GeoSmart Information

FloodSmart Plus

Flood Risk Assessment

Site Address

44 Brighton Road
Lancing
Sussex
BN15 8ET

Grid Reference

518791, 103858

Report Prepared for

Mr and Mrs Kamis
44 Brighton Road
Lancing
Sussex
BN15 8ET

Initial report

2023-02-01

Updated report

2023-04-27

Report Status

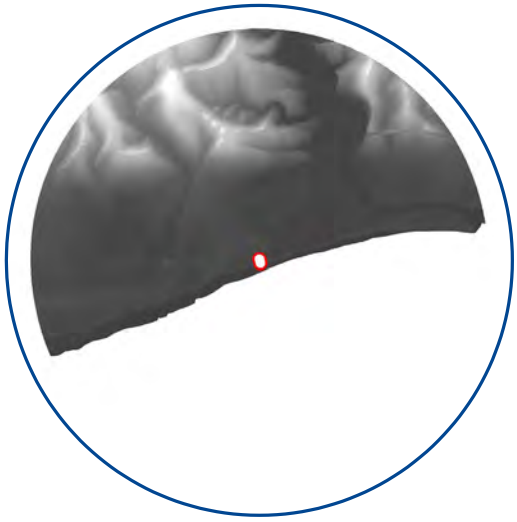
FINAL

Site Area

0.16 ha

Report Reference

78204.00.01R2



RISK – Very Low to High

The Site is located in Flood Zones 1, 2 and 3, which equates to a Low to High probability of flooding from rivers and the sea. However, flood mapping suggests that tidal flood risks are likely to be Very Low to Low, due to the presence of flood defences. Surface water (pluvial) flood risks are Very Low across the proposed development area, although High risks are present elsewhere on-Site. Groundwater flood risks are Low to Moderate and flooding risks from artificial sources (i.e. canals, reservoirs and sewers) are Negligible. Mitigation measures are recommended in this report to reduce the risks to an acceptable level over the lifetime of the development.

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1. Executive summary

A review has been undertaken of national environmental data sets to assess the flood risk to the Site from all sources of flooding in accordance with the National Planning Policy Framework (NPPF) (2021) and National Planning Practice Guidance (NPPG) (Published in 2014 and updated in August 2022). A site-specific flood risk assessment, to assess the flood risk to and from the development Site, is provided within this concise interpretative report written by an experienced GeoSmart consultant. Baseline flood risk and residual risks that remain after the flood risk management and mitigation measures are implemented are summarised in the table below.

Site analysis

Source of Flood Risk	Baseline[1]	After analysis[2]	After Mitigation[3]
River (fluvial) flooding	Very Low	Very Low	N/A
Sea (coastal/tidal) flooding	Very Low to Low	Very Low to Low	Very Low
Surface water (pluvial) flooding	Very Low to High	Very Low to High	*N/A
Groundwater flooding	Negligible to Moderate	Low to Moderate	Low
Other flood risk factors present	No	No	N/A
Is any other further work recommended?	Yes	Yes	Yes (see below)

1 BASELINE risks assigned for the whole Site, using national risk maps, including the benefit of EA flood defences.

2 AFTER ANALYSIS risks include modifications to the risk assessments based on detailed site specific analysis including some or all of the following: flood model data, high resolution mapping, building location, access routes, topographic and CCTV surveys. Reasons for the change in classification are provided in the text.

3 AFTER MITIGATION risks include risks to proposed development / asset and occupants if mitigation measures recommended in this report are implemented, including the impacts of climate change.

N/A indicates where mitigation is not required.

*Although a Very Low to High pluvial flood risk has been identified for the wider Site, the proposed development area itself is not impacted by flooding during any of the modelled flood scenarios and therefore mitigation measures are not required.

Summary of existing and proposed development

The Site is currently used within a residential capacity as a single dwelling with associated parking, access and landscaping. Finished Floor Levels (FFL) of the existing dwelling have not been provided, however, sections from the neighbouring dwelling have been provided which, according to the Client, are similar in elevation to the rear garden in the south of the Site.

Development proposals comprise the construction of a one-storey, one-bedroomed cabin in the south of the Site to be used as extra accommodation with associated landscaping. According to the Client, the highest feasible FFL for the proposed development is 350 mm above existing ground levels.

Summary of flood risks

The flood risks from all sources have been assessed as part of this report and are as follows:

- Historical flooding related to the sea is understood to have previously occurred in the vicinity of the Site but has not affected the Site itself.

River (fluvial) and Sea (estuarine/coastal) flooding

A response was received from the EA (ref: HA/2023/124858/01) in relation to the current planning application (ref: AWDM/0170/23). The EA correspondence included the following comments on the original FRA (report ref: 78204R1):

- *The submitted FRA does not comply with the requirements for site-specific flood risk assessments, as set out in paragraphs 20 to 22 of the Planning Practice Guidance for Flood Risk and Coastal Change. The FRA does not therefore adequately assess the flood risks posed by the development. In particular, the FRA fails to:*
    - *Consider how a range of flooding events (including extreme events) will affect people and property.*
    - *Take the impacts of climate change into account and show that the development is still safe from flood risk.*
- *We would request that a revised FRA considers the undefended modelling scenarios, and uses the most up-to-date climate change allowances available, to demonstrate how the proposed development is safe, without increasing risk elsewhere.*

In light of the EA comments, the FRA has been updated in this report to include the undefended scenario model data, which was received from the EA on the 17/02/2023 (see Section 4 of this report). The latest fluvial and coastal flooding risks are summarised as follows:

- According to the Environment Agency's (EA) Flood Map for Planning Purposes, the Site is located partially within tidal Flood Zones 1 (Low Probability), 2 (Medium Probability) and 3 (High Probability).

- The Site benefits from the presence of flood defences located adjacent to the southern boundary of the Site in good condition, designed to provide a 1 in 100 year event standard of protection.
- According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map, which considers the type, condition and crest height of flood defences, the Site has a risk of flooding ranging from Very Low to Low from the sea.
- Baseline mapping indicates a Very Low to Low. Flood risk in the area of the proposed development, however, a review of the flood model data, local topography and flood defences indicates the risk may be lower in the defended scenario.
- Modelled flood data obtained from the EA have been analysed in line with the most up to date guidance on climate change (EA, 2022), to confirm a maximum "design" flood level at the Site.

  The Site is not expected to be impacted by flooding during a defended 1 in 200 year 2117 scenario tidal flood event. The water level in the 2123 scenario, including the maximum allowances for climate change on sea level rise, would be 5.13 mAOD.

  The Site is also not expected to be impacted when considering wave action and storm surge.

  The Site is not expected to be impacted by flooding in the present day 2012 undefended scenario but is impacted in the future climate change scenarios, with depths of up to 1.04 m in the 2123 scenario.

  The Beachy Head to Selsey Bill Shoreline Management Plan (SMP2) designation is to "Hold the Line" to the year 2105. There is a residual risk to the Site in the case that the defences are not maintained past this, although this is not considered likely, as there is significant residential development and infrastructure behind the defences which will require protection into the future.

Surface water (pluvial) flooding

- According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping, the Site has a risk of pluvial flooding ranging from Very Low to High.
    - In a Low risk scenario an area in the southern half of the Site is at risk of pluvial flooding where depths could be up to 0.9 m.
    - In a Medium risk scenario an area in the southern half of the Site is at risk of pluvial flooding where depths could be up to 0.6 m.
    - In a High risk scenario an area in the southern half of the Site is at risk of pluvial flooding where depths could be up towards to 0.6 m.

The proposed development, which is to be located at the southern boundary of the Site, is not impacted by surface water / pluvial flooding in the above scenarios.

Although there is an increase in the built footprint at the Site, the area proposed for development is not affected by the design flood level and therefore floodplain compensation is not required.

Groundwater flooding

- Groundwater Flood Risk screening data indicate that there is a variable potential risk of groundwater flooding at the surface in the vicinity of the Site, during a 1 in 100 year event ranging from Negligible to Moderate.
    - According to a review of the hydrogeology (Section 3), the Site is underlain by permeable superficial deposits above permeable bedrock. Groundwater levels may rise in the bedrock and superficial aquifers in a seasonal response to prolonged rainfall recharge which may cause an unusually high peak in groundwater levels during some years.
    - Groundwater levels may also rise in the superficial aquifer in response to high tidal events due to the potential hydraulic continuity with the nearby coastal waters.
    - Spring lines could give rise to groundwater seepage and overland flow through the Site, a spring line has not been identified in the vicinity of the Site. However, the contacts between Raised Beach Deposits, Alluvium and Storm Beach Deposits are located on the Site. The presence of a spring line would depend on local differences in elevation and hydraulic conductivity.
    - The hydrogeological characteristics suggest there is potential for a shallow groundwater table beneath the Site.

  On the basis of a site-specific assessment, the groundwater flood risk is considered to be Low to Moderate.

Artificial sources of flooding

- The risk of flooding from artificial (man-made) sources such as reservoirs, sewers and canals has been assessed:
    - The EA's Risk of Flooding from Reservoir map confirms the Site is not at risk of reservoir flooding.
    - Ordnance Survey (OS) data confirms there are no canals near to the Site.
    - The Strategic Flood Risk Assessment (SFRA) (JBA Consulting, 2020) confirms no recorded instances of sewer flooding at or within the vicinity of the Site.

  The risk of flooding from artificial sources is considered to be Negligible.
- The risk to the development has been assessed over its expected 100 year lifetime, including appropriate allowances for the impacts of climate change which could increase the flood risk to the Site. Risks identified include sea level rise and increased potential for

surface water and groundwater flooding and appropriate mitigation measures are proposed.

As the Site is located within Flood Zone 3a and the proposed development is defined as More Vulnerable; the proposals are acceptable, but may be subject to the Sequential and Exceptions Test.

Recommendations

Recommendations for flood mitigation are provided below, based upon the proposed development and the flood risk identified at the Site.

- The Site is not at a significant risk of flooding from tidal sources, although as there is a residual risk of flooding in the unlikely instance that the neighbouring beach (which offers flood protection) is not replenished, the recommended minimum finished floor level of the proposed development should be set to at least 5.43 mAOD.[1] According to correspondence with the Client (Appendix F) the highest feasible FFL for the proposed development is 350 mm above the existing ground levels of 4.51 – 5.10 mAOD. Therefore, it is assumed that the FFLs of the proposed cabin can be up to approximately 5.45 mAOD.
- Although the Site is a risk of flooding from surface water (pluvial) sources, where flood depths could be up to 0.9 m during a 1 in 1000 year scenario (used as a proxy for the 1 in 100 year plus climate change scenario), the area of the proposed development itself is not impacted by flooding in these scenarios and therefore mitigation measures are not required to reduce surface water risks (as they are already very low).
- As there is a risk of flooding from groundwater sources at the surface, Finished Floor Levels (FFL) of the proposed development should be set at least 0.3 m above surrounding ground levels and ground levels should slope away from buildings. Recommendations for raising of FFL's to reduce tidal flooding risks are likely to be sufficient to address the identified groundwater flood risk. Risk to buried infrastructure should be considered along with water proofing of ground floor areas, standard flood resilient design and non-return valves on the sewer inlet. French drains and/or pumping systems may also be considered.

GeoSmart recommend the mitigation measures discussed within this report are considered as part of the proposed development where possible and evidence of this is provided to the Local Planning Authority as part of the planning application.

[1] 0.3 m above the maximum 1 in 200 year (2123) flood level of 5.13 mAOD.

2. Introduction

Background and purpose

A site-specific flood risk assessment has been undertaken, to assess the flood risk to and from the development Site. This assessment has been undertaken by firstly compiling information concerning the Site and the surrounding area. The information gathered was then used to construct a 'conceptual site model', including an understanding of the appropriateness of the development as defined in the NPPF (2021) and the source(s) of any flood risk present, guided by the NPPG (Published in 2014 and updated in August 2022). Finally, a preliminary assessment of the steps that can be taken to manage flood risk to the development was undertaken.

This report has been prepared with reference to the NPPF (2021) and NPPG (2022).

"*The National Planning Policy Framework set out the Government's planning policies for England and how these are expected to be applied*" (NPPF, 2021).

The NPPF (2021) and NPPG (2022) promote a sequential, risk based approach to the location of development. This also applies to locating a development within a Site which has a variable risk of flooding.

"*The approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This means avoiding, so far as possible, development in current and future medium and high flood risk areas considering all sources of flooding including areas at risk of surface water flooding*" (Paragraph: 023. NPPG, 2022).

The purpose of this report is to provide clear and pragmatic advice regarding the nature and potential significance of flood hazards which may be present at the Site.

Report scope

In accordance with the requirements set out within NPPG 2022 (Paragraph: 021 Reference ID: 7-021-20220825), a thorough review of publicly and commercially available flood risk data and EA supplied data indicating potential sources of flood risk to the Site from rivers and coastal sources, surface run-off (pluvial), groundwater and reservoirs, including historical flood information and modelled flood extent. Appropriate measures are recommended to manage and mitigate the flood risk to the property.

Information obtained from the EA and a review of the Adur and Worthing Level 1 and Level 2 Strategic Flood Risk Assessment (SFRA) (JBA Consulting, 2020) is used to ascertain local flooding issues and, where appropriate, identify information to support a Sequential and/or Exception test required as part of the NPPF (2021).

The existing and future flood risk to and from the Site from all flood sources is assessed in line with current best practice using the best available data. The risk to the development has been assessed over its expected lifetime, including appropriate allowances for the impacts of

climate change. Residual risks that remain after the flood risk management and mitigation measures are implemented, are considered with an explanation of how these risks can be managed to keep the users of the development safe over its lifetime.

An indication of whether the Site will potentially increase flood risk elsewhere is provided, including where the proposed development increases the building footprint at the Site. A drainage strategy to control runoff can be commissioned separately if identified as a requirement within this report.

Report limitations

It is noted that the findings presented in this report are based on a desk study of information supplied by third parties. Whilst we assume that all information is representative of past and present conditions, we can offer no guarantee as to its validity and a proportionate programme of site investigations would be required to fully verify these findings.

The basemap used is the OS Street View 1:10,000 scale, however the Site boundary has been drawn using BlueSky aerial imagery to ensure the correct extent and proportion of the Site is analysed.

