – Medium probability of flooding – This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding or between 1 in 200 and 1 in 1000 annual probability of sea flooding in any one year.

Zone 3a – High probability of flooding - This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding in any one year.

Zone 3b – The Functional Floodplain – This zone comprises land where water has to flow or be stored in times of flood and can be defined as land which would flood during an event having

an annual probability of 1 in 20 or greater. This zone can also represent areas that are designed to flood in an extreme event as part of a flood alleviation or flood storage scheme.

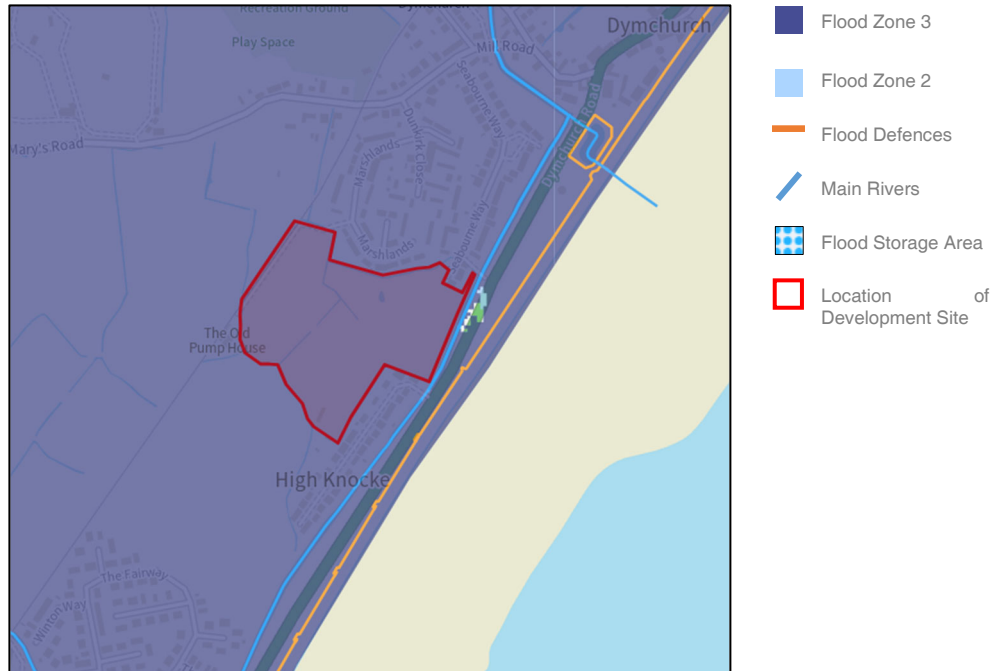


Figure 2.3 – EA's 'Flood Map for Planning' (© Environment Agency).

Figure 2.3 shows the development site is located within Flood Zone 3 and identifies that the site benefits from existing flood defences. This mapping does not distinguish between high risk areas and the functional floodplain, i.e., Zones 3a and 3b. This is an important differentiation that needs to be made by the FRA because the NPPF states that no development, other than essential transport and utilities infrastructure, should be located within the functional floodplain.

The NPPG states that the Functional Floodplain is land where water has to flow or be stored in times of flood. The NPPG provides the following definition:

The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters.

Based on information provided by the EA and that derived as part of this appraisal, the following Functional Floodplain test is applied:

Do predicted flood levels show that the site will be affected by an event having a return period of 1 in 30 years or less?	X
Is the site defended by flood defence infrastructure that prevents flooding for events having a return period of 1 in 30 years or greater?	✓
Does the site provide a flood storage or floodwater conveyance function?	X
Does the site contain areas that are 'intended' to provide transmission and storage of water from other sources?	X
Is site within the functional floodplain (Zone 3b)?	No

Table 2.1 – Functional floodplain test.

The flood zone mapping and associated information has been summarised in Table 2.2 below.

Flood Zone (percentage of site within zone)		Source of flooding	Benefiting from existing flood defences
Zone 1	0%	-	-
Zone 2	0%	-	-
Zone 3a	100%	Sea	Yes
Zone 3b	0%	-	-

Table 2.2 – Flood zone classification.

The NPPF states that the Local Planning Authority (LPA) should apply the sequential approach as part of the identification of land for development in areas at risk from flooding. The overarching objective of the Sequential Test is to ensure that lower risk sites are developed before sites in higher risk areas. When applying the Sequential Test, it is also necessary to ensure that the subject site is compared to only those sites that are available for development and are similar in size.

This requires a comprehensive knowledge of development sites within the district and is generally applied as part of the Local Plan process. However, when applying the Sequential Test to sites that have not been assessed as part of the Local Plan it is necessary to apply a bespoke test, and the Flood Risk Assessment can help to provide additional evidence to better quantify the true risk of flooding, enabling an informed judgement to be made.

Providing evidence in support of the Sequential Test is outside the scope of this FRA, nevertheless, the findings of this report can be used to assist in the application of the Sequential Test for this site if required.

The second level of appraisal is through the application of the more detailed and refined flood risk information contained within the Strategic Flood Risk Assessments (SFRA). Such a document has been prepared for Folkestone and Hythe District Council (FHDC) (formerly Shepway) and this has been referenced as part of this site-specific FRA.

The most detailed stage at which the sequential approach can be applied is at a site-based level. Careful consideration of the topography of the site and development uses can provide opportunities to locate more vulnerable buildings on the higher parts of the site and placing less vulnerable elements such as car parking or recreational use in the areas exposed to higher risk. This approach is examined later on in this FRA.

2.4 The Exception Test

According to the NPPF, if it is not possible, consistent with wider sustainability objectives, for the development to be located in areas at lower risk, the Exception Test may have to be applied. The application of the Exception Test will depend on the type and nature of the development, in line with the Flood Risk vulnerability classification set out in the NPPG. This has been summarised in Table 2.3 below.

Flood Risk Vulnerability Classification	Zone 1	Zone 2	Zone 3a	Zone 3b
Essential infrastructure – Essential transport infrastructure, strategic utility infrastructure, including electricity generating power stations	✓	✓	e	e
High vulnerability – Emergency services, basement dwellings, caravans and mobile homes intended for permanent residential use	✓	e	x	x
More vulnerable – Hospitals, residential care homes, buildings used for dwelling houses, halls of residence, pubs, hotels, non-residential uses for health services, nurseries and education	✓	✓	e	x
Less vulnerable – Shops, offices, restaurants, general industry, agriculture, sewerage treatment plants	✓	✓	✓	x
Water compatible development – Flood control infrastructure, sewerage infrastructure, docks, marinas, ship building, water-based recreation etc.	✓	✓	✓	✓
Key : ✓ Development is appropriate x Development should not be permitted e Exception Test required  Shaded cell represents the classification of this development				

Table 2.3 - Flood risk vulnerability and flood zone compatibility.

From Table 2.3 above it can be seen that the development falls into a classification that requires the Exception Test to be applied. For the Exception Test to be passed it should be demonstrated that:

- A. the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
- B. the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

Both parts of the test will have to be passed for development to be allocated or permitted.

Demonstrating that the development provides wider sustainability benefits to the community that outweigh flood risk is outside the scope of this report. Nevertheless, reference is made to the SFRA to establish the key risks associated with flooding and to help demonstrate that this objective can be achieved. The key focus of this FRA is therefore to establish whether the site is likely to pass Part B of the Exception Test.

3 Definition of Flood Hazard

3.1 Site Specific Information

Information from a wide range of sources has been referenced in order to appraise the true risk of flooding at this location. This section summarises the additional information collected as part of this FRA.

Site specific flood level data provided by the EA – The EA has provided the model results of the Romney Marsh Breach and Flood Forecasting carried out in 2020 (by others), which have been referenced as part of this appraisal.

Information contained within the SFRA – The FHDC SFRA (2015) contains detailed mapping showing historic flood records for a wide range of sources and has therefore been referenced as part of this site-specific FRA. In addition, the tidal modelling undertaken as part of the SFRA has been referenced as part of this appraisal.

Information on localised flooding contained within the SWMP – A Surface Water Management Plan (SWMP) is a study to understand the risk of flooding that arises from local surface water flooding, which is defined by the Flood and Water Management Act 2010 as flooding from surface runoff, groundwater, and ordinary watercourses. Such a document has been prepared for FHDC (2012) and has therefore been referenced as part of this site-specific FRA.

Information provided by Southern Water (SW) – SW has provided the results of an asset location search for the site. The response is included in Appendix A.2.

