

COASTAL FLOOD LEVEL ASSESSMENT

Context and Methodology

EnviroCentre Limited were commissioned by Dandara Southern to undertake a high level coastal Flood Level Assessment in order to set design heights for the inner habitat protection (for wintering birds), based on the 1 in 200 year flood level, and the outer flood protection (seaward existing bund needing repair and improvement), based on the 1 in 1 year flood level.

This assessment involved:

- Review of available information, including relevant information provided by the client, Environment Agency (EA) Flood Maps, LiDAR digital terrain model (DTM) data and aerial imagery;
- High level appraisal of local coastal conditions and wave climate;
- Utilisation of EA Coastal Flood Boundary (CFB) dataset to determine extreme sea levels over a range of return periods, including the 1 in 1 year and 1 in 200 year events, with climate change equivalents;
- Production of a flood map indicating the coastal flood extents for design events (not taking into account any existing or future flood defence structures); and
- Provision of a brief letter report outlining key findings and recommendations.

The assessment has been undertaken on a desktop basis and focuses on coastal flood levels. Other sources of floodwater such as watercourses, surface water, piped networks or groundwater have not been assessed in detail. Extreme sea level estimates provided represent still water sea levels, accounting for the effects of storm surge and astronomical tides. Given the site's sheltered location and the low vulnerability of the proposed land use, it was not considered necessary to undertake additional analysis to quantify localised increases in sea level that may be induced by onshore wave action, orientation or topography, and no wave or wave overtopping modelling has been undertaken.

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Site Description

The site (Figure 2 and 2) is low-lying and gently undulating and is currently used for agriculture. It is defended from coastal flooding at the seaward boundary by a raised earth embankment with a vertical concrete wall. A Condition Assessment of the existing outer flood protection defences was undertaken by WSP engineers on 8th July 2021, which concluded that a number of sections along the existing bund are in need of patch repairs and upgrading. Several man-made ditches discharge through the embankment via piped outfall with non-return flap valves.