This report excludes consideration of potential hazards arising from any activities at the Site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

Datasets

The following table shows the sources of information that have been consulted as part of this report:

Table 1. Datasets consulted to obtain confirmation of sources of flooding and risk

Source of flooding	Datasets consulted			
	Commercial Flood Maps	Local Policy & Guidance Documents*	Environment Agency (Appendix B)	OS Data
Historical	X	X	X	
River (fluvial) / Sea (tidal/coastal)	X	X	X	

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Source of flooding	Datasets consulted			
	Commercial Flood Maps	Local Policy & Guidance Documents*	Environment Agency (Appendix B)	OS Data
Surface water (pluvial)	X	X	X	
Groundwater	X	X		
Sewer		X		
Culvert/bridges		X		X
Reservoir		X	X	

*Local guidance and policy, referenced in Section 6, has been consulted to determine local flood conditions and requirements for flood mitigation measures.

Local policy and guidance

Adur and Worthing Level 1 and 2 Strategic Flood Risk Assessment (JBA Consulting, 2020):

Tidal Flooding

- In coastal locations the risk of flooding is linked to the stability of the coastline. If the coast is eroding, then the potential effect is that tidal flood defences near to the sea will be lost and flood risk will increase. To maintain an appropriate standard of safety from flooding it is sometimes necessary to implement works to slow down or stop the rate of coastal erosion and so maintain the integrity of the tidal defences.
- The current long-term plan for the length of the coastline within the Local Plan areas is to 'Hold the Line', with works proposed to manage and mitigate the risk of coastal erosion and flooding. Currently, there are a total of 9800 properties at risk of flooding and erosion along the coast between the River Arun and River Adur, with locations at risk within the Local Plan areas including Goring, Worthing, Brooklands, Shoreham By Sea and the River Adur. Additionally, Shoreham Lock and the eastern side of the mouth of the River Adur are at risk of flooding and erosion, with a large number of commercial and residential properties at increased risk due to climate change.

- Lancing has been susceptible to tidal flooding in the past due to overtopping of defences. Coastal flooding will potentially increase where coastal erosion threatens the stability of tidal flood defences.

Groundwater Flood Risk

- The effect of climate change on groundwater flooding problems, and those watercourses where groundwater has a large influence on winter flood flows, is much more uncertain. Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months. Where groundwater is tidally influenced, there is likely to be an increase in groundwater elevations with sea level rise that may in turn affect groundwater flood risk. The effect of climate change on groundwater levels for sites in areas where groundwater is known to be an issue should be considered at the planning application stage.

Flood Zones

Flood Zones are based on the undefended scenario with the exception of Flood Zone 3b, which includes the presence of defences on the basis that land behind existing defences is not functional floodplain.

Flood Zone 3b, unlike other Zones, shows flood risk that accounts for the presence of existing flood risk management features and flood defences, as land afforded this standard of protection is not appropriately included as functional flood plain. The mapping in the SFRA identifies this Flood Zone as land which would flood with a 5% chance (Annual Exceedance Probability) in each and every year (a 1 in 20-year return period), where detailed modelling exists.

Flood Mitigation

- Minimum finished floor levels for development should normally be above whichever is higher of the following:
    - A minimum of 600mm above the 1% AEP fluvial event plus an allowance for climate change and an appropriate allowance for freeboard.
    - A minimum of 600mm above the 0.5% AEP tidal event plus an allowance for climate change and an appropriate allowance for freeboard.
    - 300mm above the general ground level of the site.
- Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for amenity and recreational purposes. Development that may adversely affect green infrastructure assets should not be permitted.

Guidance

Strategic Flood Risk Assessments are carried out by local authorities, in consultation with the Environment Agency, to assess the flood risk to the area from all sources both now and in the future due to climate change. They are used to inform planning decisions to ensure inappropriate development is avoided (NPPF, 2021).

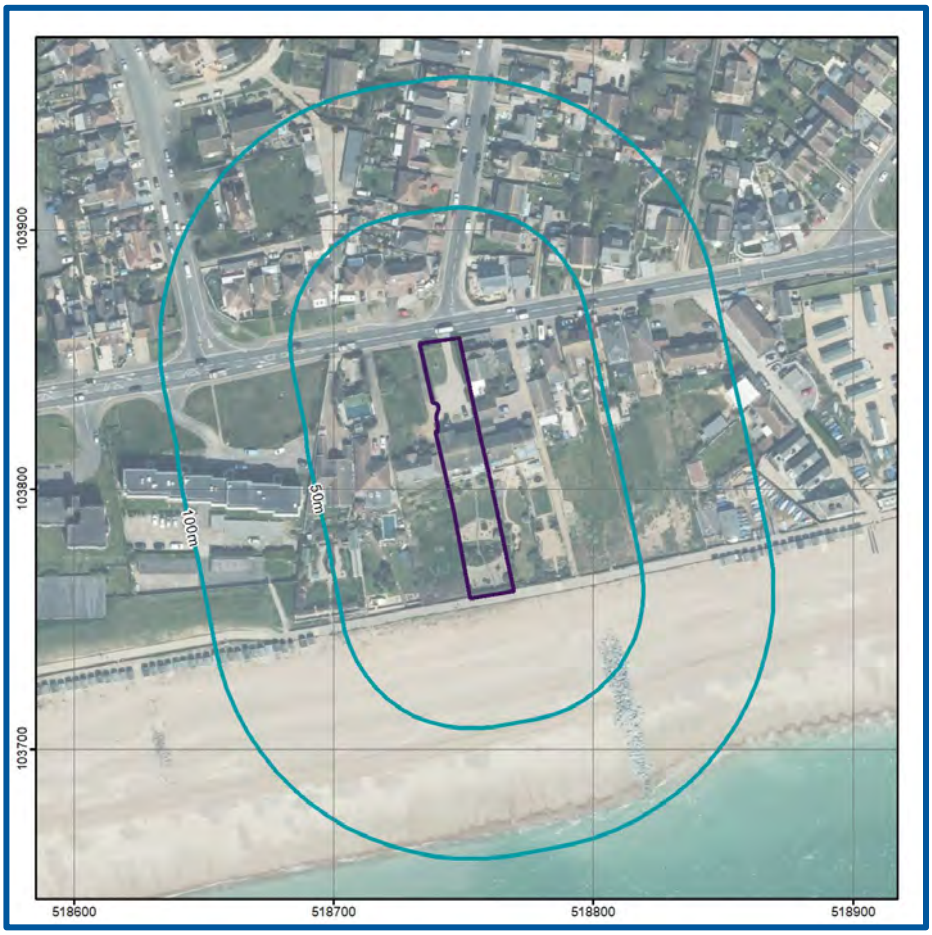
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3. Site analysis

Site information

The Site is located in 44 Brighton Road, Lancing, BN15 8ET in a setting of residential land use at National Grid Reference TQ 18791 03858.

Figure 1. Aerial imagery of the Site (Bluesky, 2023)

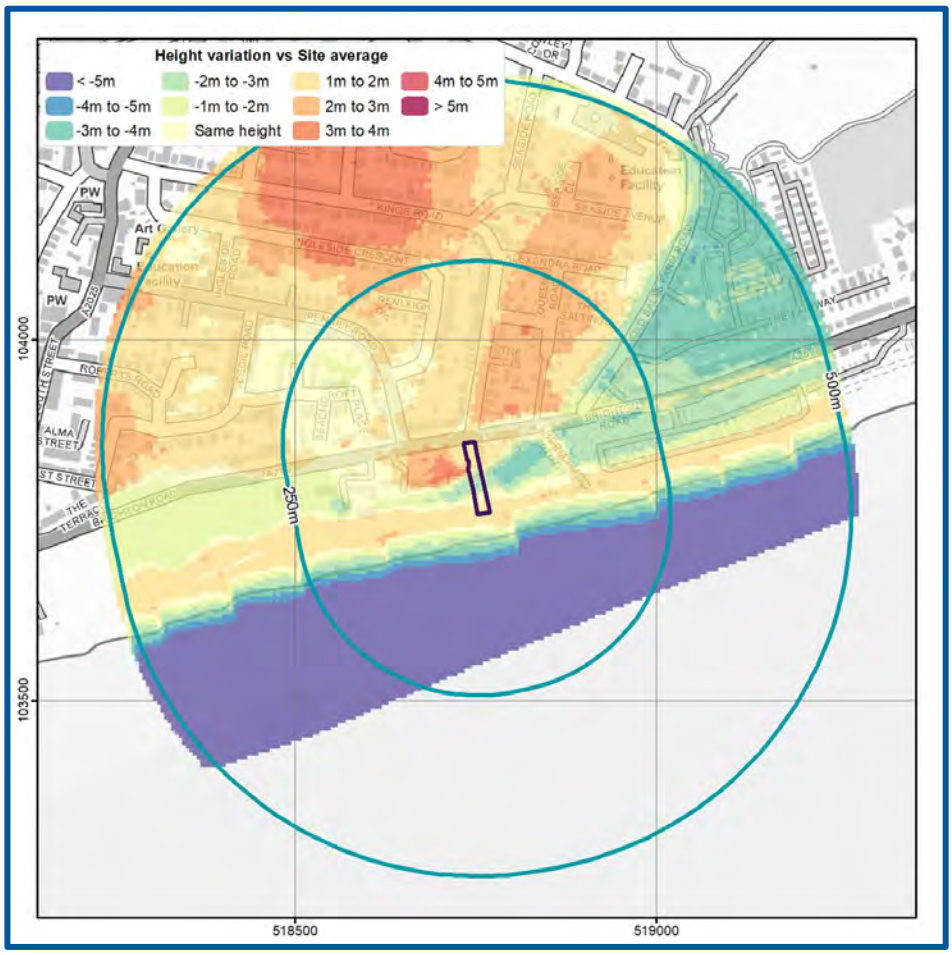


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Figure 2 indicates that ground levels within 500m of the Site rise and fall, with significant undulations owing to the elevated nature of the nearby topography.

The general ground levels on the Site are between 2.18 mAOD and 8.24 mAOD with the Site rising and falling across the Site; the topographic high point corresponds with the location of the existing dwelling. This is based on EA elevation data obtained for the Site to a 1 m resolution with a vertical accuracy of ±0.15 m (Appendix C). Ground levels in the area proposed for development in the southwest of the Site are between 4.51 and 5.10 mAOD.

Figure 2. Site location and relative elevations (GeoSmart, 2023)



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Development

The Site is currently used within a residential capacity as a single dwelling with associated parking, access and landscaping. Finished Floor Levels (FFL) of the existing dwelling have not been provided, however, sections from the neighbouring dwelling have been provided which, according to the Client, are similar to levels within the rear garden in the south of the Site.

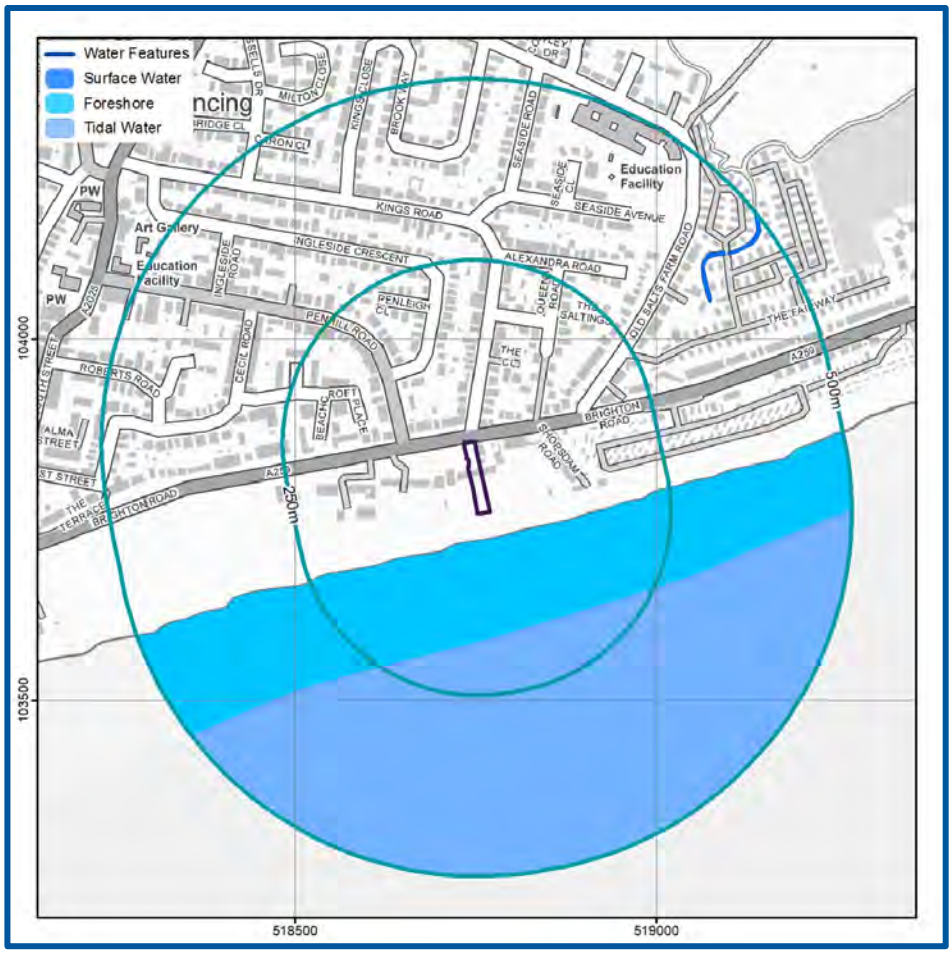
Development proposals comprise the construction of a one-storey, one-bedroom cabin in the south of the Site to be used as extra accommodation with associated landscaping. According to the Client, the highest feasible FFL of the proposed development is 350 mm above the existing ground level. Site plans are included within Appendix A.

The effect of the overall development will result in an increase in number of occupants and/or users of the Site and will may result in the change of use, nature or times of occupation. According to Annex 3 of the NPPG (2022), the vulnerability classification of the existing development is More Vulnerable and proposed development is More Vulnerable. The estimated lifespan of the development is 100 years.

Hydrological features

According to Ordnance Survey (OS) mapping included in the following figure, there are numerous surface water features within 500 m of the Site.

Figure 3. Surface water features (EA, 2023)



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The sea is located adjacent to the south of the Site.

There is an unnamed watercourse, likely associated with the River Adur, approximately 385 m to the north east of the Site.