Site specific topographic surveys – A topographic survey has been undertaken for the site and a copy of this is included in Appendix A.1. From the survey, it can be seen that the level of the site varies between 0.92m and 3.14m Above Ordnance Datum Newlyn (AODN). The site is relatively flat with the exception of the network of ditches where the lowest land levels are recorded.

Geology – Reference to the British Geological Survey (BGS) map shows that the underlying solid geology in the location of the subject site is Tunbridge Wells Sand Formation (sandstone). Overlying this are superficial Tidal Flat Deposits.

Historic flooding – Information provided by the EA identifies there are no records of flooding from rivers or the sea at the site. Mapping contained within the SFRA shows there are also no records of flooding at the site from any other sources in the past.

3.2 Potential Sources of Flooding

The main sources of flooding have been assessed as part of this appraisal. The specific issues relating to each one and its impact on this development are discussed below. Table 3.1 at the end of this section summarises the risks associated with each of the sources of flooding.

Flooding from the Sea – The site lies within Flood Zone 3 as shown on the EA's 'Flood Map for Planning' (Figure 2.3). Consequently, the risk of flooding from this source is appraised further in Section 5 of this report.

Flooding from Rivers, Ordinary or Man-Made Watercourses – Inspection of OS mapping identifies that the Clobdsden Sewer (main river) runs along the east boundary of the site, and there are multiple ordinary watercourses on site. The primary role of these watercourses is to reduce the groundwater level within the surrounding land, with pumps or tidal sluices being used to discharge flows to the sea.

Extreme rainfall, the failure of a pumping station or the tide-locking of the tidal outlet can prevent the system discharging, which may result in increased water levels in the network of drains and ditches. The EA has been contacted to obtain model information for the Clobdsden Sewer and the network of ditches, and the EA confirmed that no such modelling is available. However, due to the large and relatively flat nature of the land that is drained, it is considered that the consequence of flooding from these watercourses is likely to be water logging of the ground and shallow flooding in the lower-lying areas.

The risk and consequence of an extreme event from this source is significantly less than from a coastal flood event described in Section 5 of this report. Therefore, the mitigation measures discussed in later sections of this report, which are aimed at reducing the risk of flooding from all sources, will be more than adequate in preventing flooding from watercourses. Consequently, the risk of flooding from this source is considered to be *low*.

Flooding from Land (overland flow and surface water runoff) – Overland flooding typically occurs in natural valley bottoms as normally dry areas become covered in flowing water and in low spots where water may pond. This mechanism of flooding can occur almost anywhere, but is likely to be of particular concern in any topographical low spot, or where the pathway for runoff is restricted by terrain or man-made obstructions.

Inspection of the EA's 'Flood Risk from Surface Water' map (Figure 3.1) identifies that the majority of the site is at 'very low' risk of flooding from surface water. The exception to this is small areas of localised surface water accumulation where the existing ponds are located, or within minor topographical depressions. These areas are shown to be at 'low' to 'high' risk.

However, when the areas at 'low' to 'high' risk are considered, no development is proposed in the areas where the existing ponds are located, and any minor topographic depressions will be infilled as a result of the proposed development. Furthermore, the proposed development will include SuDS to manage rain falling on site (refer to Section 8). Consequently, it is considered that the risk of flooding to the development from surface water is *low*.

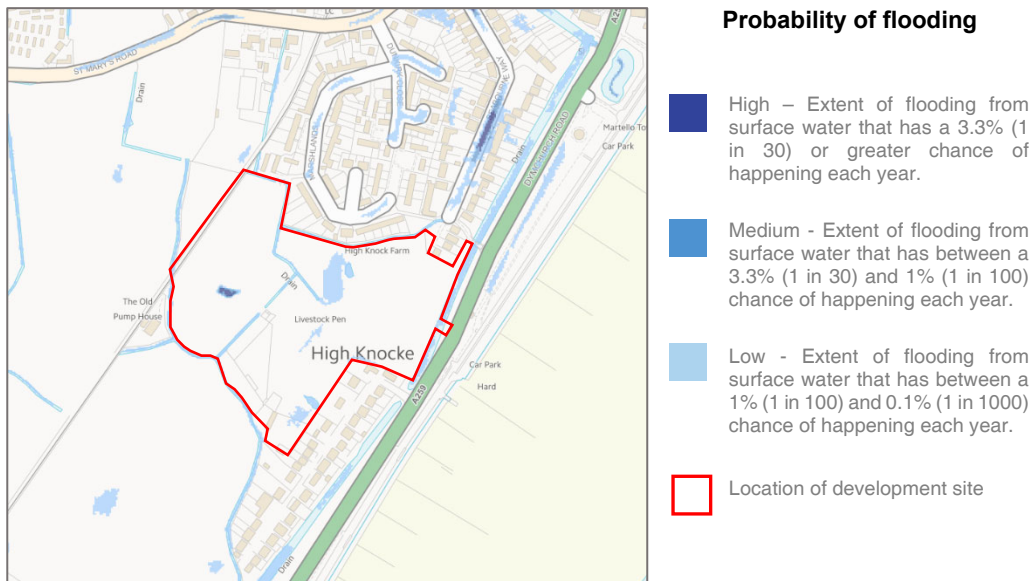


Figure 3.1 – EA's 'Flood Risk from Surface Water' map (© Environment Agency).

Flooding from Groundwater – Water levels below the ground rise during wet winter months, and fall again in the summer as water flows out into rivers. In very wet winters, rising water levels may lead to the flooding of normally dry land, as well as reactivating flow in 'bournes' (streams that only flow for part of the year).

Given the low-lying nature of this area and the proximity to the coast, there is potential for the groundwater table to become elevated. However, the detailed mapping on groundwater emergence provided as part of the Defra Groundwater Flood Scoping Study (May 2004) shows that the site itself is not located within an area where groundwater emergence is predicted.

This is supported by the absence of groundwater flooding events during the very wet periods of 2000/01 or 2002/03, and mapping contained within the SFRA which identifies that there are no records of groundwater flooding having affected the site in the past. Consequently, the risk of flooding from this source is considered to be *low*.

Flooding from Sewers – In urban areas, rainwater is typically drained into surface water sewers or sewers containing both surface and wastewater known as "combined sewers". Flooding can result when the sewer is overwhelmed by heavy rainfall, becomes blocked, or has inadequate capacity; this will continue until the water drains away.

Inspection of asset location mapping provided by SW (Figure 3.2) identifies that the only sewer onsite is a foul rising main, with no manholes present within the site. There are also separate foul and surface water sewers to the north of the site, and a foul sewer to the south east. If floodwater were to exit these sewers (i.e., following an extreme rainfall event, or due to a blockage) floodwater would likely be contained within the highways or gardens of the surrounding properties, not directed towards the site. Taking the above into account, it is considered that the risk of flooding from this source is *low*.

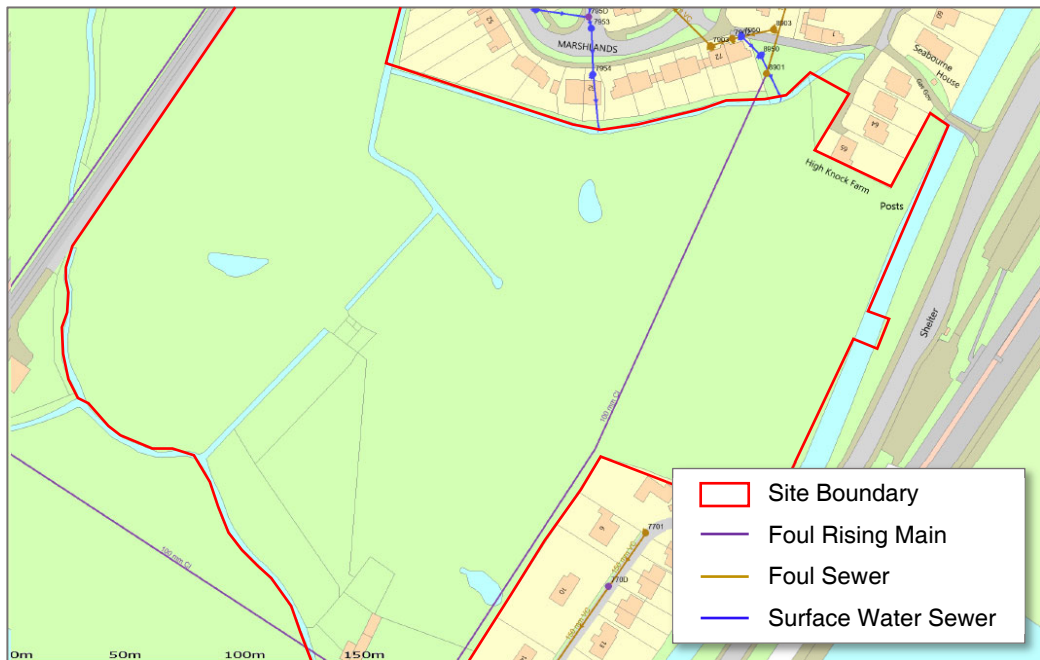


Figure 3.2 – Asset location mapping provided by SW (a full-scale copy can be found in Appendix A.2)

Whilst the risk of flooding from sewers is concluded to be low, it should be acknowledged that for any development within 3m of a public sewer, SW should be consulted to either obtain a build over agreement or to redirect the sewer. In this case, the applicant has taken into account the 3m easement and located all development outside this area.