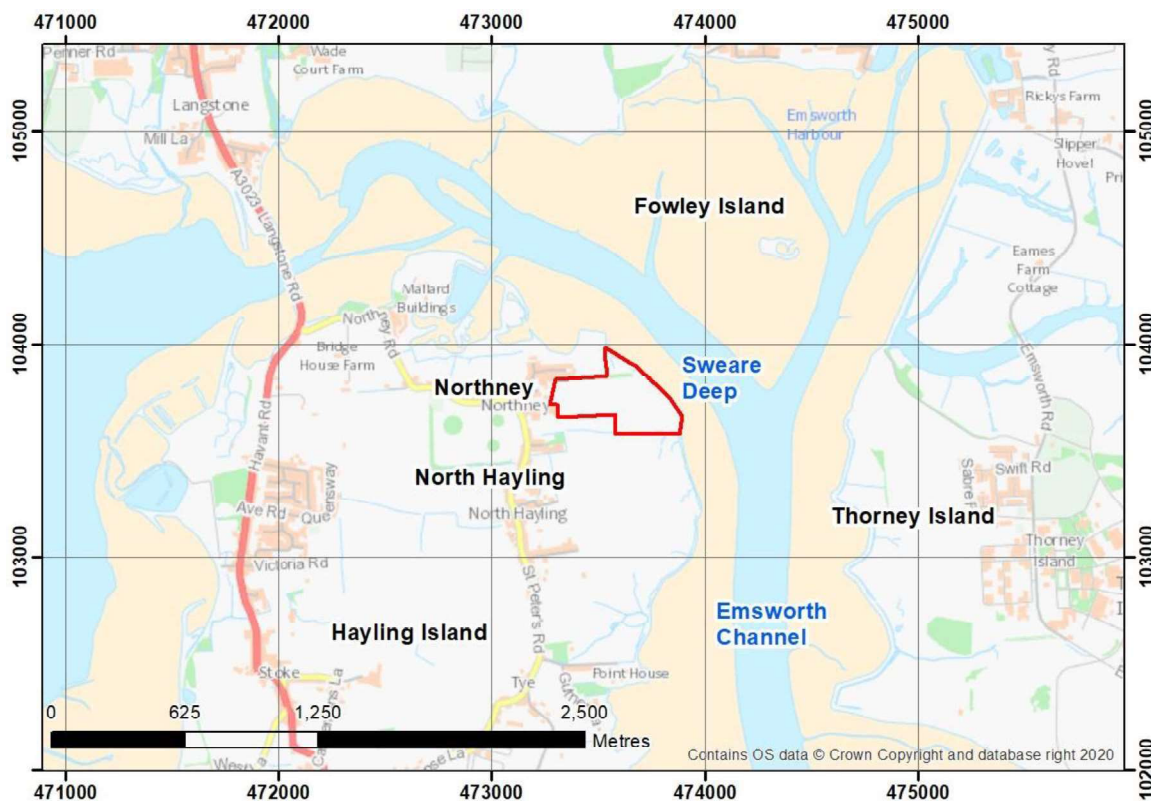


Figure 1 Site location (indicated by red boundary)

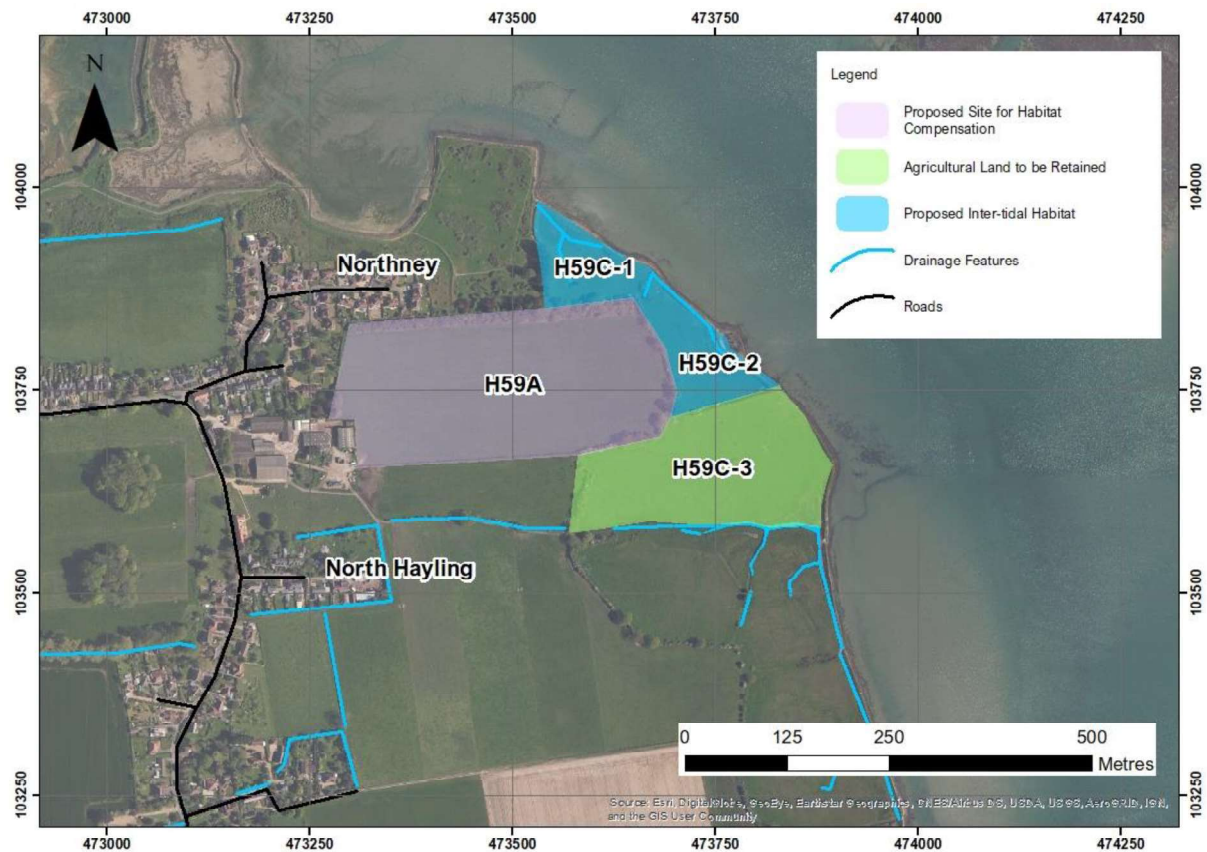


Figure 2: Site Layout Plan – Northney Farm

Overview of Current Coastal Flood Risk & Wave Climate

Table 1 provides a range of extreme design sea water levels. These levels have been derived from the Environment Agency/Department for Environment Food and Rural Affairs report entitled “Coastal flood boundary conditions for UK mainland and islands” (McMillan et al., 2011). This methodology includes the effects of both atmospheric tides and storm surge, but does not take into account the potential effects of wave action, funnelling or local bathymetry at this location.