In addition, Widewater Lagoon is approximately 750 m to the east of the Site and the River Adur is approximately 2.6 km to the north east of the Site.

Proximity to relevant infrastructure

There is a bridge on Willow Brook on the unnamed watercourse approximately 440 m north east of the Site.

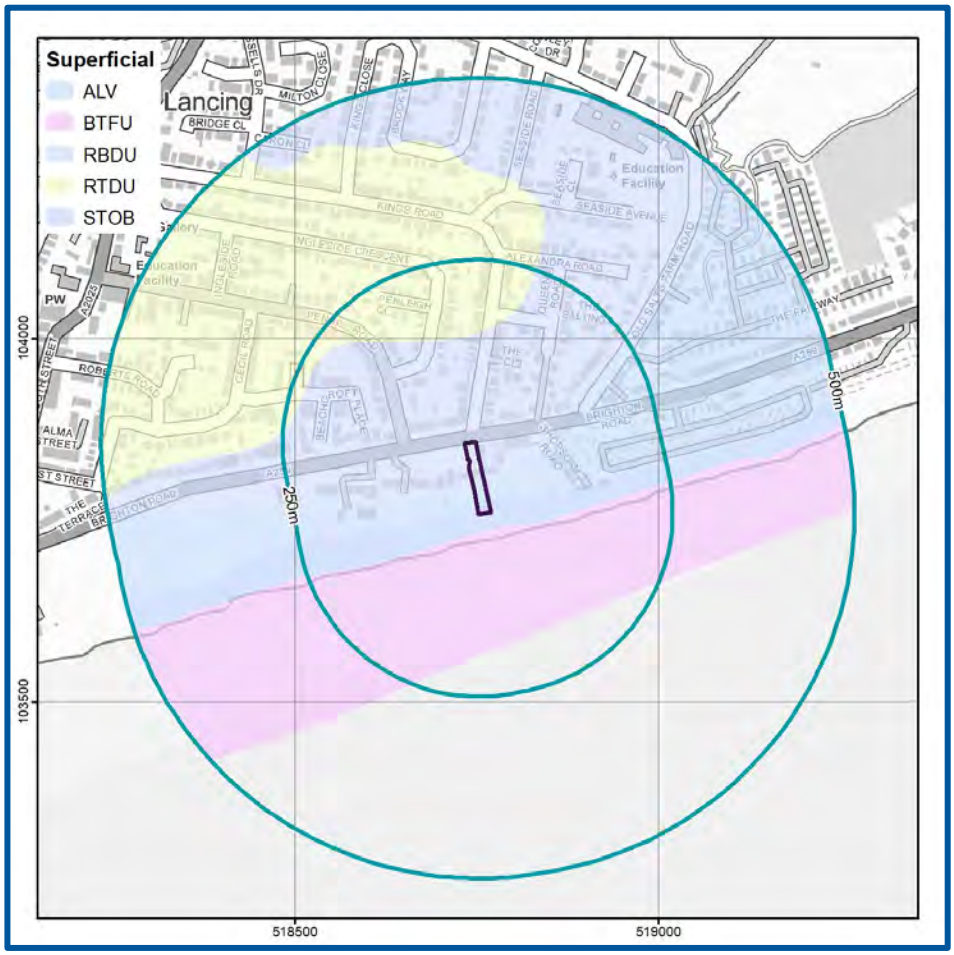
There is a bridge on Old Salts Farm Road approximately 565 m to the north east of the Site.

Hydrogeological features

British Geological Survey (BGS) mapping indicates the underlying superficial geology (Figure 4) of the Site comprises the following:

- Approximately 60% of the Site (in the north) consists of Raised Beach Deposits – Sand and Gravel (RBDU) (BGS, 2022) which area classified as a Secondary (A) Aquifer (EA, 2022).
- Approximately 25% of the Site (towards the south) consists of Alluvium (ALV) which is classified as a Secondary Undifferentiated Aquifer (EA, 2022).
- Approximately 15% of the Site (in the south) consists of Storm Beach Deposits – Gravel (STOB) which are classified as a Secondary (A) Aquifer (EA, 2022).

Figure 4. Superficial Geology (BGS, 2023)



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BGS mapping indicates the underlying bedrock geology (Figure 5) consists of the Lambeth Group – Clay, Silt and Sand (LMBE) (BGS, 2022) which is classified as a Secondary (A) Aquifer (EA, 2022).

Figure 5. Bedrock Geology (BGS, 2023)



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Geological conditions

A review of the BGS borehole database (BGS, 2022) indicates the nearest and most relevant borehole to the Site (ref: TQ10SE32) is located approximately 155 m to the north west of the Site boundary in an area of Raised Beach Deposits overlying the Lambeth Group bedrock at an elevation of 5.04 mAOD. The borehole log indicates the underlying geology to consist of drift (gravel, clay and marl) to a depth of 3.7 m below ground level (bgl) overlying chalk and flints to a depth of 22.8 m bgl, where the borehole record ends.

Borehole ref: TQ10SE194 is located approximately 200 m to the north west of the Site boundary within the same superficial and bedrock geology as the above borehole at an elevation of 4.66 mAOD. The borehole log indicates the underlying geology to consist of a thin layer of topsoil overlying clay, gravel and sand to a depth of 5.4 m bgl overlying lignite to a depth of 7.6 m bgl overlying clay to a depth of 10 m bgl, where the borehole record ends.

Groundwater

Groundwater levels are not presented in the record for borehole ref: TQ10SE32. Due to the poor quality of the record for borehole ref: TQ10SE194 it is difficult to determine exact recorded groundwater levels, although groundwater is understood to have been encountered between 3.20 and 10.0 m bgl.

4. Flood risk to the development

Historical flood events

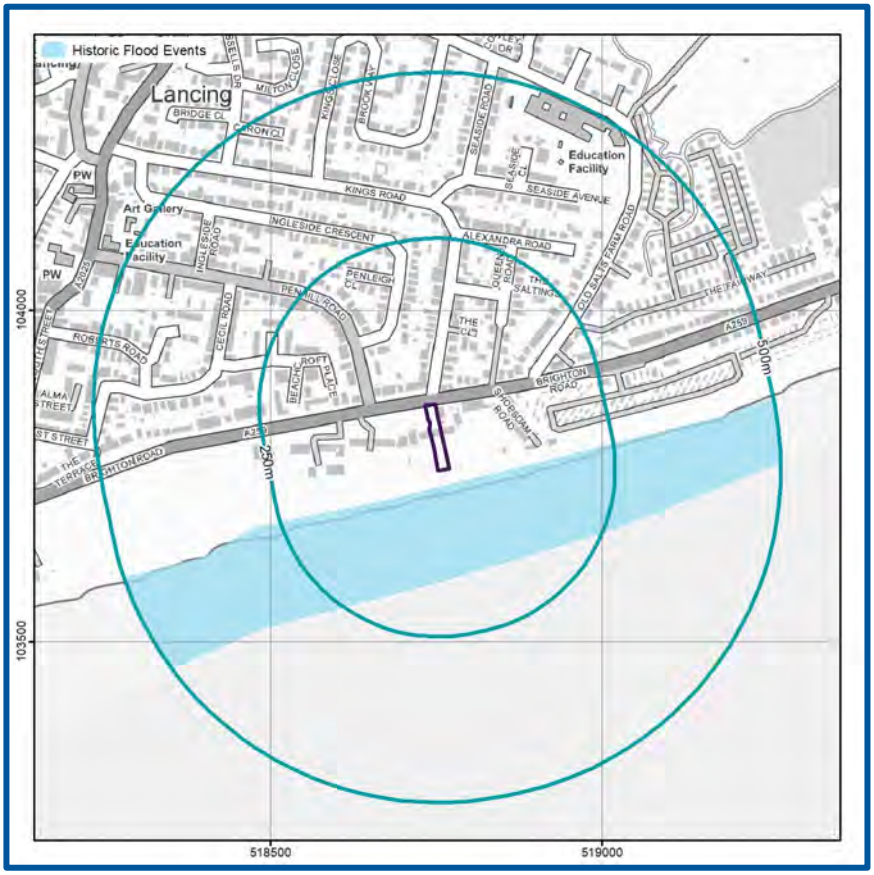
According to the EA's Historical Flood Map (Figure 6) there have been no flooding events affecting the Site, however, a flood event has been recorded directly to the south of the Site.

- Flooding occurred in 2013/2014 during a particularly wet winter, where a small number of properties were impacted, as well as the A27 and Shoreham Airport. The SFRA does not specify which properties were affected.
- According to the SFRA (JBA Consulting, 2020) tidal flooding has been recorded in Lancing due to overtopping of defences, although it does not specify any particular events.

Appendix A of the SFRA (JBA Consulting, 2020) does not hold any records of historical flooding at the Site.

The purpose of historical flood data is to provide information on where and why flooding may have occurred in the past. The absence of any recorded events does not mean flooding has never occurred on-Site or that flooding will never occur at the Site.

Figure 6. EA historical flood map



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Rivers (fluvial) / Sea (coastal) / Estuarine (tidal) flooding

The Site is located in a coastal location and the predominant risk at the Site is from flooding from the sea, termed as coastal and/or tidal processes.

Coastal flooding is caused by extreme coastal conditions that occur because of three main mechanisms, either individually or in combination. These are:

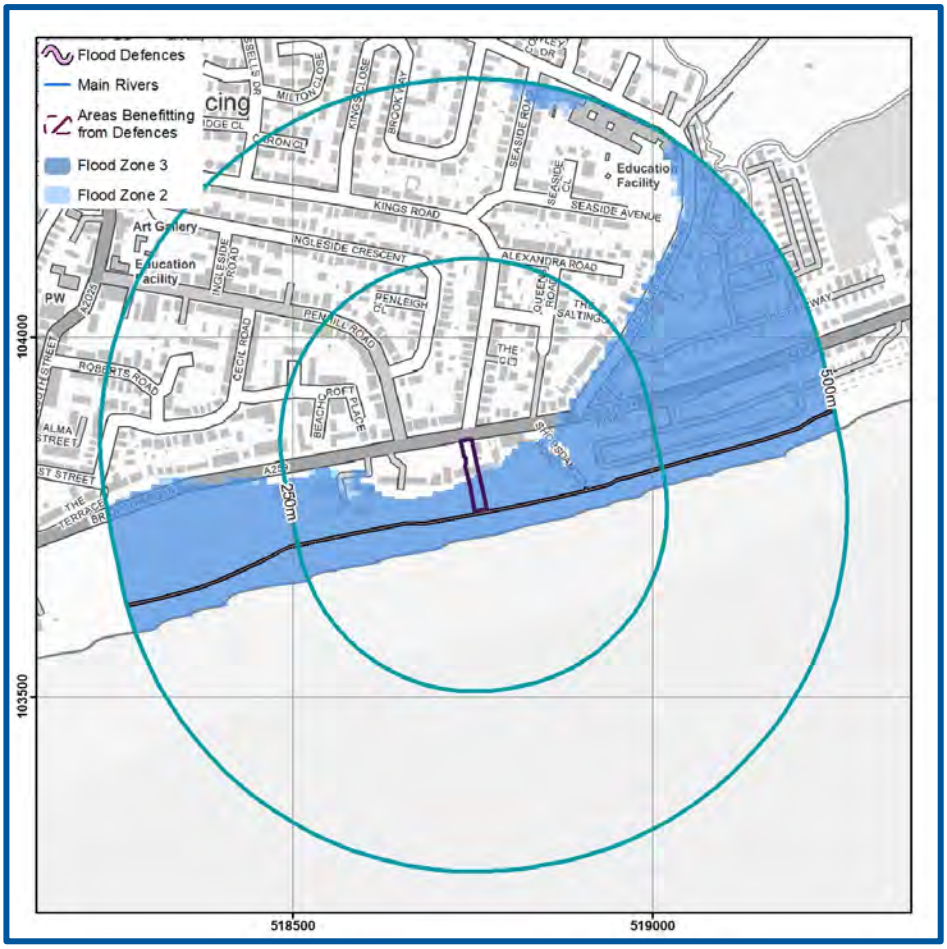
- High tide levels – variations in tidal levels due to gravitational effects of the sun and moon can result in higher sea levels – there is an approximate twice daily variation between high and low tide, onto which is superimposed a spring-neap tide cycle when extra high and low tides occur.
- Surge – an increase in sea level above tidal level caused by low atmospheric pressure which may be exacerbated by the wind acting on the sea.
- Wave action – dependent on wind speed and direction, local topography and exposure.

According to the EA's Flood Map for Planning Purposes (Figure 7), the Site is located partially within tidal Flood Zones 1, 2 and 3 and is therefore classified as having a Low to High probability of tidal (coastal) flooding from the Sea.

- Approximately 50% of the Site is located within Flood Zone 1 and this extends from the northern boundary of the Site to the central part of the Site.
- Approximately 5% of the Site is located within Flood Zone 2, including a small area at the eastern boundary of the Site.
- Approximately 45% of the Site is located within Flood Zone 3; this extends from the southern boundary to the central part of the Site.

The proposed development area is located within Flood Zone 3a. According to the SFRA (JBA Consulting (2020), Flood Zone 3b is defined using the defended scenario and land located behind existing defences is not functional floodplain. As the proposed development is located behind raised coastal defences and is not impacted in the 1 in 20 year defended flooding scenario (Appendix B), it is not part of the functional floodplain and is considered to be in Flood Zone 3a.

Figure 7. EA Flood Map for Planning Purposes (EA, 2023)



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Guidance

As defined in the NPPF (2021):

Ignoring the presence of any defences, land located in a Flood Zone 1 is considered to have a Low probability of flooding, with less than a 1 in 1000 annual probability of fluvial or coastal flooding in any one year.

Ignoring the presence of any defences, land located in a Flood Zone 2 is considered to have a Medium probability of flooding, with between a 1 in 100 and 1 in 1000 annual probability of fluvial flooding or between a 1 in 200 and 1 in 1000 annual probability of coastal flooding in any one year.

Ignoring the presence of any defences, land located in a Flood Zone 3 is considered to have High probability of flooding with a 1 in 100 year or greater annual probability of fluvial flooding or a 1 in 200 or greater annual probability of coastal flooding in any one year.

Development of "Water-Compatible" and "Less Vulnerable" land uses are suitable for this zone with "More Vulnerable" and "Essential Infrastructure" requiring an Exception test to be passed prior to development taking place. (see glossary for terminology).