Flooding from Reservoirs, Canals and other Artificial Sources – Non-natural or artificial sources of flooding can include reservoirs, canals, and lakes, where water is retained above natural ground level. In addition, operational and redundant industrial processes including; mining, quarrying, sand and gravel extraction, may also increase the depth of floodwater in areas adjacent to these features.

The potential effects of flood risk management infrastructure and other structures also needs to be considered. For example; reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of dam or bank failure.

Inspection of the OS mapping for the area shows that there are no artificial sources of flooding within close proximity to the site. In addition, the EA's 'Flood Risk from Reservoirs' map shows that the site is not within an area considered to be at risk of flooding from reservoirs. Therefore, the risk of flooding from this source is considered to be *low*.

A summary of the overall risk of flooding from each source is provided in Table 3.1 below.

Source of flooding	Initial level of risk	Appraisal method applied at the initial flood risk assessment stage
Sea	Appraised further in Section 5	EA's 'Flood Map for Planning'
Rivers, Ordinary and man-made watercourses	Low	OS mapping and aerial height data
Overland flow	Low	EA's 'Flood Risk from Surface Water' map and site-specific topographic survey
Groundwater	Low	Defra Groundwater Flood Scoping Study, BGS Geology of Britain map, historic records in the SFRA
Sewers	Low	OS mapping and asset location data provided by SW
Artificial sources	Low	OS mapping and EA's 'Flood Risk from Reservoirs' map

Table 3.1 – Summary of flood sources and risks.

3.3

Existing Flood Risk Management Measures

Dymchurch - Information provided by the EA and contained within the SFRA identifies that the site benefits from sea defence infrastructure along the Dymchurch frontage, which is designed to provide a 1 in 200 year standard of protection. The defences between High Knocke and Martello Tower number 23 comprise a sea wall, which includes a concrete wave return wall and stepped revetment. The defences from Martello Tower number 23 to Dymchurch Redoubt comprise a sea wall with rock armour revetment. The crest height of the defences along this stretch of coast varies from 6.5 to 7.7m AODN.

Romney Marsh – As part of the Folkestone to Cliff End Strategy, it is planned to improve the remaining sea defences along the Romney Marsh to provide a 1 in 200 standard or protection. The EA's Hythe Ranges Sea Defence Scheme, which forms part of this strategy, was completed in December 2020. This scheme improved the defences to a 1 in 200 year standard of protection. The works undertaken involved refurbishment and replacement of timber groynes, shingle recharge and a small rock revetment around the Grand Redoubt.

4 Climate Change

The global climate is constantly changing, but it is widely recognised that we are now entering a period of accelerating change. Over the last few decades there have been numerous studies into the impact of potential changes in the future and there is now an increasing body of scientific evidence which supports the fact that the global climate is changing as a result of human activity. Past, present, and future emissions of greenhouse gases are expected to cause significant global climate change during this century.

The nature of climate change at a regional level will vary: for the UK, projections of future climate change indicate that more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall could be expected.

These effects will tend to increase the size of Flood Zones associated with rivers, and the amount of flooding experienced from other inland sources. The rise in sea level will change the frequency of occurrence of high water levels relative to today's sea levels. It will also increase the extent of the area at risk should sea defences fail. Changes in wave heights due to increased water depths, as well as possible changes in the frequency, duration and severity of storm events are also predicted.

4.1 Planning Horizon

To ensure that any recommended mitigation measures are sustainable and effective throughout the lifetime of the development, it is necessary to base the appraisal on the extreme flood level that is commensurate with the planning horizon for the proposed development. The NPPF and supporting Planning Practice Guidance Suite state that residential development, such as the proposed development, should be considered for a minimum of 100 years.

4.2 Potential Changes in Climate

Extreme Sea Level

Global sea levels will continue to rise, depending on greenhouse gas emissions and the sensitivity of the climate system. The relative sea level rise in England also depends on the local vertical movement of the land, which is generally falling in the south-east and rising in the north and west.

Reference to guidance published by the EA specifies allowances for different epochs and regions across England. The predicted rates of relative sea level rise for the 'South East' region, relevant to the subject site, are shown in Table 4.1. These values which correspond with the Higher Central and Upper End percentiles (the 70th and 90th percentile respectively).

Administrative Region	Allowance Category	Net Sea Level Rise (mm/yr) (Relative to 2000)			
		2000 to 2035	2036 to 2065	2066 to 2095	2096 to 2125
South east	Higher Central	5.7	8.7	11.6	13.1
	Upper end	6.9	11.3	15.8	18.2

Table 4.1 – Recommended contingency allowances for net sea level rise.

From these values, the extreme sea level at the site can be seen to change with time and this change is not linear. The 1 in 200 year extreme sea level at the site has therefore been calculated for a number of steps between the current day and the year 2115 and these values are shown in Table 4.2 below.

Year	'Higher Central' scenario	'Upper End' scenario
Current day (year 2017)	4.83	4.83
2035	4.93	4.95
2065	5.19	5.29
2080	5.37	5.53
2095	5.54	5.77
2115	5.80	6.13

Table 4.2 – Climate change impacts on extreme sea levels for a 1 in 200 year return period event based on values taken from the EA's Coastal Flood Boundary Condition database.

The development that is the subject of this FRA is classified as residential and therefore the extreme sea level is taken as 5.80m AODN in the 'Higher Central' scenario, and 6.13m AODN in the 'Upper End' scenario.

It is recognised that the Romney Marsh Breach and Flood Forecasting (completed in 2020) uses UKCP09 guidance for its climate change projections. The model is therefore based on previous estimates of sea level rise as opposed to the values stated in Table 4.1. However, the EA has confirmed that the previous climate change allowances, which have been used within the model, "represent the high end of the range of sea level rise projected by UKCP18" (i.e., the new 'Upper End scenario'). Consequently, in the absence of detailed modelling which references the latest guidance, the Romney Marsh Breach and Flood Forecasting modelling has been used to assess the risk of flooding to the development site (Section 5).

Offshore Wind Speed and Extreme Wave Height

As a result of increased water depths resulting from changes in the climate, wave heights may change. The climate change allowances for offshore wind speed and wave height are shown in Table 4.3 below and where appropriate have been applied as part of this appraisal. These figures are applicable around the entire English coast and are relative to a 1990 baseline. They also include a sensitivity allowance which should be used to show that the range of impact of climate change is understood.

Parameter	2000 to 2055	2065 to 2125
Offshore wind speed allowance	+5%	+10%
Offshore wind speed sensitivity test	+10%	+10%
Extreme wave height allowance	+5%	+10%
Extreme wave height sensitive test	+10%	+10%

Table 4.3 – Recommended climate change allowance and sensitivity ranges for offshore wind speed and extreme wave height (relative to 1990).

The Romney Marsh Breach and Flood Forecasting, which has been referenced as part of this appraisal, includes the appropriate 10% allowance for both offshore wind speed and extreme wave height.

Peak Rainfall Intensity

Recognising that the impact of climate change will vary across the UK, the allowances were updated in May 2022 to show the anticipated changes to peak rainfall across a series of management catchments. The proposed development site is located in the **Rother Management Catchment**, as defined by the 'Peak Rainfall Allowance' maps, hosted by the Department for Environment, Food and Rural Affairs. Guidance provided by the EA states that this mapping should be used for site-scale applications (e.g. drainage design), in small catchments (less than 5km²), or urbanised drainage catchments. For large rural catchments, the peak river flow allowances should be used.

The proposed development will include a surface water management strategy and the Peak Rainfall Allowances for the Rother Management Catchment should be applied to the hydraulic calculations undertaken as part of this.