Based on extreme still water level calculations using the Coastal Flood Boundary (CFB) Method, under current climate conditions, the estimated 1 in 1 year design peak water level for the area is **2.70 m AOD** (with a 95% confidence interval ranging from 2.69 – 2.74 m AOD), while the estimated 1 in 200 year design peak water level for the area is **3.24 m AOD** (with a 95% confidence interval ranging from 3.14 – 3.39 m AOD). For context, the current mean Mean High Water Spring level (MHWS) is 1.94 m AOD and the Highest Astronomical Tide (HAT) is 2.38 m AOD.

Table 1: Extreme Sea Levels for Northney Farm (CFB data point reference 3610, 7.5km to south)

Flood Return Period (years)	Extreme Sea Level (mAOD)	95% Confidence Interval (mAOD)
1	2.70	2.69 – 2.74
2	2.78	2.76 – 2.82
10	2.94	2.91 – 2.98
50	3.10	3.04 – 3.18
75	3.14	3.07 – 3.24
100	3.17	3.09 – 3.29
200	3.24	3.14 – 3.39
500	3.34	3.20 – 3.55
1000	3.41	3.25 – 3.68

Northney Farm is located within a relatively sheltered area, which leads to low offshore swell wave exposure and a wave climate limited to locally generated wind waves. The site is located at the north-eastern end of Hayling Island and is not exposed to the dominant swells from the south. It is sheltered from the south and west by Hayling Island, and to the east by Thorney Island, which is located approximately 0.8km to the east across Emsworth Channel. The mainland is located approximately 1.5km to the north, with the local wind fetch limited to the surrounding waters of Sweare Deep and Emsworth Channel, and from south-south-east through the narrows of Chichester Harbour to Sweare Deep.

Climate Change

The Environment Agency's latest climate change guidance for the South East River Basin District¹ advises applying sea level rise allowances of 1.2m and 1.6m for the 'High central allowance' and 'Upper end allowance' respectively, to account for the impacts of climate change up to the year 2125. The 'High central allowance' is based on the 70th percentile and is therefore exceeded by 30% of projections in the range, while the 'Upper end' allowance is based on the 95th percentile and is therefore exceeded by 5% of projections in the range.

Taking account of site specific factors at Northney Farm, such as the low vulnerability of the proposed land use to flooding and the capacity or space in the development to include measures to manage flood risk in the future, it is considered reasonably conservative to apply the 'High central allowance' to account for the impacts of climate change. The estimated 1 in 200 year plus climate change water level for the area would be **4.44 m AOD**.

Figure 3 indicates the undefended coastal flood extent across the site and surrounding land (based on LiDAR ground levels) for the 1 in 1 year and 1 in 200 year flood events, including the 1 in 200 plus climate change equivalent.