Flood defences

Guidance

Sites that are located close to flood defences are likely to be zones where rapid inundation will occur in the event of the flood defences being overtopped or breached. A Site located close to flood defences (within 250 m) may require a more detailed FRA subject to local topography.

Existing flood defences

- The Site is in an area which benefits from flood defences but is not within the EA's ABD.[2]
- There are flood defences immediately adjacent to the southern boundary of the Site.

Information from the EA and SFRA relating to the flood defences is outlined below.

[2] The EA maps Areas which Benefit from the presence of Defences (ABD) in a 1 in 100 (1%) chance of flooding each year from rivers; or 1 in 200 (0.5 %) chance of flooding each year from the sea. If the defences were not there, these areas would flood in a 1 in 100 (1%)/ 1 in 200 (0.5 %) or larger flooding incident. The EA do not show all areas that benefit from all flood defences, some defences are designed to protect against a smaller flood with a higher chance of occurring in any year, for example a flood defence which protects against a 1 in 30 chance of flooding in any year. Such a defence may be overtopped in a flood with a 1 in 100 (1%)/ 1 in 200 (0.5%) chance of occurring in any year, but the defence may still reduce the affected area or delay (rather than prevent) a flood, giving people more time to act and therefore reduce the consequences of flooding.

- According to the mapping within Appendix J.1 and J.2 of the SFRA (JBA Consulting, 2020; Appendix D) and the Arun to Adur Flood Modelling Report (JBA Consulting, 2012), the defences adjacent to the south of the Site comprise of a combination of the shingle beach and small man-made walls which form a backstop to the beach.
- The man-made wall in place is designed to defend up to a 1 in 100 year flood event (Appendix D). The EA inspects the defences twice a year and classifies their current condition as "Good (Condition Grade: 2)".
- According to the Arun to Adur Flood Modelling Report (JBA Consulting, 2012), the shingle beach along the Arun to Adur coastline forms the main line of defence against coastal flooding. The shingle beach through the study area has a large volume and there are a number of areas where beach replenishment is undertaken to ensure that this natural defence is not compromised. During storm events, the volume of material present means that the beach will naturally increase its own crest level as a response to high water levels and persistent wave action (JBA Consulting, 2012).

The Beachy Head to Selsey Bill Shoreline Management Plan (SMP2) designation for defence lines at Worthing to Lancing (Policy Unit 4d15) is to "Hold the Line" over the long term period to 2105, which means that the proposed development should remain protected by flood defences over its 100 year lifetime (South Downs Coastal Group, 2006). It is assumed the defences will continue to be maintained thereafter until 2123.

Model data

As the Site is located within the EA's tidal floodplain, modelled flood elevation data have been obtained from the EA. These data is more up to date than that which is included in the Adur and Worthing SFRA (2020) and have been used to assess flood risk and to provide recommendations for mitigation for the proposed development. The data are provided in the tables below and also within Appendix B.

Defended Scenario

Modelled flood level data have been taken from the Arun to Adur Flood Modelling Report (JBA Consulting, 2012) to assess flood risk and provide recommendations for mitigation measures. According to correspondence with the EA (Appendix E), the defended outputs include the combined impacts from sea level inundation and wave overtopping.

The flood level data have been taken from the EA's 2D floodplain grid data using QGIS (v3.16.10). According to the modelling report (JBA Consulting, 2012), breach modelling has not been undertaken for the study area.

Table 2. Modelled Flood Levels (Defended)

Ground levels in area proposed for development (mAOD)	Defended scenario flood levels (mAOD)*		
	1 in 20 year	1 in 75 year	1 in 200 year
4.51 to 5.10**	4.02	4.16	4.28
Flood depths (m)	No Flooding	No Flooding	No Flooding

*Although the maximum flood extents in the modelled scenarios are higher than minimum ground levels on the Site, flooding would be contained to the beach and the proposed development would not be impacted.

**The ground levels in the above table include the area in the southwest of the Site where the proposed extra accommodation is to be situated. Ground levels across the entire Site are between 2.18 and 8.24 mAOD.

Climate change factors

The climate change allowances provided by the modelling report are not up to date (i.e. only provide up to 2117), and therefore in order to assess the full 100 year lifespan of the proposed development up to 2123, the EA's most up-to-date guidance on climate change impacts has been used.

In order to assess the higher central allowance, a 13.1 mm allowance has been added for each year (6 years). A 10% allowance for wave action has been included and an additional 2 mm a year (above the 2117 allowance) has been added for each year (6 years) to allow for storm surge.

These calculations were carried out by doing the following:

- 13.1 mm was multiplied by 6 to give 78.6 mm or 0.0786 m.
- 10% was added to this value to account for wave action: 0.0846.
- 2 mm (the allowance for storm surge) was multiplied by 6 to give 12 mm or 0.012 m.
- The above values were added to the 2117 scenario flood level of 5.03 mAOD to give 5.13 mAOD.

The model data indicates that the Site would not flood in the 2012, 2117 and 2123 defended flooding scenarios.

Table 3. Modelled Flood Levels (Defended)

Ground levels in area proposed for development (mAOD)	1 in 200 year defended scenario flood level (mAOD)			
	2012 scenario	2067 scenario	2117 scenario	2123 scenario higher central**
4.51 to 5.10*	4.28	4.60	5.03	5.13
Flood depths (m)***	No Flooding	No Flooding	No Flooding	No Flooding

*The ground levels in the above table include the area in the southwest of the Site where the proposed extra accommodation is to be situated. Ground levels across the entire Site are between 2.18 and 8.24 mAOD.

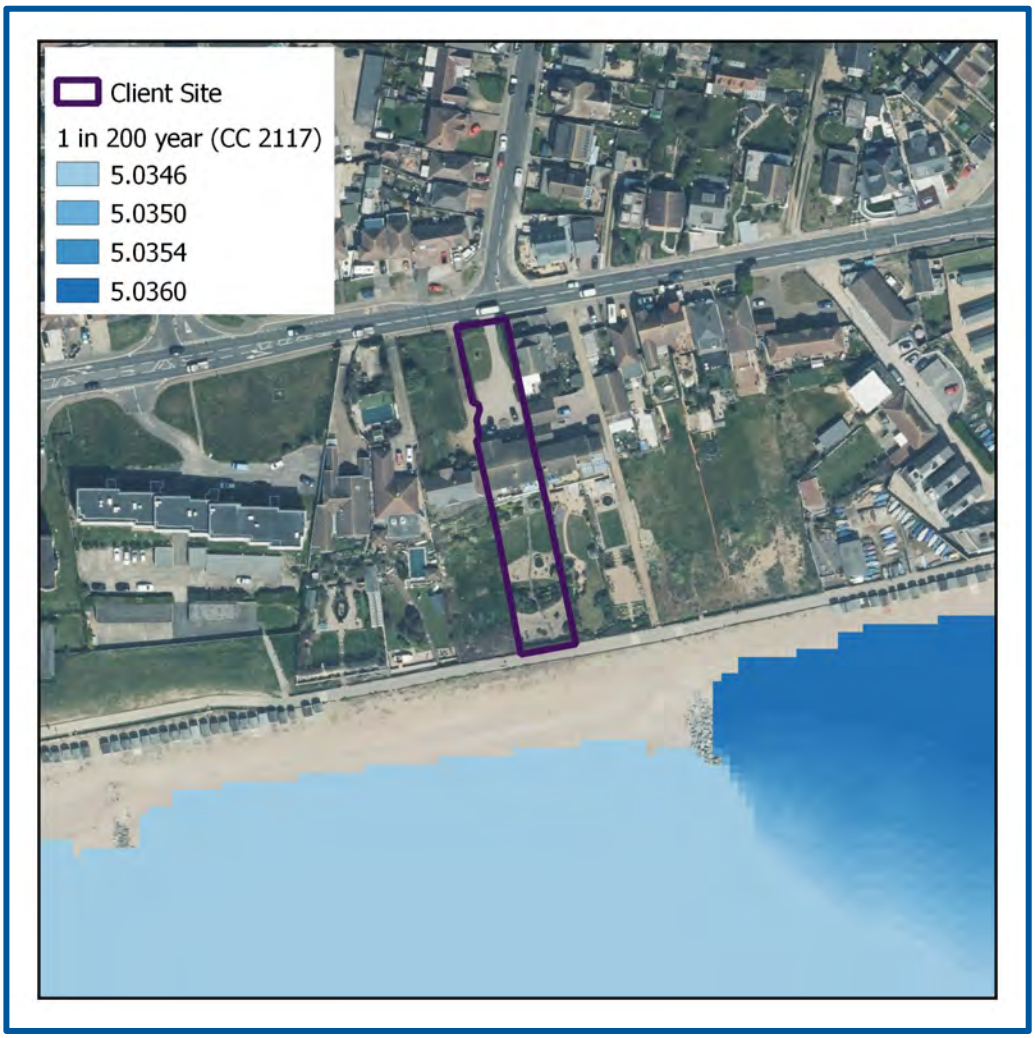
**Climate change allowances calculated using the most up to date Government Guidance (EA, 2022), which includes an allowance for sea level rise, wave action and surge increase.

*** Although the modelled flood levels are higher than ground levels across parts of the development area, 2D grid extents indicate that the Site is not impacted by flooding. The EA data have considered the flood wall and shingle beach within its modelling (JBA Consulting, 2012) therefore it is likely that the Site does not flood due to a combination of the large volume of the beach, the natural increase in crest level during storm events and the replenishment undertaken on the beach.

The average crest height of the defences adjacent to the Site is 6.31 mAOD (Appendix B), therefore the Site is protected from flooding in the defended scenario.

It should be noted that although the Beachy Head to Selsey Bill Shoreline Management Plan (SMP2) designation is to "Hold the Line" over the long-term period to 2105, there is a residual risk to the Site in the case that the beach is not replenished beyond this time. However, it is assumed that the defences will continue to be maintained after this period.

Figure 8. Modelled Breach Flood Levels (2117 Scenario)



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Undefended Scenario

A response was received from the EA (ref: HA/2023/124858/01) in relation to the planning application for the development (ref: AWDM/0170/23), which was refused on the basis that the original FRA did not consider the undefended modelling scenarios with the most up-to-date climate change allowances available, to demonstrate how the proposed development is safe, without increasing risk elsewhere.

Following correspondence with the EA (Appendix B), grid data for the undefended scenario was provided on the 17/02/2023 from the Arun to Adur Modelling Report (JBA Consulting, 2012) and is provided in the tables below. According to correspondence with the EA (Appendix E), the data for the undefended scenario shows the impact of sea level inundation. The climate change allowances used in the original report (ref: 78204R1) are the most up-to-date and have therefore been applied to the undefended scenarios.

Table 4. Modelled Flood Levels (Undefended)

Ground levels in area proposed for development (mAOD)	Undefended scenario flood levels (mAOD)			
	1 in 20 year	1 in 75 year	1 in 200 year	1 in 1000 year
4.51 to 5.10*	4.03	4.18	4.30	4.49
Flood depths (m)	No flooding**	No flooding**	No flooding**	No flooding**

*The ground levels in the above table include the area in the southwest of the Site where the proposed extra accommodation is to be situated. Ground levels across the entire Site are between 2.18 and 8.24 mAOD.

**Although the grid data indicates that areas of the Site would flood during all modelled scenarios, the most recent EA LiDAR data indicates that the area proposed for development is at a higher elevation than the maximum flood levels.

It should be noted that the grid data for the undefended scenario is at odds with the EA LiDAR data (2022) that has been used. Although the grid data shows the south of the Site would flood in the undefended scenario, LiDAR data shows that ground elevations in the area proposed for development are higher than the maximum flood levels up to the 1 in 1000 year scenario. As the model data is from 2012, it is likely that the LiDAR data used within the study is outdated and regrading of the Site has occurred since. Therefore, it is likely the Site would not flood to such a degree in the undefended scenario.

Climate change factors

The climate change allowances provided for the undefended scenario by the modelling report are not up to date (i.e. only provide up to 2115), and therefore in order to assess the full 100 year lifespan of the proposed development up to 2123, the EA's most up-to-date guidance on climate change impacts has been used.

In order to assess the higher central allowance, a 13.1 mm allowance has been added for each year (8 years). A 10% allowance for wave action has been included and an additional 2 mm a year (above the 2115 allowance) has been added for each year (8 years) to allow for storm surge.

These calculations were carried out by doing the following:

- 13.1 mm was multiplied by 8 to give 104.8 mm or 0.1048 m.
- 10% was added to this value to account for wave action: 0.11528.
- 2 mm (the allowance for storm surge) was multiplied by 8 to give 16 mm or 0.016 m.
- The above values were added to the 2115 scenario flood level of 5.42 mAOD to give 5.55 mAOD.

The model data indicate that the Site would not flood in the present day (2012) scenario but would flood in the 2070, 2115 and 2123 scenarios.