For each Management Catchment, a range of climate change allowances are provided for two time epochs and for each epoch, there are two climate change allowances defined. These represent different levels of statistical confidence in the possible scenarios on which they are calculated. The two levels are as follows:

- Central: based on the 50th percentile
- Upper End: based on the 90th percentile

The EA has provided guidance regarding the application of the climate change allowances and how they should be applied in the planning process. The range of allowances for the Management Catchment in which the development site is located are shown in Table 4.4 below.

Management Catchment Name	Annual exceedance probability	Allowance Category	2050s	2070s
Rother	3.3 %	Central	20%	20%
		Upper End	40%	40%
	1 %	Central	20%	20%
		Upper End	45%	45%

Table 4.4 – Recommended peak rainfall intensity allowances for each epoch for the Rother Management Catchment.

For a development with a design life of 100 years the Upper End climate change allowance is recommended to assess whether:

- there is no increase in flood risk elsewhere, and;
- the development will be safe from surface water flooding.

From Table 4.4 above, it can be seen that the recommended climate change allowance for this site is a 45% increase in peak rainfall. Therefore, this increase has been applied to the hydraulic drainage model constructed to inform the surface water management strategy. Where this allowance has been applied the abbreviation “+45%cc” has been used.

5 Probability and Consequence of Flooding

When appraising the risk of flooding to new development it is necessary to assess the impact of the 'design flood event'. Flood conditions can be predicted for a range of return periods and these are expressed in either years or as a probability, i.e., the probability that the event will occur in any given year, or Annual Exceedance Probability (AEP). The design flood event is taken as the 1 in 200 year (0.5% AEP) event for sea or tidal flooding, including an appropriate allowance for climate change (refer to Section 4.2).

5.1 Actual Risk of Flooding

The EA has provided the modelling results from the Romney Marsh Breach and Flood Forecasting (2020), which includes defended and undefended scenarios. The site is currently defended by sea defence infrastructure providing a standard of protection up to 1 in 200 year return period event and, therefore, the undefended outputs would provide an unrealistic representation of the actual risk to the site.

When the results of the defended scenario are considered, it is evident that the vast majority of the site is not affected by flooding. During a 1 in 50 year return period event (used to define the functional floodplain in the absence of modelling results for a 1 in 30 year return period event) and a 1 in 200 year return period event under current day conditions only a small area of the site is shown to be subject to flooding (Figure 5.1). The only area of the site where flooding is predicted to occur is along the coastal frontage, within the Clobdsen Sewer (main river), with all development located outside this area.

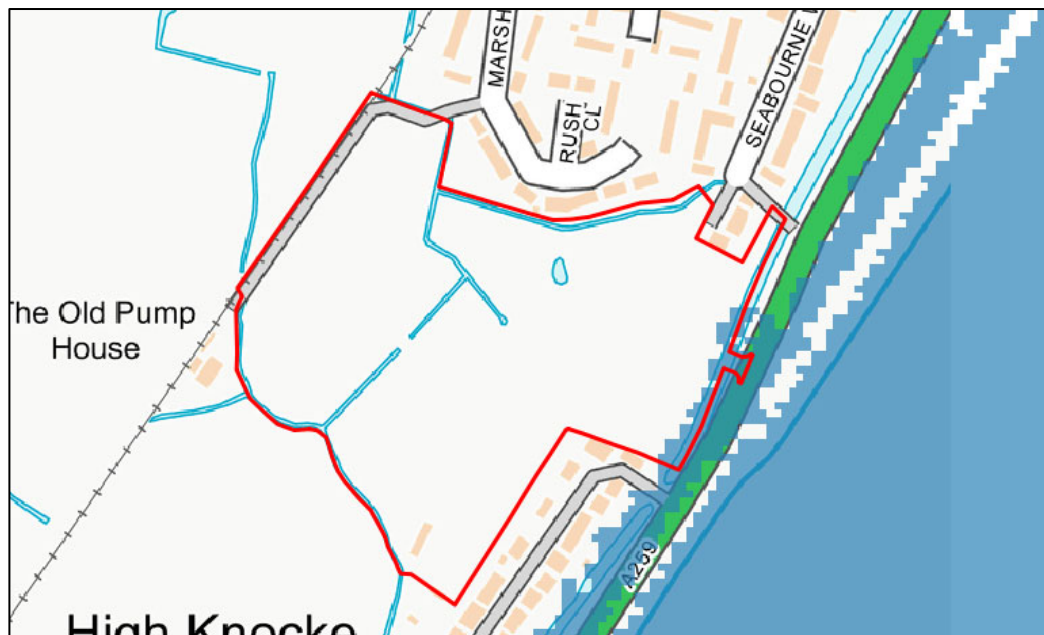


Figure 5.1 – Extent of flooding during a 1 in 50 year return period event (contains Ordnance Survey data © Crown copyright and database right 2024 - © Environment Agency).

When considering an allowance for climate change (i.e., the design flood event), again only a very small area along the coastal frontage in and adjacent to the Clobdsen Sewer is shown to be subject to flooding with all units being located outside the extent of flooding. (Figure 5.2). The flood level during this event varies due the nature of wave overtopping and the flow of water. The maximum flood level of 5.00m AODN is recorded on the access point to Dymchurch Road, with the lowest flood level of 0.84m AODN recorded within the Clobdsen Sewer.



Figure 5.2 – Extent of flooding during the design flood event, overlain onto the proposed site layout (© Environment Agency).

5.2 Residual Risk of Flooding

Whilst the defences may provide a high standard of protection into the future, there is always the risk that these defences could fail, for example through structural failure (i.e., breach), or a less predictable mechanism such as ship impact, or an act of terrorism. The risk of flooding through such a scenario is termed *residual risk*.

To determine the impact of such an event requires the use of detailed hydrodynamic flood modelling, such as that undertaken as part of the Romney Marsh Breach and Flood Forecasting. Analysis of the 14 individual breach locations tested as part of the modelling study identifies that, during design flood conditions, the site could be affected by one of the breach scenarios: at the Hythe Ranges (Breach 8). Under this scenario, there is a maximum predicted flood level on site of **2.54m AODN**.

When this flood level is compared to the land levels on site, the depth of flooding where development is proposed could vary from 0.79m in the lowest areas, to no flooding in the highest areas (Figure 5.3).

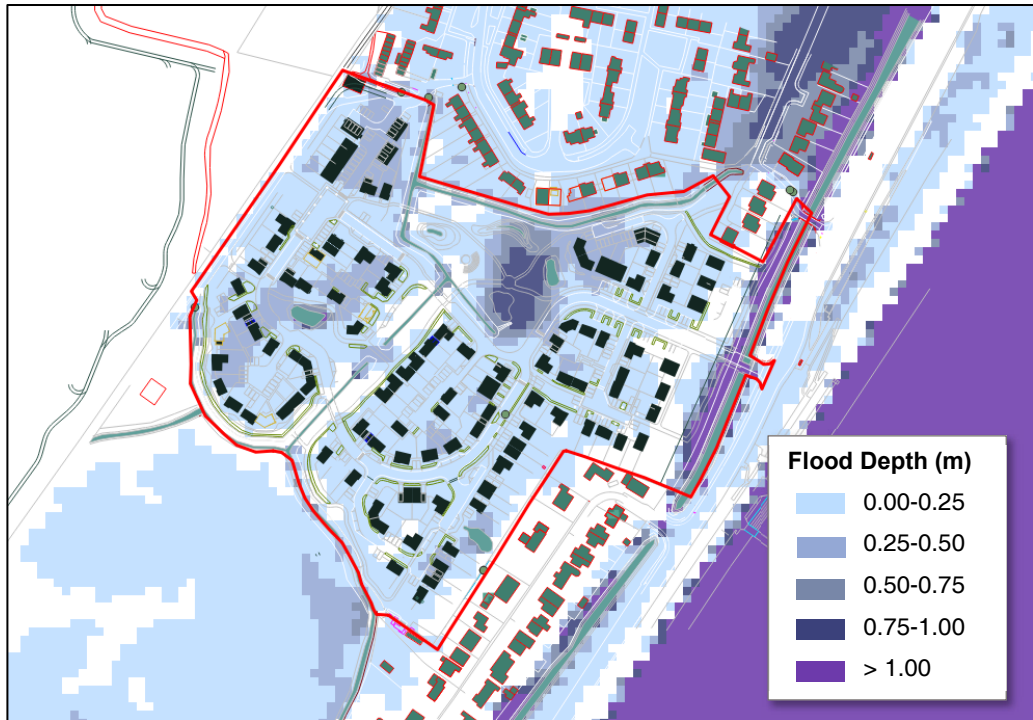


Figure 5.3 – Predicted extent and depth of flooding during a breach in the Hythe Ranges defences under design event conditions, overlain onto the proposed site layout (© Environment Agency).