¹ <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#sea-level-allowances>

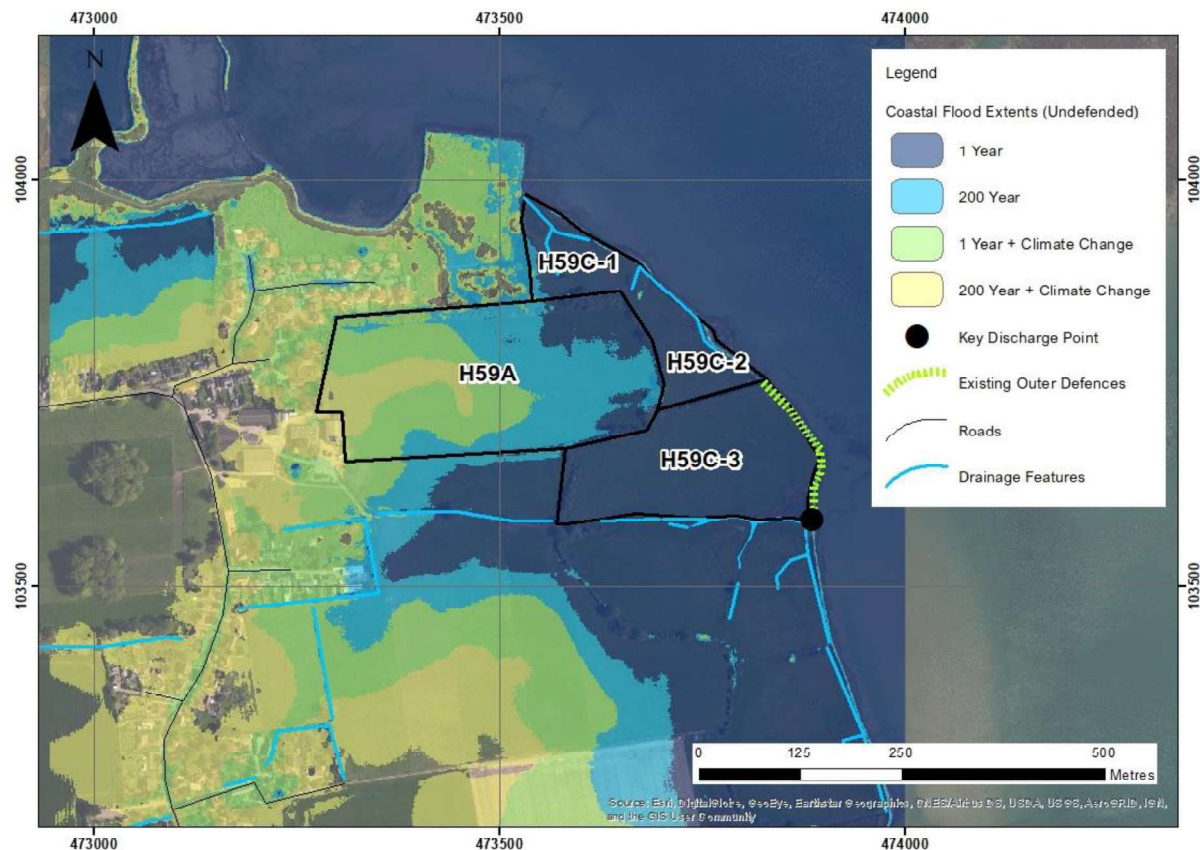


Figure 3: Coastal Flood Extents (Undefended)

Summary of Coastal Flood Risk and Recommendations

In an undefended scenario, coastal flooding would be extensive across the land parcels H59C-1, H59C-2 and H59C-3 during a 1 in 1 year design flood event, with limited ingress into the eastern extent of land parcel H59A. It is recommended that the minimum bund crest level for the outer flood protection, i.e. the seaward existing bund needing repair and improvement, is set to the peak flood level for the 1 in 1 year design flood event. Therefore, in addition to the required patch repairs, it is recommended that the outer flood protection has a minimum bund crest level of **2.70 m AOD**. Available topographic data shows that the existing bund crest level is typically between 2.80 and 2.90m AOD, indicating that raising of the structure would not be required to achieve the proposed 1 in 1 year level of defence.

In the undefended scenario, coastal flooding would be extensive over the site during a 1 in 200 year coastal flood event. It is recommended that the minimum bund crest level for the inner habitat protection (for wintering birds), is set to a minimum of the peak flood level for the 1 in 200 year design flood event. Therefore, it is recommended that the inner habitat protection has a minimum bund crest level of **3.24 m AOD**. Current ground levels along the proposed footprint for the inner bund typically vary between 2.2 and 2.8m AOD, with some localised low points closer to 1.9 or 2.0 m AOD.

The inclusion of an additional allowance for climate change on design levels is also recommended to account for future sea level rise and extend the longevity of the defence level. On the basis of predictions of the 'High central allowance' scenario for climate change, 1 in 200 year coastal flood levels would reach 4.44 m AOD by the year 2125, and inundation would occur more extensively across the site, including the entirety of land parcel H59A. Flooding over the bund crest would also be expected to occur more frequently in line with climate change. Depending upon the long-term intentions for the site, consideration may be given to the potential need to raise crest levels at some point in the future, and pre-emptive measures to enable this, such as widening for the bund footprint.

It should be noted that the recommended minimum bund crest levels for the outer flood protection and the inner habitat protection, of 2.70 m AOD and 3.24 m AOD respectively, exclude any freeboard allowance to account for uncertainties and wave overtopping. Given the low vulnerability of the proposed land use behind the bunds and relatively low exposure to wave action, it is not considered necessary to include a separate freeboard allowance in this case.

It is advised that plans for long-term monitoring and maintenance of drainage channels, outlets and flap valves are also put in place, to minimise the risk of coastal inundation through these pathways.