Table 5. Modelled Flood Levels (Undefended)

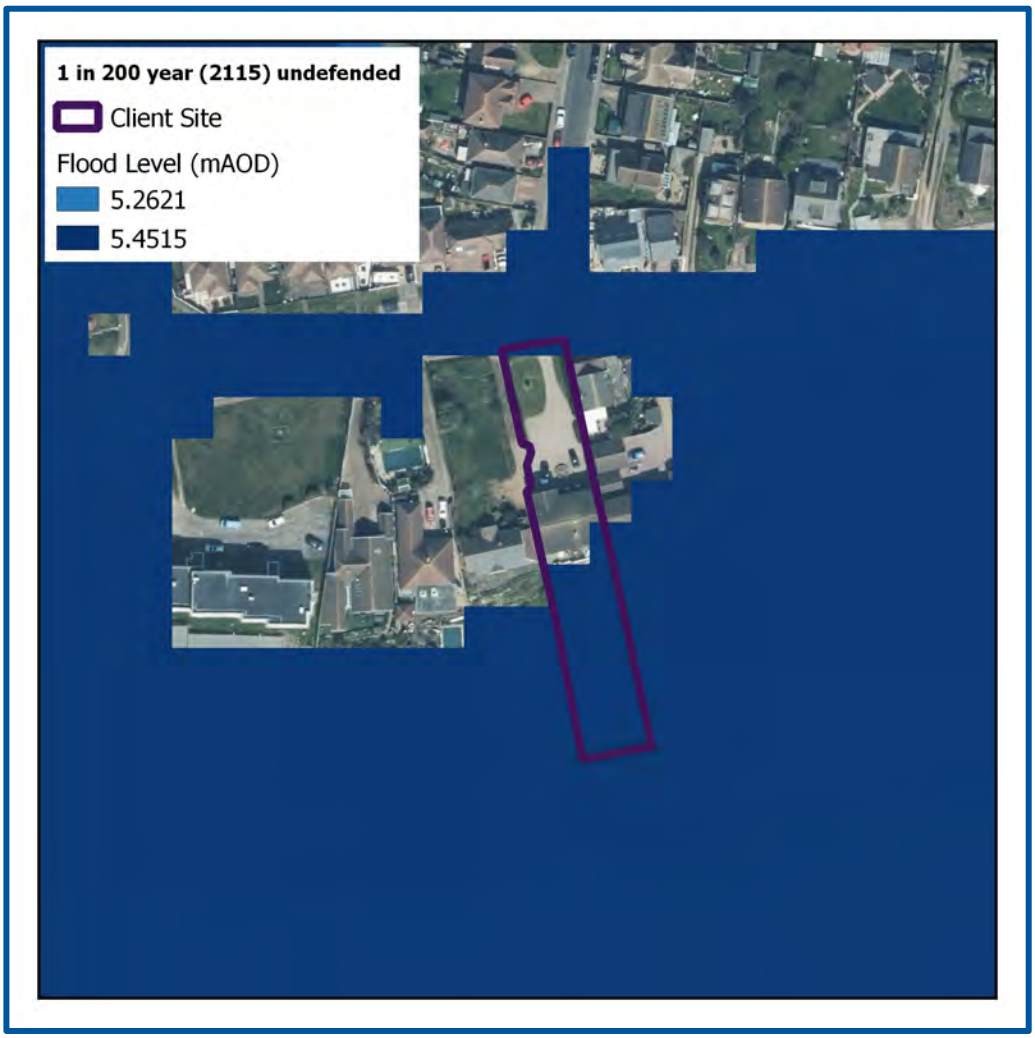
Ground levels in area proposed for development (mAOD)	1 in 200 year undefended scenario flood level (mAOD)			
	2012 scenario	2070 scenario	2115 scenario	2123 scenario higher central**
4.51 to 5.10*	4.30***	4.79	5.42	5.55
Flood depths (m)	No Flooding	Up to 0.28	Up to 0.91	Up to 1.04

*The ground levels in the above table include the area in the southwest of the Site where the proposed extra accommodation is to be situated. Ground levels across the entire Site are between 2.18 and 8.24 mAOD.

**Climate change allowances calculated using the most up to date Government Guidance (EA, 2022), which includes an allowance for sea level rise, wave action and surge increase.

***Although the grid data indicates that the Site would flood in the present day (2012) scenario, the most recent EA LiDAR data indicates the area proposed for development is at a higher elevation than the maximum flood level of 4.30 mAOD.

Figure 9. Modelled Flood Levels (2115 Undefended Scenario)



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Although the proposed development is at risk of flooding during the undefended scenarios, the Beachy Head to Selsey Bill Shoreline Management Plan (SMP2) is to "Hold the Line" up to 2105 and it is assumed the defences will continue to be maintained thereafter until 2123. Therefore, it is considered that the flood depths modelled in the undefended scenario are unlikely to occur.

Flood risk including the benefit of defences

The type and condition of existing flood defences influence the 'actual' risk of fluvial flooding to the Site, albeit the long-term residual risk of flooding (ignoring the defences) should be considered when proposing new development.

According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map (Figure 10), which considers the type, condition and crest height of flood defences, the Site has a Very Low to Low risk of flooding from the sea. It should be noted that the Site is immediately adjacent to the beach which is at High risk of flooding.

Further analysis of Site ground levels and modelled flood data indicate the Site would not be impacted in the 1 in 200 year (2117) overtopping scenario. The risk of flooding from rivers and sea are different to the EA's mapping, which indicates the risks range from Very Low to Low. Analysis of the model data indicates that the Site would not be flooded during the development's lifetime in the defended scenario, but would flood in the undefended climate change scenario.

Figure 10. Risk of Flooding from Rivers and Sea map (EA, 2023)



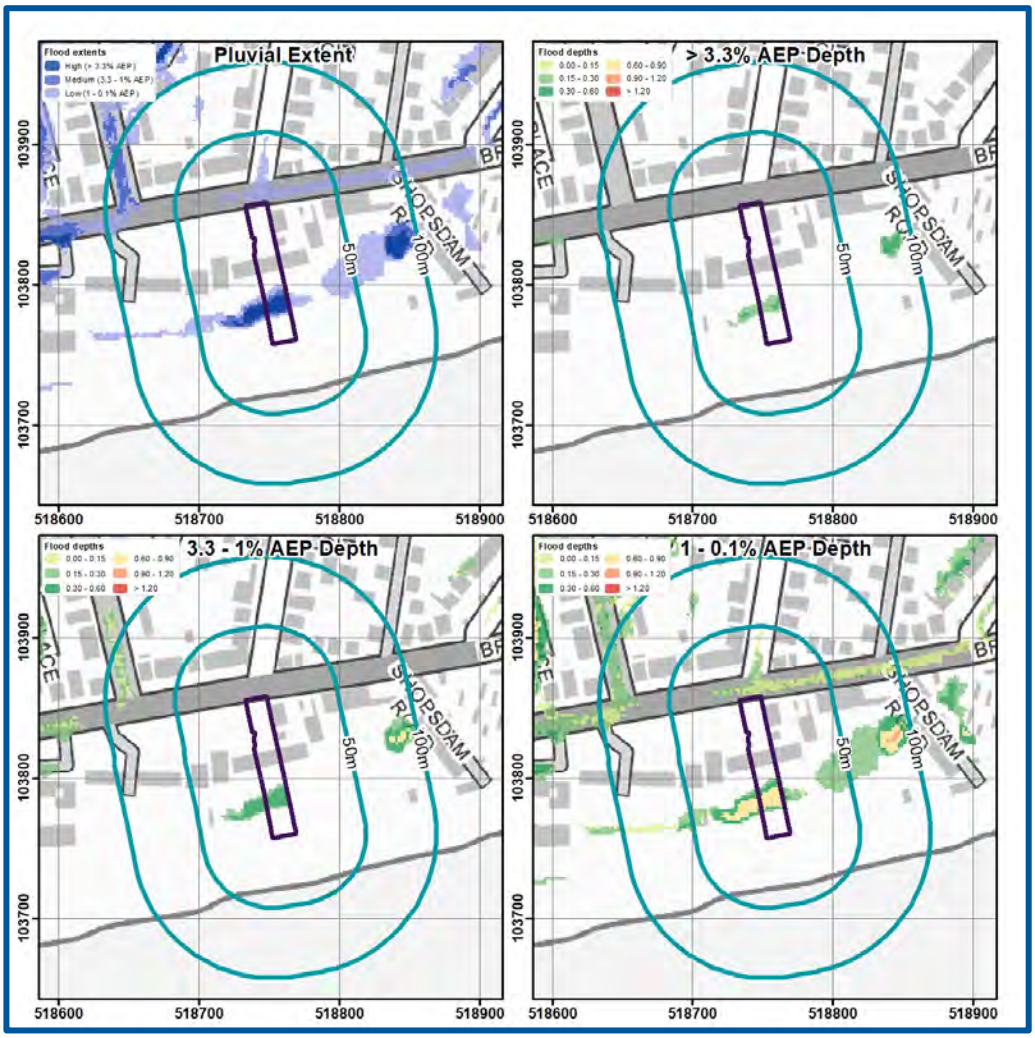
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Surface water (pluvial) flooding

Surface water flooding occurs when intense rainfall exceeds the infiltration capacity of the ground and overwhelms the drainage systems. It can occur in most locations even at higher elevations and at significant distances from river and coastal floodplains.

- According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping (Figure 11), the Site is at a variable risk of pluvial flooding ranging from Very Low to High.

Figure 11. EA surface water flood extent and depth map (EA, 2023)



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Guidance

According to EA's surface water flood risk map the Site is at:

- Very Low risk - chance of flooding of less than 1 in 1000 (0.1%).
- Low risk - chance of flooding of between a 1 in 1000 & 1 in 100 (0.1% and 1%).
- Medium risk - chance of flooding of between a 1 in 100 and 1 in 30 (1% and 3.3%).
- High risk - chance of flooding of greater than 1 in 30 (3.3%).

According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping (Figure 11), the Site is at a variable risk of pluvial flooding ranging from Very Low to High.

- In a Low risk scenario an area in the southern half of the Site is at risk of pluvial flooding where depths could be up to 0.9 m.
- In a Medium risk scenario an area in the southern half of the Site is at risk of pluvial flooding where depths could be up to 0.6 m.
- In a High risk scenario an area in the southern half of the Site is at risk of pluvial flooding where depths could be up towards to 0.6 m.

Surface water flooding is likely to occur in this area of Site due to it being topographically lower than the majority of the Site.

It should be noted that the proposed extra accommodation is to be situated further south than the mapped extent of surface water flooding and is therefore unlikely to be affected.

The SFRA does not indicate reported incidents of historical surface water flooding within 100 m of the Site and does not confirm the Site is located within a Critical Drainage Area (CDA)[3] (JBA Consulting, 2020).

Guidance

According to EA's surface water flood risk map the following advisory guidance applies to the Site:

Flood Depth

- 0.15 to 0.3 m - Flooding would: typically exceed kerb height, likely exceed the level of a damp-proof course, cause property flooding in some areas

[3] A Critical Drainage Area (CDA) is an area that has critical drainage problems and which has been notified to the local planning authority as such by the Environment Agency in line with the National Planning Policy Framework (NPPF, 2021). CDA's are specific to Flood Zone 1, defined as areas where runoff can and may have historically contributed to flooding downstream, although they are not necessarily areas where flooding problems may occur. Where a Site is located in Flood Zone 1 and within a CDA, a Flood Risk Assessment (FRA) is required and the Council may also request Sustainable Drainage Scheme (SuDS) features to be included within the proposed development.

- 0.3 to 0.9 m - Flooding is likely to exceed average property threshold levels and cause internal flooding. Resilience measures are typically effective up to a water depth of 0.6 m above floor level.

Climate change factors

Paragraph 002 of the National Planning Practice Guidance (August, 2022) requires consideration of the 1% AP (1 in 100 year) event, including an appropriate allowance for climate change.

As the Site is located within the Adur and Ouse Management Catchment and the proposed development is classed as More Vulnerable, where the proposed lifespan is approximately 100 years. years, the Upper (45%) allowance is required to determine a suitable climate change factor to apply to rainfall data.

The 0.1% AP (1 in 1000 year) surface water flooding event has been used as a proxy in this instance for the 1% AP (1 in 100 year) plus climate change event.

Surface water flooding flow routes

Analysis of OS mapping, ground elevation data and the EA's pluvial flow route mapping in the 1 in 1000 year (Low probability) event confirms the Site is located on a potential overland flow route.

The 1 in 1000 year (low probability) event indicates the extent of flooding in a worst-case future 100 year with climate change scenario, where a flood flow route potentially develops within the Site.

During a 1 in 100 year event and a 1 in 30 year event all of flow velocities are less than 0.25 m/s. The flows could potentially affect the buildings and/or access routes to the Site.

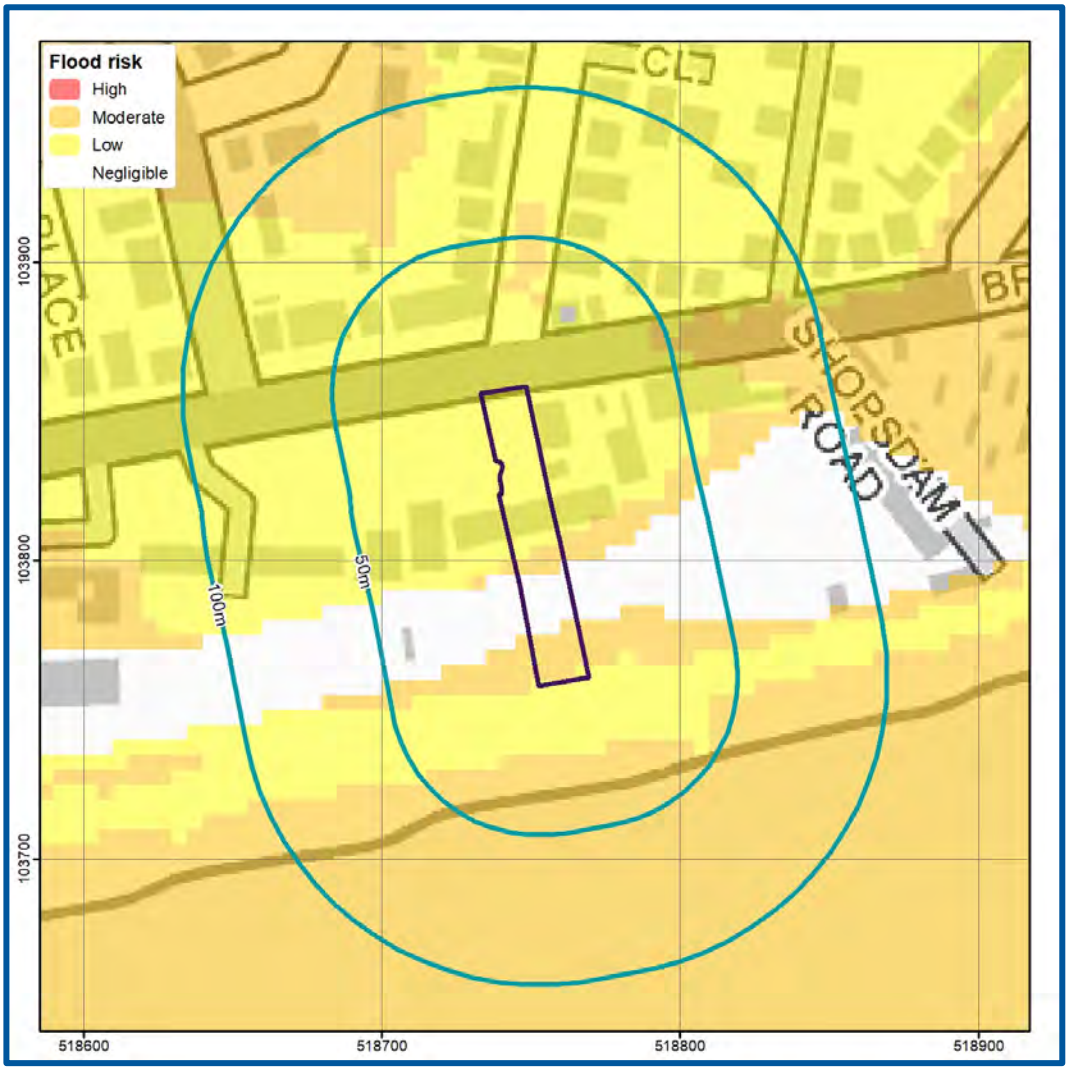
All of the potential flow routes in the above scenarios occur in the area of the Site where the development is proposed and will likely impact the proposed dwelling.