However, the EA's Hythe Ranges Sea Defence Scheme was completed in December 2020 (refer to Section 3.3), and as such, the defences along the Hythe Ranges frontage have been constructed to a high standard. Consequently, it is considered that a breach is unlikely to occur in this location, and therefore, this modelling represents a worst-case scenario. Notwithstanding this, a conservative approach has been adopted and the breach results have been used to inform the mitigation measures outlined within this report.

5.3 Time to Inundation and Rate of Rise of Floodwater

The site is located over 5km from the Hythe Ranges defences and as such, there will be a residual delay between the defences breaching and the floodwater reaching the site. Given that the volumes of water flowing through the breach are likely to be very large, the flow velocities in close proximity to the breach will be very high and are likely to cause structural damage. However, these velocities will decrease with distance away from the breach.

It is anticipated that from the point of a breach, it will take in excess of 6 hours for floodwater to reach the site from Hythe Ranges. Due to the extensive nature of the floodplain, it is considered that the rate of rise will be gradual.

6 Offsite Impacts and Other Considerations

6.1 Displacement of Floodwater

The construction of a new building within the floodplain has the potential to displace water and to increase the risk elsewhere by raising flood levels. However, where development is proposed in tidal floodplains such as is the case here, it is generally accepted by the EA that raising the ground or building on the floodplain is unlikely to impact on maximum tidal levels.

In regard to the proposed new access bridge across the Clobdsden Sewer, the soffit level and design of the bridge has been compared to existing bridges in the surrounding area (by others) and it has been confirmed that the bridge is designed to ensure that the structure does not impede flows within the main river.

6.2 Public Safety and Access

The NPPF states that safe access and escape should be available to/from new developments located within areas at risk of flooding. The Practice Guide goes on to state that access routes should enable occupants to safely access and exit their dwellings during design flood conditions and that vehicular access should be available to allow the emergency services to safely reach the development.

It has been identified that the actual risk of flooding of the proposed development is low, and it is only in the unlikely event that the defence infrastructure was to fail that the site could flood. In order to determine if safe access is available, the hazard classification outputs from the SFRA modelling have been referenced. The outputs (Figure 6.1) show that the majority of the site is classified as having either no, or a 'low' hazard classification. Consequently, access may still be available at the peak of the design event for the majority of the residents of the site.

However, there are small areas shown to have a 'moderate' to 'significant' hazard classification. Therefore, safe access from these areas of the site to the surrounding area will not be available during the design flood event.



Figure 6.1 – Hazard rating classification on site during a breach at Hythe Ranges under design conditions. Site boundary delineated in black. See Table 6.1 for key.

Hazard Rating (HR)	Degree of flood hazard	Description
< 0.75	Low	Caution – shallow flowing water or deep standing water
0.75 to 1.25	Moderate	Dangerous for some, i.e., children – deep or fast flowing water
1.25 to 2.0	Significant	Dangerous for most people – deep fast flowing water
> 2.0	Extreme	Dangerous for all – extreme danger with deep and fast flowing water

Table 6.1 – Classification of Hazard Rating Thresholds.

As safe access may not be available to all residents at the peak of the design event, it is recommended that the residents sign up to receive the EA's Flood Warnings (Refer to Section 7.4) to ensure that they receive forewarning of extreme conditions which could result in a breach occurring.

6.3 Proximity to Watercourse

Under the Water Resources Act 1991 and Land Drainage Byelaws, any proposals for development in close proximity to a 'main river' would need to take into account the EA's requirement for an 8m

buffer zone between the riverbank and any permanent construction such as buildings or car parking etc. This buffer zone increases to 16m for tidal waterbodies and sea defence infrastructure.

In addition, an Internal Drainage Board (IDB) is responsible for the regulation of watercourses located within defined 'internal drainage districts'. The IDB will need to be consulted to obtain consent to discharge to the watercourses crossing the site, however, the IDB have confirmed that the developer is responsible for the maintenance of the watercourses crossing the site.

The applicant has confirmed that all dwellings will be located over 16m easement from the Clobdsen Sewer (main river) and over 8m from the ordinary watercourses which cross the site. The only development within the easements will be access roads and bridges.

7 Flood Mitigation Measures

The key objectives of flood risk mitigation are:

- to reduce the risk of the development being flooded
- to ensure continued operation and safety during flood events
- to ensure that the flood risk downstream of the site is not increased by increased runoff
- to ensure that the development does not have an adverse impact on flood risk elsewhere

The following section of this report examines ways in which the risk of flooding at the development site can be mitigated.

Mitigation Measure	Appropriate	Comment
Careful location of development within site boundaries (i.e., Sequential Approach)	✓	Refer to Section 7.1
Raising floor levels	✓	Refer to Section 7.2
Land raising	✓	Refer to Section 7.2
Compensatory floodplain storage	✗	Not required
Flood resistance & resilience	✓	Refer to Section 7.3
Alterations/ improvements to channels and hydraulic structures	✗	Not required
Flood defences	✗	Not required
Flood warning	✓	Refer to Section 7.4
Surface water management	✓	Refer to Section 8

Table 7.1 – Appropriateness of mitigation measures.

7.1 Application of the Sequential Approach at a Local Scale

The sequential approach to flood risk management can also be adopted on a site based scale and this can often be the most effective form of mitigation. For example, on a large scheme this would mean locating the more vulnerable dwellings on the higher parts of the site and placing parking, recreational land or commercial buildings in the lower lying and higher risk areas.

The scheme has applied the sequential approach to the layout by locating as many of the proposed dwellings as possible outside the areas with the greatest hazard rating on site. The proposals have also applied the sequential approach to the internal layout of the dwellings by locating the most vulnerable elements (i.e., sleeping accommodation) on the first floor of the dwellings.

7.2 Raising Floor Levels & Land Raising

The EA recommends that the minimum floor level of buildings at risk of flooding should be 300mm above the design flood level. The EA's guidance also requires that all sleeping accommodation be raised a minimum of 600mm above the design flood level.

The design flood level for this development is 2.54m AODN and therefore based on the above guidance, the minimum floor levels are as follows:

Living accommodation = 2.84m AODN

Sleeping accommodation = 3.14m AODN

The applicant has confirmed that all the proposed dwellings will meet the above requirements for finished floor levels. The floor levels will be achieved through a combination of floor level raising and land raising. As such, it is considered that the EA's floor level requirements are achieved.

7.3 Flood Resistance and Resilience

Flood Resistance or 'dry proofing', where flood water is prevented from entering the building. For example, using flood barriers across doorways and airbricks, or raising floor levels. These measures are considered appropriate for 'more vulnerable' development where recovery from internal flooding is not considered to be practical.

Flood Resilience or 'wet proofing', accepts that flood water will enter the building and allows for this situation through careful internal design for example raising electrical sockets and fitting tiled floors. The finishes and services are such that the building can quickly be returned to use after the flood. Such measures are generally only considered appropriate for some 'less vulnerable' uses and where the use of an existing building is to be changed and it can be demonstrated that no other measure is practicable.

It has been shown that the ground floor of all dwellings will be raised above the design flood level. Notwithstanding this, it is recommended that the ground floor of the dwellings is constructed using flood resilient design techniques to manage the impact of floodwater on the structure below the flood level.

Details of flood resilience and flood resistance construction techniques can be found in the document '*Improving the Flood Performance of New Buildings; Flood Resilient Construction*', which can be downloaded from www.gov.uk.

7.4 Flood Warning

The nature of the flood mechanism in this location is tidal flooding associated with a tidal surge in the North Sea. The EA operate a flood forecasting and warning service in areas at risk of flooding from rivers or the sea, which relies on direct measurements of rainfall, river levels, tide levels, in-house predictive models, rainfall radar data and information from the Met Office. This service operates 24 hours a day, 365 days a year. Whilst it is not possible to predict the occurrence of a breach, it is possible to receive forewarning of extreme offshore conditions could result in a failure of the defences. It is therefore recommended that the residents of the proposed development sign up to the EA's Flood Warning Service either by calling 0345 988 1188, or by visiting;

www.gov.uk/sign-up-for-flood-warnings

With these warnings in place, the residents of the proposed development will receive forewarning of conditions which could result in flooding and can retreat to an area outside the predicted extent of flooding. In the unlikely event the defences were to fail, and it is not possible to evacuate before the onset of flooding, safe refuge will be available within the dwellings which will be raised above the design flood level.

8 Surface Water Management Strategy

8.1 Background and Policy

The general requirement for all new development is to ensure that the runoff from the development is managed sustainably, and that the drainage solution does not increase the risk of flooding at the site or within the surrounding area. For undeveloped greenfield sites, the impact of the proposed development will require mitigation to ensure that the runoff from the site replicates the natural drainage characteristics of the pre-developed site.

The Non-statutory Technical Standards for SuDS (NTSS) specify criteria to ensure sustainable drainage is included within development classified as 'major development', as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010. It is, however, recognised that SuDS should be designed to ensure that the maintenance and operation requirements are economically proportionate.

In this instance, the proposed development is for the construction of over 100 residential units. As a result, the proposals are classified as 'major' development and therefore, the NTSS will apply. Reference to the NTSS has been made throughout the following sections of this report to ensure the principles of sustainable drainage are considered.

In addition to the NTSS, Kent County Council's (KCC) Drainage and Planning Policy Statement (December 2019) also states that all major developments should undertake a SWMS to provide evidence on how SuDS can be incorporated within the proposed development.

8.2 Surface Water Management Overview

The main characteristics of the site, which have the potential to influence surface water drainage, are summarised in Table 8.1 below.

Site Characteristic	Value
Total area of site	6.3 ha
Impermeable area (existing)	Greenfield Site
Impermeable area (proposed)	Roof area = 7400 m ² Roads and parking spaces = 11195 m ² Total = 1.86 ha
Greenfield runoff rates (based on Flood Estimation Handbook (FEH) methodology)	QBar = 9.0 l/s Q30 = 19.9 l/s Q100 = 25.3 l/s
Current surface water discharge method	Discharges into a series of existing ditches onsite
Is there a watercourse within close proximity to site?	Yes

Table 8.1 – Site characteristics affecting rainfall runoff.

Greenfield runoff rates have been calculated using the FEH methodology. Synthetic rainfall data has been derived using the variables obtained from the FEH online web service, and the routines within the Causeway Flow+ software. The water flows generated on site for the existing and post-development conditions have been calculated by using the Modified Rational Method.

Runoff rates have been calculated for a range of annual return probabilities, including the 100 year return period event. The values for the developed site represent the peak runoff rates for the critical storm duration in the case that no attenuation would be provided. These values are summarised in Table 8.2 below for a range of return periods.

Return Period (years)	Peak Runoff	
	Existing Site (greenfield)	Developed Site
2	9.0 l/s	422.9 l/s (15 minutes)
30	19.9 l/s	1,084.1 l/s (15 minutes)
100	25.3 l/s	1,381.9 l/s (15 minutes)

*Table 8.2 – Summary of peak runoff. *Critical storm durations shown in (x minutes)*

Reference to the tables above show the proposed development will increase the percentage of impermeable area within the boundaries of the site. Consequently, this will increase the rate and volume of surface water runoff discharged from the site. It will therefore be necessary to provide

mitigation measures to ensure the rate of runoff discharged from the site is not increased as a result of the proposed development.

Furthermore, the potential use of SuDS within the proposed development will be considered to assess the practicality of better replicating greenfield behaviour, in accordance with Local Planning Policy, and S3 and S5 of the NTSS.

8.3 Existing Drainage

The existing site is greenfield, and currently discharges surface water runoff into a series of ditches flowing through the site.

Reference to asset location mapping provided by SW (Figure 3.2) shows that the sewers in this area are typically separated into dedicated surface water and foul water networks. The surface water sewers discharge into the ditches around the site.

8.4 Opportunities to Discharge Surface Water Runoff

Part H of the Building Regulations summarises a hierarchy of options for discharging surface water runoff from developments. The preferred option is to **infiltrate** water into the ground, as this deals with the water at source and serves to replenish groundwater. If this option is not viable, the next option of preference is for the runoff to be discharged into a **watercourse**. Only if neither of these options are possible, the water should be conducted into the **public sewer** system.

The following opportunities for managing the surface water runoff discharged from the development site are listed in order of preference:

Water Re-Use - Water re-use systems can rarely manage 100% of the surface water runoff discharged from a development, as this requires the yield from the building and hardstanding area to balance perfectly with the demand from the proposed development. Consequently, whilst rainwater recycling systems can be considered for inclusion within the scheme, an alternative solution for attenuating storm water will still be required.

Infiltration – Reference to BGS mapping shows that the bedrock geology of the site is made up of Tunbridge Wells Sand Formation (Sandstone), with superficial deposits of Tidal Flat deposits. Although the strata are considered permeable, the low-lying nature of the land, alongside the adjacent watercourses, indicates high ground water levels within the area and as such, it is unlikely that a sufficient distance between groundwater and the proposed SuDS can be provided. Consequently, it has been assumed on this basis that infiltration will not be a suitable method for discharging surface water runoff from the site. Although the use of permeable surfacing may still be appropriate as a means to store surface water.

Discharge to Watercourses – Figure 2.1 (above) shows the location of a series of existing drainage ditches through the site. The IDB has confirmed that only the ditch along the north boundary has onward connectivity, and they have recommended that a direct connection into the

Clobsden Sewer is proposed. Consequently, connecting into this watercourse is likely to be the most sustainable solution for draining surface water runoff from the proposed development.

Discharge to Public Sewer System – A more preferable solution for managing surface water runoff discharged from the development is available and therefore, it is unlikely that a connection to the public sewer system will be required.

8.5 Constraints and Further Considerations

There are a number of potential constraints that should be considered as part of the drainage strategy. The key constraints that are relevant to this development are listed below:

- There is limited open space to incorporate SuDS that require significant areas of land, such as wetland areas.
- Land levels will be raised in order to achieve the minimum floor level of buildings at risk of flooding. A proposed level plan has not been provided at this stage and therefore this assessment has been based upon existing ground levels.
- Due to the anticipated high groundwater levels at the site, it will not be possible to discharge surface water runoff via infiltration.
- It is recommended that seasonal groundwater monitoring is undertaken to confirm groundwater levels and its potential influence on the drainage system.
- For the new connections to the Clobsden Sewer, it will be necessary to obtain consent from the Environment Agency, who should be consulted as part of the connection proposals.
- Due to the configuration of the site and the land levels, it will be necessary to pump in different locations of the site to the proposed outfall. This has been incorporated into the design of the SuDS system and is discussed further in Section 8.7.

8.6 Sustainable Drainage Systems (SuDS)

Appropriately designed SuDS can be utilised such that they not only attenuate runoff, but also provide a level of improvement to the quality of the water passed on to watercourses or into the groundwater table. This is known as Source Control and is a fundamental part of the SuDS philosophy.

A range of typical SuDS that can be used to improve the environmental impact of a development is listed in Table 8.3 below, along with the relative benefits of each feature and the appropriateness for the subject site.

SuDS	Description	Comments	Appropriate for Site?
Rainwater Harvesting Systems	Collection of rainwater and storage for reuse on site (e.g., water butts)	There are no known constraints	Yes
Green/Blue Roofs	Provide landscaping and planting at roof level to reduce surface water runoff rates	Dependent on roof type	No
Infiltration Systems	Allow water to percolate into the ground at a controlled rate via natural infiltration	Limited due to the potential for high groundwater levels	No
Filter Strips	Wide, gently sloping, densely planted areas promoting sedimentation and filtration	Limited due to the potential for high groundwater levels	No
Filter Drains	Trenches infilled with stone/gravel providing attenuation, sedimentation and filtration	Limited due to the potential for high groundwater levels	No
Swales	Broad, shallow channels that convey and store runoff, and allow infiltration	None	Yes
Bioretention Systems / Rain Gardens	A shallow landscaped depression allowing runoff to pond temporarily on the surface	None	Yes
Permeable Pavements	Runoff is allowed to soak into structural paving and stored, potentially being allowed to infiltrate	None	Yes
Underground Storage	Below ground storage which can be used to temporarily store storm water	None	Yes
Detention Basins	A landscaped depression for attenuation with a restricted runoff	Insufficient space	No
Ponds and Wetlands	A permanent pool of water which can be used for attenuation and controlled outflows by water levels	Insufficient space	No

Table 8.3 – An assessment into the suitability of SuDS at this site.

From Table 8.3 above, it can be seen that there are a number of SuDS which could be considered suitable for use at this site. However, at this stage in the planning process, it is envisaged that a combination of underground storage and permeable surfacing will be used to attenuate the surface water runoff, before discharging into the Clobdsen Sewer.