Groundwater flooding

Groundwater flooding occurs when sub-surface water emerges from the ground at the surface or into Made Ground and structures. This may be as a result of persistent rainfall that recharges aquifers until they are full; or may be as a result of high river levels, or tides, driving water through near-surface deposits. Flooding may last a long time compared to surface water flooding, from weeks to months. Hence the amount of damage that is caused to property may be substantially higher.

Groundwater Flood Risk screening data (Figure 12) indicates there is a Negligble to Moderate risk of groundwater flooding at surface in the vicinity from permeable bedrock and superficial deposits during a 1 in 100 year event.

Figure 12. GeoSmart GW5 Groundwater Flood Risk Map (GeoSmart, 2023)



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Mapped classes within the screening map combine likelihood, possible severity and the uncertainty associated with predicting the subsurface system. The map is a national scale screening tool to prompt site-specific assessment where the impact of groundwater flooding would have significant adverse consequences. Mapping limitations and a number of local factors may reduce groundwater flood risk to land and property even where it lies within mapped groundwater flood risk zones, which do not mean that groundwater floods will occur across the whole of the risk area.

A site-specific assessment has been undertaken to refine the groundwater risk screening information on the basis of site-specific datasets (see Section 3) including BGS borehole data, and the EA's fluvial and tidal floodplain data (where available) to develop a conceptual groundwater model. The risk rating is refined further using the vulnerability of receptors including occupants and the existing and proposed Site layout, including the presence of any basements and buried infrastructure. The presence of any nearby or on-Site surface water features such as drainage ditches, which could intercept groundwater have also been considered.

It is understood there are no existing basements, and a basement is not proposed as part of the development.

According to a review of the hydrogeology (Section 3), the Site is underlain by permeable superficial deposits above permeable bedrock. Groundwater levels may rise in the bedrock and superficial aquifers in a seasonal response to prolonged rainfall recharge which may cause an unusually high peak in groundwater levels during some years.

Groundwater levels may also rise in the superficial aquifer in response to high tidal events due to the potential hydraulic continuity with the nearby coastal waters.

It is noted groundwater flooding may occur in response to prolonged high water levels, by-passing flood defences even if overtopping does not occur. The mapping in Figure 12 indicates the area of the Site underlain with Alluvium deposits where ground levels are lowest is at Negligible risk of groundwater flooding. However, it is likely that in the event that groundwater by-passes flood defences these low lying areas of the Site would also be impacted.

The design of the property should consider the groundwater pathway through permeable formations.

Despite the presence of an underlying aquifer the Site would only be at risk of groundwater flooding if the water table reaches the base of the Site development or the ground surface when groundwater seepage could lead to overland flow and ponding.

According to a review of the hydrogeology (Section 3), BGS borehole ref: TQ10SE32, located approximately 155 m to the north west of the Site, did not encounter groundwater during its 22.86 m depth. Borehole TQ10SE194 encountered groundwater between 3.20 m and 10.0 m bgl, however, due to the quality of the borehole record it is not possible to determine the exact groundwater levels. It is noted that the available borehole information may not be wholly representative of the Site itself.

According to Appendix H of the SFRA (JBA Consulting, 2020) the Site is at variable risk of groundwater flooding where groundwater levels are potentially between 0.5 m and 5 m below the ground surface (Appendix D). According to the SFRA, one of the areas predicted to be at the highest risk of groundwater flooding within Adur District is Lancing (JBA Consulting, 2020).

Spring lines could give rise to groundwater seepage and overland flow through the Site, a spring line has not been identified in the vicinity of the Site. However, the contacts between Raised Beach Deposits, Alluvium and Storm Beach Deposits are located on the Site. The presence of a spring line would depend on local differences in elevation and hydraulic conductivity.

The hydrogeological characteristics suggest there is potential for a shallow groundwater table beneath the Site.

The baseline groundwater flood risk rating is Negligble to Moderate, but on the basis of the site-specific assessment the groundwater flood risk is considered to be Low to Moderate.

Guidance
Negligible Risk - There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.
Low Risk - There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.
Moderate Risk - There will be a significant possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.

Climate change predictions suggest an increase in the frequency and intensity of extremes in groundwater levels. Rainfall recharge patterns will vary regionally resulting in changes to average groundwater levels. A rise in peak river levels will lead to a response of increased groundwater levels in adjacent aquifers subject to the predicted climate change increases in peak river level for the local catchment. Sea level rises of between 0.4m and 1m are predicted by 2100, leading to a rise in average groundwater levels in the adjacent coastal aquifer systems, and potential increases in water levels in the associated drainage systems. The 'backing up' of groundwater levels from both coast and tidal estuary locations may extend a significant distance inland and affect infrastructure previously constructed above average groundwater levels.

The impact of climate change on groundwater levels beneath the Site is linked to the predicted rise in average sea level.

Flooding from artificial sources

Artificial sources of flood risk include waterbodies or watercourses that have been amended by means of human intervention rather than natural processes. Examples include reservoirs (and associated water supply infrastructure), docks, sewers and canals. The flooding mechanism associated with flood risk from artificial sources is primarily related to breach or failure of structures (reservoir, lake, sewer, canal, flood storage areas, etc.).

Sewer flooding

Table 6-4 of the SFRA has identified six incidences or modelled incidences of flooding as a result of surcharging sewers within the BN15 postcode. However, it is recognised that this four digit postcode covers a large area and instances of flooding are not specific to the Site (JBA Consulting, 2020).

Guidance

Properties classified as "at risk" are those that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system either once or twice in the ten year reference period. Records held by the sewage utility company provide information relating to reported incidents, the absence of any records does not mean that the Site is not at risk of flooding.

Canal failure

According to Ordnance Survey (OS) mapping, there are no canals within 500 m of the Site.

Water supply infrastructure

Water supply infrastructure is comprised of a piped network to distribute water to private houses or industrial, commercial or institution establishments and other usage points. In urban areas, this represents a particular risk of flooding due to the large amount of water supply infrastructure, its condition and the density of buildings. The risks of flooding to properties from burst water mains cannot be readily assessed.

If more information regarding the condition and history of the water supply infrastructure within the vicinity of the Site is required, then it is advisable to contact the local water supplier, Southern Water.

Culverts and bridges

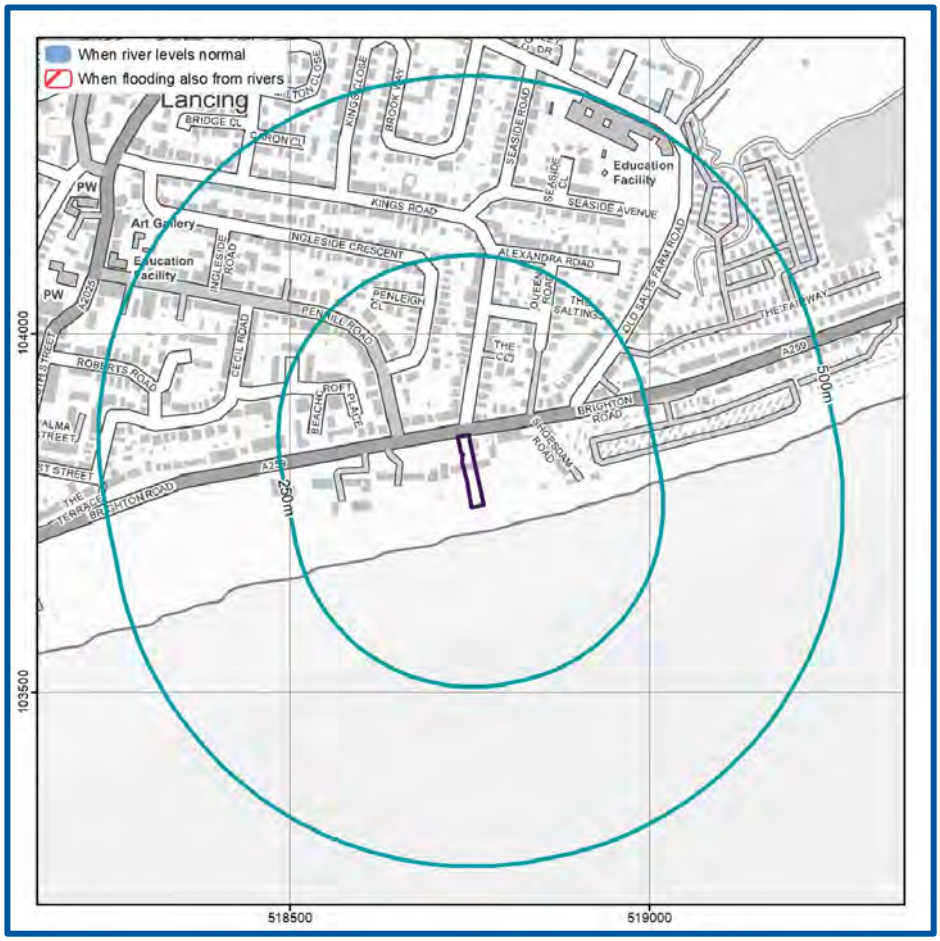
The blockage of watercourses or structures by debris (that is, any material moved by a flowing stream including vegetation, sediment and man-made materials or refuse) reduces flow capacity and raises water levels, potentially increasing the risk of flooding. High water levels can cause saturation, seepage and percolation leading to failure of earth embankments or other structures. Debris accumulations can change flow patterns, leading to scour, sedimentation or structural failure.

Culverts and bridges have not been identified within 50 m of the Site.

Reservoir flooding

According to the EA's Risk of Flooding from Reservoir mapping the Site is not at risk of flooding from reservoirs (Figure 13) (EA, 2022).

Figure 13. EA Risk of Reservoir Flooding (EA, 2023)



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Guidance

The risk of reservoir flooding is related to the failure of a large reservoir (holding over 25,000 m^3 of water) and is based on the worst-case scenario. Reservoir flooding is extremely unlikely to occur (EA, 2022).

5. Flood risk from the development

Floodplain storage

Where flood storage from any source of flooding is to be lost as a result of development, on-site level-for-level compensatory storage, accounting for the predicted impacts of climate change over the lifetime of the development, should be provided. Where it is not possible to provide compensatory storage on site, it may be acceptable to provide it off-site if it is hydraulically and hydrologically linked.

The loss of floodplain storage is less likely to be a concern in areas benefitting from appropriate flood risk management infrastructure or where the source of flood risk is solely tidal.

The development is located within a tidal Flood Zone 3 and involves an increase in the proposed building footprint.

The Beachy Head to Selsey Bill Shoreline Management Plan (SMP) (2006) confirms the policy for defences over the next 100 years is to hold the line.

As the development is proposed in a defended flood risk area, the impact on residual flood risk to other properties needs to be considered. New development behind flood defences can increase the residual risk of flooding if the flood defences are breached or overtopped by changing the conveyance of the flow paths or by displacing flood water elsewhere. If the potential impact on residual risk is unacceptable then mitigation should be provided.

Drainage and run-off

The potential surface water run-off generated from the Site during a 1 in 100 year return period should be calculated, using FEH 2013 rainfall data from the online Flood Estimation Handbook (FEH), developed by NERC (2009) and CEH (2016).

The NPPF (2021) recommends the effects of climate change are incorporated into FRA's. As per the most recent update to the NPPG (May 2022) the applicable climate change factor for the 1 in 30 (≥ 3.3% AEP) and 1 in 100 (< 3.3 to 1% AEP) year event to apply to surface water flooding is dependent upon the management catchment.

As the proposed development is residential, the lifespan of the development and requirements for climate change should allow up to the 1% AEP upper end allowance. As the Site is located within the Adur and Ouse Management Catchment the following peak rainfall allowances are to be applied.

Table 6. Climate change rainfall allowances

Adur and Ouse Management Catchment	3.3% Annual exceedance rainfall event		1% Annual exceedance rainfall event	
	2050s	2070s	2050s	2070s
Central	20%	20%	20%	25%
Upper end	35%	40%	45%	45%

Sustainable Drainage System (SuDS)

It is recommended that attenuation of run-off is undertaken on-Site to compensate for proposed increases in impermeable surface areas. Attenuation may comprise the provision of storage within a Sustainable Drainage System (SuDS). SuDS can deliver benefits from improving the management of water quantity, water quality, biodiversity and amenity. Potential SuDS options are presented in the table below, subject to further investigation:

Table 7. SuDS features which may be feasible for the Site

Option	Description
Rainwater harvesting	Rainwater harvesting can collect run-off from the roofs for use in non-potable situations, using water butts for example.
Permeable paving	Permeable pavements can be used for driveways, footpaths and parking areas to increase the amount of permeable land cover. Suitable aggregate materials (angular gravels with suitable grading as per CIRIA, 2007) will improve water quality due to their filtration capacity. Plastic geocellular systems beneath these surfaces can increase the void space and therefore storage but do not allow filtration unless they are combined with aggregate material and/or permeable geotextiles.

6. Suitability of the proposed development

The information below outlines the suitability of proposed development in relation to national and local planning policy.

National policy and guidance

The aims of the national planning policies are achieved through application of the Sequential Test and in some cases the Exception Test.

Guidance

Sequential test: The aim of this test is to steer new development towards areas with the lowest risk of flooding (NPPF, 2021). Reasonably available sites located in Flood Zone 1 should be considered before those in Flood Zone 2 and only when there are no reasonably available sites in Flood Zones 1 and 2 should development in Flood Zone 3 be considered.

Exception test: In some cases, this may need to be applied once the Sequential Test has been considered. For the exception test to be passed it must be demonstrated that the development would provide wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that 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.