8.7

Proposed Surface Water Management Strategy

The drainage strategy set out below discusses each of the different elements of the proposed scheme, along with calculations that have been undertaken to demonstrate how the overall objectives can be achieved. This does not represent a detailed surface water drainage design; it is simply an assessment to demonstrate that the objectives and requirements of the NPPF can be met at the planning stage.

Water Butts

To reduce the developments reliance on potable water supplies for external use, there is the potential to incorporate water butts within the rear gardens. Typical sizes and dimensions of water butts are outlined below.

Typical house water butt options	Dimensions of a typical house water butt	Volume of storage provided (litres)
Type 1 (wall mounted – small)	1.22m high x 0.46m x 0.23m	100
Type 2 (standard house water butt)	0.9m high x 0.68m diameter	210
Type 3 (large house water butt)	1.26m high x 1.24m x 0.8m	510
Type 4 (column tank – very large)	2.23m high x 1.28m diameter	2,000

Table 8.4 – Estimated storage capacity of available water butts.

In this case, the demand for potable water from each of the gardens is likely to be relatively small and as a result, small wall mounted water butts or slightly larger standard house water butts are likely to be the most appropriate size for inclusion within the scheme.

It is recognised that each of the water butts will need to overflow into the main drainage system for the site, to ensure that in the event the water butt is full prior to the onset of the design rainfall event, water can be discharged away from the properties without increasing the risk of flooding.

Rain gardens

To store and manage surface water across the site a series of rain gardens can be used. Runoff from some of the outflows from the permeable surfacing and impermeable areas can be directed into rain gardens subsequently transported across the site into the geo-cellular storage tanks. In addition, these features will further integrate water within the design of the development and provide additional pollution control benefits, as well as providing habitats for wildlife. However, these systems have not been included in the calculations, due to the fact that the hydraulic model is based on the worst-case scenario where attenuation is dealt with underground storage and permeable surfacing only.

Permeable Surfacing

Runoff from the proposed roofs and hardstanding areas across the site, in addition to overflow from the water butts, will be directed via underground pipes into a layer of open graded sub-base material located beneath permeable surfacing. The permeable surfacing will be laid across the proposed roads on site, with exact locations shown in the indicative drainage layout in Figure 8.1. The open graded sub-base will be used to store surface water runoff, before being conveyed to geo-cellular storage tanks. Exact details of each permeable surfacing system can be found in the full scale drainage layout drawing in Appendix A.4.

Underground Storage (Geo-cellular Storage Tank)

Surface water runoff stored within the permeable surfacing systems will be directed via underground pipes into a series of geo-cellular storage tanks located beneath the roads and parking areas. The locations of all geo-cellular storage tanks are shown within the indicative drainage layout in Figure 8.1. These underground storage tanks are designed to store runoff from the entire development site during the design rainfall event. The rate runoff is discharged offsite will be restricted to a rate no greater than the greenfield runoff rates using flow control devices and pumps. Due to the flat topography of the site, it will be necessary to pump surface water in order to discharge into the Clobdsen Sewer. The IDB has been contacted and they have indicated that the summer water retention level is approximately 1.2mAODN. Therefore, the drainage network has been designed to discharge above this level, to avoid the outfall becoming hydraulically locked. Notwithstanding this, it is likely that the watercourse along the north boundary of the site also has a connection into the Clobdsen Sewer. It is recommended that further investigation is undertaken to confirm the onward connectivity of this watercourse, as this may provide a more suitable connection to discharge runoff from the proposed development, facilitating a discharge by gravity. If a connection to this watercourse were proposed, it will be necessary to include the long-term maintenance of the watercourse in any management arrangement, and to confirm the ownership of the watercourse to ensure that access for maintenance will be possible.

Exact details for each geo-cellular storage tank can be found in the full scale drainage layout drawing in Appendix A.4.

Runoff rates have been calculated for a range of annual return probabilities, including the 1 in 100 year return period event, with a 45% increase in rainfall intensity to account for future climatic changes. These values are summarised in Table 8.5 below.

Return Period	Pre-development discharge rates	Post-development discharge rates
1 in 2yr	9.0 l/s	9.0 l/s
1 in 30yr	19.9 l/s	9.0 l/s
1 in 100yr+45%cc	25.3 l/s	9.0 l/s

Table 8.5 – Summary of Causeway Flow+ analysis of discharge rates for the proposed SuDS.

It is evident that, with the inclusion of the proposed SuDS, there is the potential to accommodate all the surface water runoff from the site up to, and including, the design rainfall event. Furthermore, the rate at which water is discharged to the Clobdsen Sewer will be attenuated to a rate which is no greater than Qbar and is considered likely to be acceptable to the IDB and LLFA.

8.8 Indicative Drainage Layout Plan

Figure 8.1 below is an indicative drainage layout plan delineating how the proposed SuDS can be incorporated into the scheme proposals.



Figure 8.1 - Indicative drainage layout plan showing the proposed location of SuDS.

A full copy of this layout is located in Appendix A.4 of this report.

8.9 Management and Maintenance

For any surface water drainage system to operate as originally designed, it is necessary to ensure that it is adequately maintained throughout its lifetime.

The key requirements of any management regime are routine inspection and maintenance. When the development is taken forward to the detailed design stage, an 'owner's manual' will need to be prepared. This should include:

- A description of the drainage scheme
- A location plan showing all of the SuDS features and equipment, such as flow control devices etc
- Maintenance requirements for each element, including any manufacturer-specific requirements

- An explanation of the consequences of not carrying out the specified maintenance
- Details of who will be responsible for the ongoing maintenance of the drainage system

For the SuDS features recommended by this assessment, the most obvious maintenance tasks will be the cleaning of the permeable surfacing, and the desilting and cleaning of the geo-cellular storage tanks. General maintenance schedules have been included in Appendix A.5 of this report, which demonstrate the maintenance requirements of the proposed SuDS.

For developments such as this, that rely to some extent on the ongoing inspection and maintenance of SuDS, it will be necessary to ensure that measures are in place to maintain the system for the lifetime of the development.

For the permeable surfacing system and the geo-cellular storage tanks, it is likely that the management company responsible for maintaining the rest of the site, will be tasked with the inspection and maintenance of these features.

For the SuDS located within the private garden areas, maintenance will be the responsibility of the individual property occupants. In this case, maintenance tasks are likely to include the desilting of the water butts.

Further details of the maintenance and management strategy should be confirmed following completion of a detailed drainage design for the development.

8.10 Sensitivity Testing and Residual Risk

When considering residual risk, it is necessary to consider the impact of a flood event that exceeds the design event, or the implications if the proposed drainage system becomes blocked.

For the water butts, there is a chance that a small amount of localised flooding could occur if the overflows from these features were to become blocked. Given the small catchment area draining to each of these features, the volume of floodwater will be relatively small, and it is unlikely to present a risk to the properties or occupants.

In the event of an exceedance scenario, localised flooding could occur within the roads. Raised kerbing can be used to create a temporary holding area, which will channel the water to the existing ditches or out of the site. Figure 8.2 below shows the most likely path water would take during an event that exceeds the design storm.



Figure 8.2 – Anticipated flow routes during an exceedance or blockage event.

Based on the analysis above, it is concluded that the proposed drainage system outlined within this strategy will not result in an increased risk of flooding to properties at the site or within the surrounding area.

9 Foul Water Management Strategy

9.1 Background

The objective of this foul water drainage strategy is to ensure a viable solution is available for managing foul effluent discharged from the proposed development site.

In general, there are two methods for draining effluent from proposed developments. The preferred solution is a connection to the public sewer network, which is controlled by the sewerage undertaker. Nonetheless, if there are no sewers near to the development site or there are particular reasons why a connection to the public sewer system would not be possible i.e., topography, cost, environmental concerns, then the use of package treatment systems or cesspits is permitted.

The EA's "Binding Rules" control the use of package treatment systems, and require the development to connect to the public sewer system if the site boundary is located within 30 metres of an existing sewer (plus an additional 30 meters for every proposed unit). In this case, the site is located within close proximity of a public foul sewer. Therefore, the use of package treatment systems is unlikely to be considered appropriate for this development.