Suitability of the proposed development, and whether the Sequential and Exception Tests are required, is based on the Flood Zone the Site is located within and the flood risk vulnerability classification of the existing and proposed development. Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

This report has been produced to assess all development types, prior to any development. The vulnerability classification and Flood Zones are compared within the table overleaf (Table 2 of the NPPG (2022)).

As the Site is located within Flood Zone 3a and the proposed development is defined as More Vulnerable; the proposals are acceptable, but may be subject to the Sequential and Exceptions Test.

Where the Sequential Test is required it must be demonstrated that there are no alternative reasonably available Sites at lower risk of flooding within an area agreed with Adur District Council.

Table 8. Flood risk vulnerability and flood zone 'incompatibility (taken from NPPG, 2022)

Flood risk vulnerability classification		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone	Zone 1 – low probability	✓	✓	✓	✓	✓
	Zone 2 – medium probability	✓	✓	Exception test required	✓	✓
	Zone 3a - high probability	Exception test required	✓	X	Exception test required	✓
	Zone 3b – functional flood plain	Exception test required	✓	X	X	X

EA Flood Risk Standing Advice for vulnerable developments located in Flood Zones 2 or 3 (February, 2022)

For all relevant vulnerable developments (i.e. more vulnerable, less vulnerable and water compatible), advice on the points should be followed:

- Surface water management;
- Access and evacuation; and
- Floor levels.

Surface water management

Plans for the management of surface water need to meet the requirements set out in either the local authority's:

- Surface water management plan where available; OR
- Strategic flood risk assessment.

They also need to meet the requirements of the approved building regulations Part H: drainage and water disposal. Read section H3 rainwater drainage.

Planning permission is required to use a material that can't absorb water (e.g. impermeable concrete) in a front garden larger than 5m^2.

Access and evacuation

Details of emergency escape plans should be provided for any parts of a building that are below the estimated flood level:

Plans should show:

- Single storey buildings or ground floors that don't have access to higher floors can access a space above the estimated flood level, e.g. higher ground nearby;
- Basement rooms have clear internal access to an upper level, e.g. a staircase;
- Occupants can leave the building if there's a flood and there's enough time for them to leave after flood warnings.

Floor levels

The following should be provided:

- average ground level of your site;
- ground level of the access road(s) next to your building;
- finished floor level of the lowest room in your building.

Finished floor levels should be a minimum of whichever is higher of 300mm above the:

- average ground level of the site;
- adjacent road level to the building;
- estimated river or sea flood level.

You should also use construction materials that have low permeability up to at least the same height as finished floor levels.

If you cannot raise floor levels to meet the minimum requirement, you will need to:

- raise them as much as possible;
- consider moving vulnerable uses to upper floors;
- include extra flood resistance and resilience measures.

When considering the height of floor levels, you should also consider any additional requirements set out in the SFRA. Flood water can put pressure on buildings causing structural issues. If your design aims to keep out a depth of more than 600mm of water, you should get advice from a structural engineer. They will need to check the design is safe.

Extra flood resistance and resilience measures

Follow the guidance in this section for developments in flood risk areas where you cannot raise the finished floor levels to the required height. You should design buildings to exclude flood water where possible and to speed recovery in case water gets in.

Make sure your flood resilience plans for the development follow the guidance in the CIRIA Property Flood Resilience Code of Practice. Please note that the code of practice uses the term 'recovery measures'. In this guide we use 'resilience measures'.

Flooding can affect the structural stability of buildings. If your building design would exclude more than 600mm of flood water, you should get advice from a structural engineer. They will need to check the design is safe. Only use resistance measures that will not cause structural stability issues during flooding. If it is not possible to safely exclude the estimated flood level, exclude it to the structural limit then allow additional water to flow through the property.

The design should be appropriately flood resistant and resilient by:

- using flood resistant materials that have low permeability to at least 600mm above the estimated flood level;
- making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level;
- using flood resilient materials (for example lime plaster) to at least 600mm above the estimated flood level;
- by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level;
- making it easy for water to drain away after flooding such as installing a sump and a pump;
- making sure there is access to all spaces to enable drying and cleaning;
- ensuring that soil pipes are protected from back-flow such as by using non-return valves.

Temporary or demountable flood barriers are not appropriate for new buildings. Only consider them for existing buildings when:

- there is clear evidence that it would be inappropriate to raise floor levels and include passive resistance measures;
- an appropriate flood warning or other appropriate trigger is available.

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7. Resilience and mitigation

Based on the flood risk identified at the Site, the national and local policies and guidance and proposed development, the mitigation measures outlined within this section of the report are likely to help protect the development from flooding.

Sea (coastal/tidal) flood mitigation measures

The Site is located within tidal flood zone 3, although the following table confirms that the Site would not be affected by flooding due to the protection offered from natural and man-made defences.

Table 9. Flood levels and flood depths in the area proposed for development (defended scenario)

Ground levels in area proposed for development (mAOD)	1 in 200 year defended scenario flood level (mAOD)			
	2012 scenario	2067 scenario	2117 scenario	2123 scenario higher central**
4.51 to 5.10*	4.28	4.60	5.03	5.13
Flood depths (m)***	No Flooding	No Flooding	No Flooding	No Flooding

*The ground levels include the area in the southwest of the Site where the proposed extra accommodation is to be situated. Ground levels across the entire Site are between 2.18 and 8.24 mAOD.

**Climate change allowances calculated using the most up to date Government Guidance (EA, 2022), which include an allowance for sea level rise, wave action and surge increase.

*** Although the modelled flood levels are higher than ground levels across parts of the development area, 2D grid extents indicate that the Site is not impacted by flooding. The EA data have considered the flood wall and shingle beach within its modelling (JBA Consulting, 2012) therefore it is likely that the Site does not flood due to a combination of the large volume of the beach, the natural increase in crest level during storm events and the replenishment undertaken on the beach.

Table 10. Flood levels and flood depths in the area proposed for development (undefended scenario)

Ground levels in area proposed for development (mAOD)	1 in 200 year undefended scenario flood level (mAOD)			
	2012 scenario	2070 scenario	2115 scenario	2123 scenario higher central**
4.51 to 5.10*	4.30***	4.79	5.42	5.55
Flood depths (m)	No Flooding	Up to 0.28	Up to 0.91	Up to 1.04

*The ground levels in the above table include the area in the southwest of the Site where the proposed extra accommodation is to be situated. Ground levels across the entire Site are between 2.18 and 8.24 mAOD.

**Climate change allowances calculated using the most up to date Government Guidance (EA, 2022), which includes an allowance for sea level rise, wave action and surge increase.

***Although the grid data indicates that the Site would flood in the present day (2012) scenario, the most recent EA LiDAR data indicates the area proposed for development is at a higher elevation than the maximum flood level of 4.30 mAOD.

Raising minimum floor levels

Although the defended model data indicates that the Site is unlikely to be impacted by tidal flooding, there is a residual risk to the Site in the case that the beach is not replenished. As such, the recommended minimum finished floor level of the proposed development should be set at least 0.3 m above the maximum defended 1 in 200 year (2123) flood level of 5.13 mAOD, to a level of 5.43 mAOD.

According to correspondence with the Client (Appendix F) the highest feasible FFL for the proposed development is 350 mm above the existing ground levels of 4.51 – 5.10 mAOD. Therefore, it is assumed that the FFLs of the proposed cabin can be up to approximately 5.45 mAOD.

As the proposed development includes ground floor sleeping accommodation, additional mitigation measures have been recommended below in order to protect the proposed development in the unlikely case that the beach is not replenished.

Additional Mitigation

The following addition mitigation measures should be considered to protect the proposed development from the residual risk to the Site:

A water exclusion strategy may be appropriate for flood depths up to 0.3 m in line with the EA's Standing Advice. A water exclusion strategy, using avoidance and resistance measures, is appropriate where floods are expected to last for short durations. Potential water exclusion strategies include:

- Passive flood door systems;
- Temporary flood barriers;
- Air brick covers (manual or automatic closing);
- Non-return flap valves on sewer outfalls.
- Construction of local bunds;
- Landscaping to divert water away from the property;
- Sustainable Drainage Systems (SuDS) to store/intercept flood water;
- Boundary walls/fencing;

Avoidance and resistance measures are unlikely to completely prevent floodwater entering a property, particularly during longer duration flood events. Therefore, it is recommended that the following flood resilience measures are also considered.

- Flood resilient materials and designs:
    - Use of low permeability building materials up to 0.3 m such as engineering bricks (Classes A and B) or facing bricks;
    - Hard flooring and flood resilient metal staircases;
    - The use of internal lime plaster/render or where plasterboards are used these should be fitted horizontally instead of vertically and/or using moisture resistant plasterboard at lower levels;
    - Water, electricity and gas meters and electrical sockets should be located above the predicted flood level;
    - Communications wiring: wiring for telephone, TV, Internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage.

If these mitigation measures are implemented this could reduce the flood risk to the development from Low to Very Low.

Rivers (fluvial) flood mitigation measures

As the Site is not identified as being at risk of flooding from fluvial sources, mitigation measures are not required.

Surface water (pluvial) flood mitigation measures

The entire Site is at Very Low to High risk of surface water flooding; however, the proposed development area is not affected by flooding in any scenario. Therefore, mitigation measures are not required.

Groundwater flood mitigation measures

A Negligible to Moderate risk of groundwater flooding has been identified at the Site. In order to ensure the development includes sufficient flood mitigation measures to reduce the risk of groundwater flooding over its lifetime, the following mitigation measures are recommended:

- Finished floor levels of the proposed development should be set at least 0.3 m above the adjacent ground levels.
- Interceptor drains;
- Automatic sump to extract flood water; and
- Non-return flap valves on the proposed foul and surface water sewer lines.

If these mitigation measures are implemented this could reduce the flood risk to the development from Negligible/Moderate to Negligible/Low.

Reservoir flood mitigation measures

The Site is not a risk of flooding from reservoirs; therefore, mitigation measures are not required.

Other flood risk mitigation measures

As the Site is not identified as at risk from other sources, mitigation measures are not required.

Residual flood risk mitigation measures

The risk to the Site has been assessed from all sources of flooding and appropriate mitigation and management measures proposed to keep the users of the development safe over its lifetime. There is however a residual risk of flooding associated with the potential for failure of mitigation measures if regular maintenance and upkeep isn't undertaken. If mitigation measures are not implemented or maintained, the risk to the development will remain as the baseline risk.

Further flood mitigation information

More information on flood resistance, resilience and water entry can be found here: http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

www.knowyourfloodrisk.co.uk

Emergency evacuation - safe access / egress and safe refuge

Emergency evacuation to land outside of the floodplain should be provided if feasible. Where this is not possible, 'more vulnerable' developments and, where possible, development in general (including basements), should have internal stair access to an area of safe refuge within the building to a level higher than the maximum likely water level. An area of safe refuge should be sufficient in size for all potential users and be reasonably accessible to the emergency services. It is understood that the proposed development is single storey and therefore cannot provide safe refuge.

Emergency evacuation from the development and the Site should only be undertaken in strict accordance with any evacuation plans produced for the Site, with an understanding of the flood risks at the Site including available mitigation, the vulnerability of occupants and preferred evacuation routes.

Flood warnings

The EA operates a flood warning service in all areas at risk of flooding; this is available on their website: https://www.gov.uk/check-flood-risk. The Site is located within an EA Flood Alerts/Warning coverage area (ref: 065WAC407 and 065FWC2801, respectively) so is able to receive alerts and warnings (Figure 14). All warnings are also available through the EA's 24 hour Floodline Service 0345 988 1188.

The EA aims to issue Flood Warnings 2 hours in advance of a flood event. Flood Warnings can provide adequate time to enable protection of property and evacuation from a Site, reducing risk to life and property.

Figure 14. EA Flood Warning Coverage for the local area (EA, 2023).



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Emergency evacuation

Where possible, a safe access and egress route with a 'very low' hazard rating from areas within the floodplain to an area wholly outside the 1 in 100 year flood event including an allowance for climate change should be demonstrated.

Based on the EA's Flood Zone Map the closest dry evacuation area within Flood Zone 1 is along Brighton Road (immediately adjacent to the north of the Site). It is advised that evacuation from the premises would be the preferred option in a flood event if safe to do so. It is recommended that residents prepare to evacuate as soon as an EA Flood Warning is issued in order to completely avoid flood waters.

On-Site refuge

Evacuation should be the primary action in preference, however safe refuge could be sought in the north of the Site as it is situated in Flood Zone 1. As the proposed development does not include a first floor, safe refuge could not be sought within the proposed building.

Other relevant information

Occupants should be signed up to receive EAs Flood Alerts and Warnings.

Registration to the Environment Agency's flood warning scheme can be done by following this link: https://www.gov.uk/sign-up-for-flood-warnings.

It is recommended that main communication lines required for contacting the emergency services, electricity sockets/meters, water supply and first aid stations and supplies are not compromised by flood waters. Where possible these should all be raised above the extreme flood level.

8. Conclusions and recommendations

Table 11. Risk ratings following Site analysis

Source of Flood Risk	Baseline[1]	After analysis[2]	After Mitigation[3]
River (fluvial) flooding	Very Low	Very Low	N/A
Sea (coastal/tidal) flooding	Very Low to Low	Very Low to Low	Very Low
Surface water (pluvial) flooding	Very Low to High	Very Low to High	*N/A
Groundwater flooding	Negligible to Moderate	Low to Moderate	Low
Other flood risk factors present	No	No	N/A
Is any other further work recommended?	Yes	Yes	Yes (see below)

1 BASELINE risks assigned for the whole Site, using national risk maps, including the benefit of EA flood defences.

2 AFTER ANALYSIS risks include modifications to the risk assessments based on detailed site-specific analysis including some or all of the following: flood model data, high resolution mapping, building location, access routes, topographic and CCTV surveys. Reasons for the change in classification are provided in the text.

3 AFTER MITIGATION risks include risks to proposed development / asset and occupants if mitigation measures recommended in this report are implemented, including the impacts of climate change.

N/A indicates where mitigation is not required.

*Although a Very Low to High pluvial risk has been identified for the Site, the proposed development is not impacted by flooding in any scenario and therefore mitigation measures are not required.

The table below provides a summary of where the responses to key questions are discussed in this report. Providing the recommended mitigation measures are put in place it is likely that flood risk to this Site will be reduced to an acceptable level.