9.2 Sewer Connection and Capacity

As indicated in Figure 3.2, there is an existing public foul sewer to the north-east of the site. There is also a foul sewer manhole to the north-west of the site which is not shown in Figure 3.2 as it is outside the area depicted in this figure. To drain foul effluent from the development to the public sewer system, it will be necessary to construct a foul water pumping station, and to pump into the existing foul network. In accordance with the Design and Construction Guidance (DCG), a Type 3 pumping station has been specified. A minimum 15 metre easement has been applied to ensure that the proposed wet well is at adequate distance from habitable buildings.

It is anticipated that the proposed development will connect into the existing sewer network. Figure 9.1 below outlines the potential connection routes for foul drainage into the existing sewer.

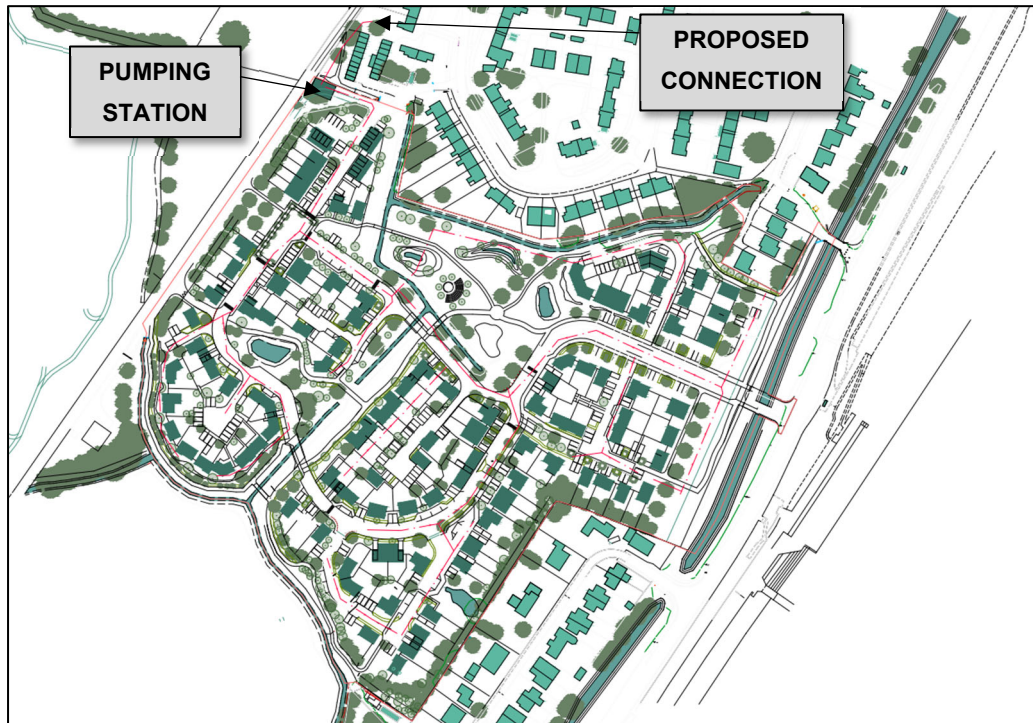


Figure 9.1 – Potential foul connection from the proposed properties to the existing foul sewer.

In accordance with the DCG, the design peak flow rate for foul water discharged from the proposed development has been calculated as 500m³/day.

It will be necessary to undertake foul water capacity checks with SW at the detailed design stage, to determine the existing capacity within the public sewer network at this location. If insufficient capacity is available within the existing foul sewer, then it will be necessary to undertake a 'Level 2 Capacity Check' to determine the viability of upgrading the existing foul sewer system.

9.3 The Water Industry Act

The Water Industry Act 1991 provides developers with a mechanism for connecting to the public sewerage infrastructure. The type of connection depends on the type and location of the sewers in relation to the site and third-party land.

As the nearest sewers to the site are located outside of the development site boundary, the developer must requisition a new length of sewer from the sewerage undertaker, through a Section 98 application.

As part of the Section 98 process, it is necessary to determine whether the existing sewer network requires any upgrades to accommodate effluent from the development site. If upgrades to the sewerage system are required these will be requisitioned under the same Section 98 application. In this case, it is likely additional offsite works will be required and these will therefore be included within the Section 98 application. It is acknowledged that the cost of a new connection and any additional works which are required to upgrade the public sewer system (to accommodate the additional foul effluent from the development) can be charged to the developer.

Under Section 101, the sewerage undertaker must undertake any works as part of this process within a reasonable timeframe, which is typically 6 months following the agreement being made. Mitigating circumstances and Grampian planning conditions can, however, result in different timescales.

9.4 Summary

While Figure 9.1 confirms a potential option for discharging foul water from the site is available, this does not constitute a detailed foul water drainage design and does not take into account detailed analysis of levels across the proposed site. Notwithstanding this, at this stage in the planning process, the scheme proposals do suggest that the proposed strategy for foul water management is achievable.

10 Conclusions and Recommendations

The overarching objective of this FRA is to appraise the risk of flooding at High Knocke Farm in Dymchurch, Kent to ensure that the proposals for development are acceptable in this location. In addition, the NPPF also requires the risk of flooding offsite to be managed to prevent any increase in flood risk as a result of new development. This report has therefore been prepared in accordance with the NPPF to quantify the risk and to provide recommendations for appropriate mitigation where necessary.

The proposals for development are for the construction of 125 new dwellings in Flood Zones 2 and 3, therefore, it will be necessary to apply the Sequential Test and Exception Test. Providing evidence in support of the Sequential Test is outside the scope of this report, although the information contained within this report can be used to support the test if required. The primary aim of this report is, however, to determine whether the proposals for development can pass Part B of the Exception Test.

The risk of flooding has been considered across a wide range of sources and it has been identified that the risk of flooding is low. The development site currently benefits from existing defence infrastructure, which provides a 1 in 200 year standard of protection over the next 100 years and therefore, it is only in the unlikely event that the defences were to fail that the development could be affected by flooding.

The following flood mitigation measures have therefore been recommended to ensure that the risk of flooding to the proposed development under this extreme scenario is appropriately managed, and to ensure that the development does not increase the risk of flooding offsite:

- **The sequential approach should be applied by avoiding development in the areas of site with the greatest hazard classification, where possible.** Inspection of the scheme drawings shows that as many of the dwellings as possible have been located outside the areas classified as having a significant hazard rating. The applicant has confirmed that the sequential approach has also been applied to the internal layout by locating the most vulnerable elements (i.e., sleeping accommodation) on the upper floors.
- **The ground floor should be raised 300mm above the design flood level of 2.54m AODN. Sleeping accommodation should be 600mm above the flood level.** The applicant has confirmed that the ground floor of all dwellings will be raised 300mm above the design flood level (i.e., to 2.84m AODN), and all sleeping accommodation will be on the upper floor (over 600mm above the flood level). This will be achieved through a combination of floor level raising and land raising, and will ensure that the dwellings meet the EA's floor level requirements.

- **The ground floor of the dwellings should be constructed using flood resilient design techniques.** The ground floor of the dwellings is proposed to be raised above the design flood level; however, the ground floor should be constructed using flood resilient materials to ensure that the structure can withstand the impacts of floodwater in the unlikely event of a breach.
- **The residents of the dwellings should sign up to the EA's Flood Warning Service.** The EA's flood warnings will provide forewarning of extreme weather conditions which may result in a breach occurring and enable the residents to evacuate the site to an area outside the predicted extent of flooding. If it is not possible to evacuate before floodwater reaches the site, safe refuge above the design flood level will be available within the dwellings.
- **Surface water runoff from the proposed development should be managed using SuDS.** In order to restrict the rate at which surface water runoff is discharged offsite, various SuDS have been proposed, including water butts, swales/rain gardens, permeable surfacing and a series of geo-cellular storage tanks. These SuDS will be used to store water onsite before it is discharged to the Clobdsden Sewer. Flow control devices and pumps have been specified to attenuate the rate at which surface water runoff is discharged from the site, limiting the rate to Q_{bar} . It is recommended that further investigation is undertaken to confirm the onward connectivity of the watercourse along the north boundary of the site, as this may facilitate a discharge by gravity. If a connection to this watercourse were proposed, it will be necessary to include the long-term maintenance of the watercourse in any management arrangement, and to confirm its ownership to ensure that access for maintenance will be possible.
- **Foul effluent from the development should be managed using the public sewer system.** The most viable solution is to connect into the existing foul sewer network, located northwest of the site. Due to the relatively flat levels across the site, a foul water pumping station will be required.

With the above mitigation measures incorporated into the design of the development, the proposals will meet the requirements of the NPPF and can pass Part B of the Exception Test. The development will therefore be acceptable and sustainable in terms of flood risk.