More vulnerable developments in a Flood Zone 3 are acceptable according to the NPPF and providing the recommended mitigation measures are put in place (see previous sections) it is likely that flood risk to this Site will be reduced to an acceptable level.

Table 12. Summary of responses to key questions in the report

Key sources of flood risks identified	Tidal and groundwater (see Section 4).
Are standard mitigation measures likely to provide protection from flooding to/from the Site?	Yes (see Section 7).
Is any further work recommended?	Yes (see executive summary and Section 7)

9. Further information

The following table includes a list of additional products by GeoSmart:

Additional GeoSmart Products			
✓	Additional assessment: SuDSmart Report		The SuDSmart Report range assesses which drainage options are available for a Site. They build on technical detail starting from simple infiltration screening and work up to more complex SuDS Assessments detailing alternative options and designs. Please contact info@geosmartinfo.co.uk for further information.
✓	Additional assessment: EnviroSmart Report		Provides a robust desk-based assessment of potential contaminated land issues, taking into account the regulatory perspective. Our EnviroSmart reports are designed to be the most cost effective solution for planning conditions. Each report is individually prepared by a highly experienced consultant conversant with Local Authority requirements. Ideal for pre-planning or for addressing planning conditions for small developments. Can also be used for land transactions. Please contact info@geosmartinfo.co.uk for further information.

10. References and glossary

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GeoSmart Information

Glossary

General terms

BGS	British Geological Survey
EA	Environment Agency
GeoSmart groundwater flood risk model	GeoSmart's national groundwater flood risk model takes advantage of all the available data and provides a preliminary indication of groundwater flood risk on a 50m grid covering England and Wales. The model indicates the risk of the water table coming within 1 m of the ground surface for an indicative 1 in 100 year return period scenario.
Dry-Island	An area considered at low risk of flooding (e.g. In a Flood Zone 1) that is entirely surrounded by areas at higher risk of flooding (e.g. Flood Zone 2 and 3)
Flood resilience	Flood resilience or wet-proofing accepts that water will enter the building, but through careful design will minimise damage and allow the re-occupancy of the building quickly. Mitigation measures that reduce the damage to a property caused by flooding can include water entry strategies, raising electrical sockets off the floor, hard flooring.
Flood resistance	Flood resistance, or dry-proofing, stops water entering a building. Mitigation measures that prevent or reduce the likelihood of water entering a property can include raising flood levels or installation of sandbags.
Flood Zone 1	This zone has less than a 0.1% annual probability of river flooding
Flood Zone 2	This zone has between 0.1 and 1% annual probability of river flooding and between 0.1% and 0.5 % annual probability sea flooding
Flood Zone 3	This zone has more than a 1% annual probability of river flooding and 0.5% annual probability of sea flooding
Functional Flood Plain	An area of land where water has to flow or be stored in times of flood.
Hydrologic model	A computer model that simulates surface run-off or fluvial flow. The typical accuracy of hydrologic models such as this is ±0.25m for estimating flood levels at particular locations.
OS	Ordnance Survey
Residual Flood Risk	The flood risk remaining after taking mitigating actions.

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SFRA	Strategic Flood Risk Assessment. This is a brief flood risk assessment provided by the local council
SuDS	A Sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the Site does not increase as a result of the land being developed. SuDS also significantly improve the quality of water leaving the Site and can also improve the amenity and biodiversity that a Site has to offer. There are a range of SuDS options available to provide effective surface water management that intercept and store excess run-off. Sites over 1 Ha will usually require a sustainable drainage assessment if planning permission is required. The current proposal is that from April 2014 for more than a single dwelling the drainage system will require approval from the SuDS Approval Board (SABs).

Aquifer Types

Principal aquifer	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
Secondary A aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Secondary B aquifer	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
Secondary undifferentiated	Has been assigned in cases where it has not been possible to attribute either category A or B to a rock type due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.

NPPF (2021) terms

Exception test	Applied once the sequential test has been passed. For the exception test to be passed it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that 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.

Sequential test	Aims to steer new development to areas with the lowest probability of flooding.
Essential infrastructure	Essential infrastructure includes essential transport infrastructure, essential utility infrastructure and wind turbines.
Water compatible	Water compatible land uses include flood control infrastructure, water-based recreation and lifeguard/coastal stations.
Less vulnerable	Less vulnerable land uses include police/ambulance/fire stations which are not required to be operational during flooding and buildings used for shops/financial/professional/other services.
More vulnerable	More vulnerable land uses include hospitals, residential institutions, buildings used for dwelling houses/student halls/drinking establishments/hotels and sites used for holiday or short-let caravans and camping.
Highly vulnerable	Highly vulnerable land uses include police/ambulance/fire stations which are required to be operational during flooding, basement dwellings and caravans/mobile homes/park homes intended for permanent residential use.

Data Sources

Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2022 BlueSky copyright and database rights 2022
Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2022 Ordnance Survey data © Crown copyright and database right 2022
Flood Risk (Flood Zone/RoFRS/Historic Flooding/Pluvial/Surface Water Features/Reservoir/ Flood Alert & Warning)	Environment Agency copyright and database rights 2022 Ordnance Survey data © Crown copyright and database right 2022
Flood Risk (Groundwater)	GeoSmart, BGS & OS

	GW5 (v2.4) Map (GeoSmart, 2022) Contains British Geological Survey materials © NERC 2022 Ordnance Survey data © Crown copyright and database right 2022
Location Plan	Contains Ordnance Survey data © Crown copyright and database right 2022
Topographic Data	OS LiDAR/EA Contains Ordnance Survey data © Crown copyright and database right 2022 Environment Agency copyright and database rights 2022

11. Appendices

GeoSmart Information

Appendix A

Site plans

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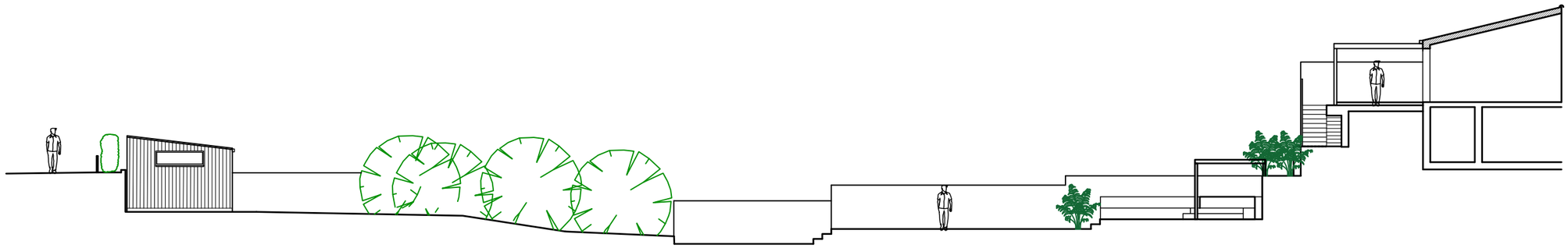


LOCATION PLAN 1:1250

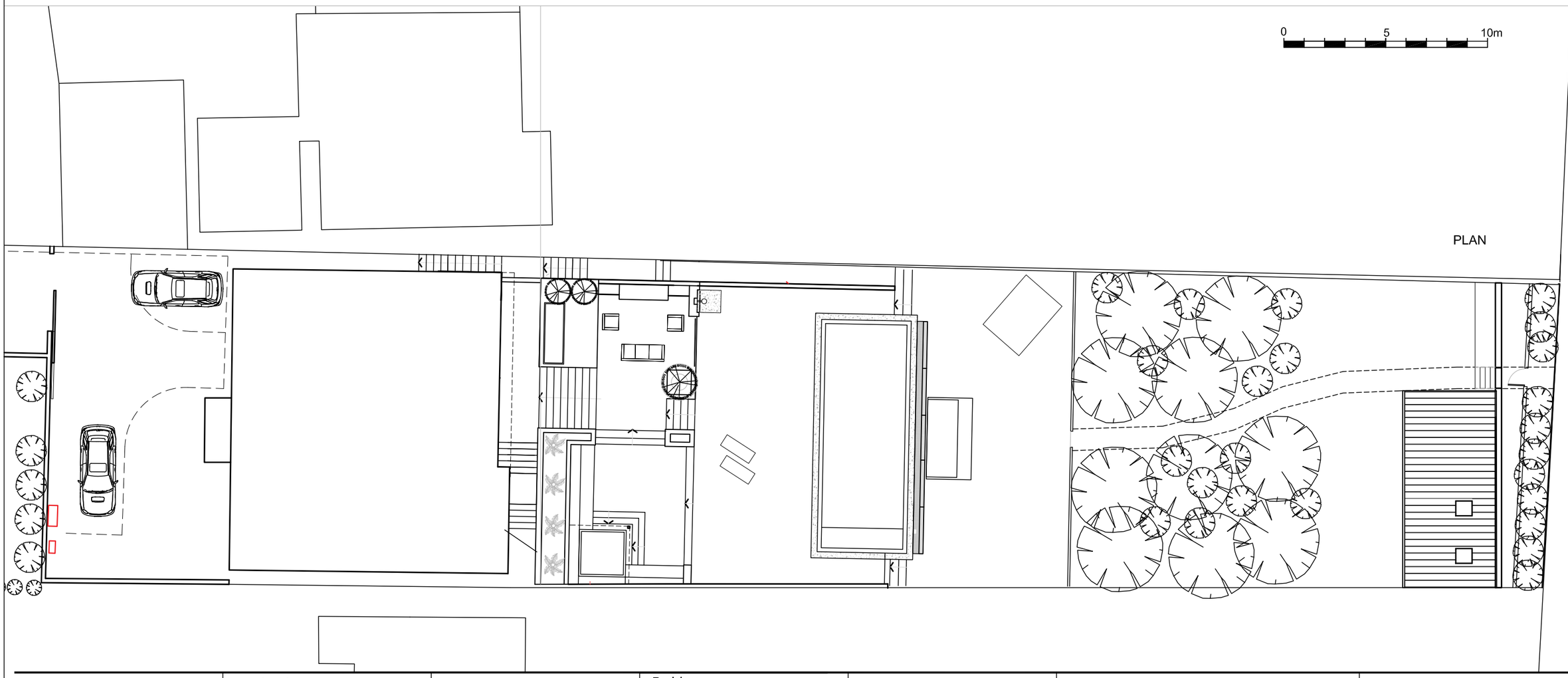


BLOCK PLAN 1:500

Client D. IRESON AND M. KAMIS Job Title 44 BRIGHTON ROAD - CABIN LANCING SUSSEX BN15 8ET	Drawing Title LOCATION & BLOCK PLAN Drawing Status FOR PLANNING Drawn By / Checked By LT	Scale AS @ A3 Date FEB 2023 Drawing No. 2794 - 01 Rev. A	Revisions Rev. Date. Description A 07.02.23 MINOR AMENDMENTS		All site dimensions and levels to be verified by contractors and subcontractors on site prior to manufacture Do not Scale from this drawing apart for planning purposes To be read in conjunction with all other drawings and contract documentation Contractor to refer to all relevant consultants and engineers drawings throughout the course of the works All works to comply to local authority requirements Any errors, dimensional discrepancies or omissions to be reported to Inature prior to manufacture Drawing is for design intent only	inature architecture & design www.inature.co.uk T. 0207 223 8100 T. 01273 710 056 © inature



SECTION LOOKING TOWARDS NO 42 BRIGHTON ROAD



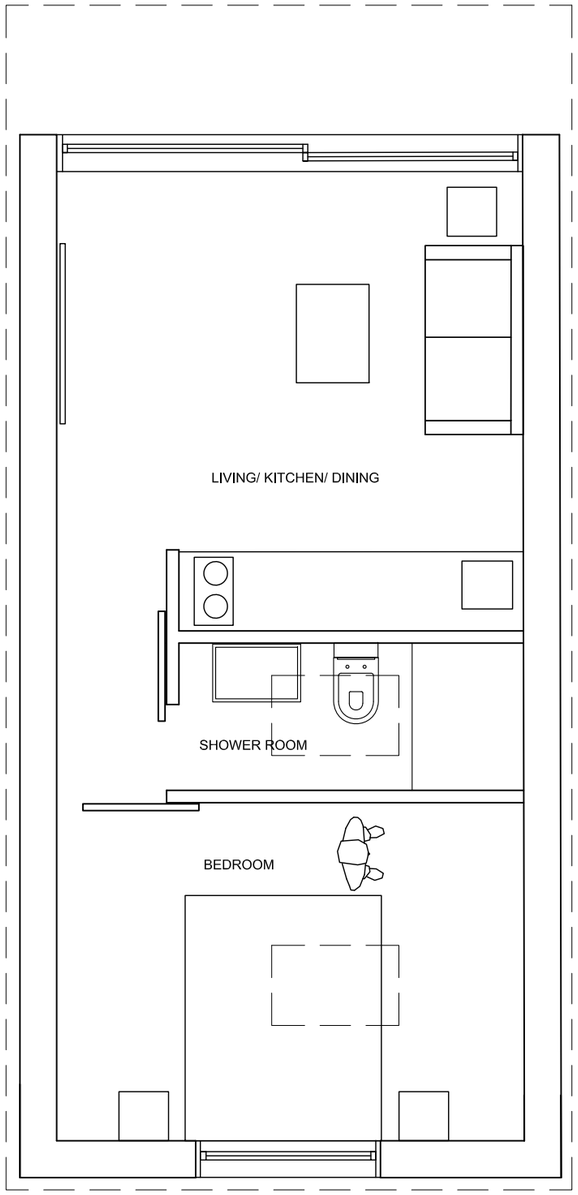
PLAN

Client D.IRESON & M.KAMIS Job Title 44 BRIGHTON ROAD - CABIN LANCING BN15 8ET	Drawing Title PROPOSED SITE PLAN AND SECTION Drawing Status FOR PLANNING Drawn By / Checked By LT	Scale 1:200 @ A3 Date FEB 2023 Drawing No. 2794 - 02 Rev. A	Revisions Rev. Date. Description A 07.02.23 MINOR AMENDMENTS		All site dimensions and levels to be verified by contractors and subcontractors on site prior to manufacture Do not Scale from this drawing apart for planning purposes To be read In conjunction with all other drawings and contract documentation Contractor to refer to all relevant consultants and engineers drawings throughout the course of the works All works to comply to local authority requirements Any errors, dimensional discrepancies or omissions to be reported to Inature prior to manufacture Drawing is for design intent only

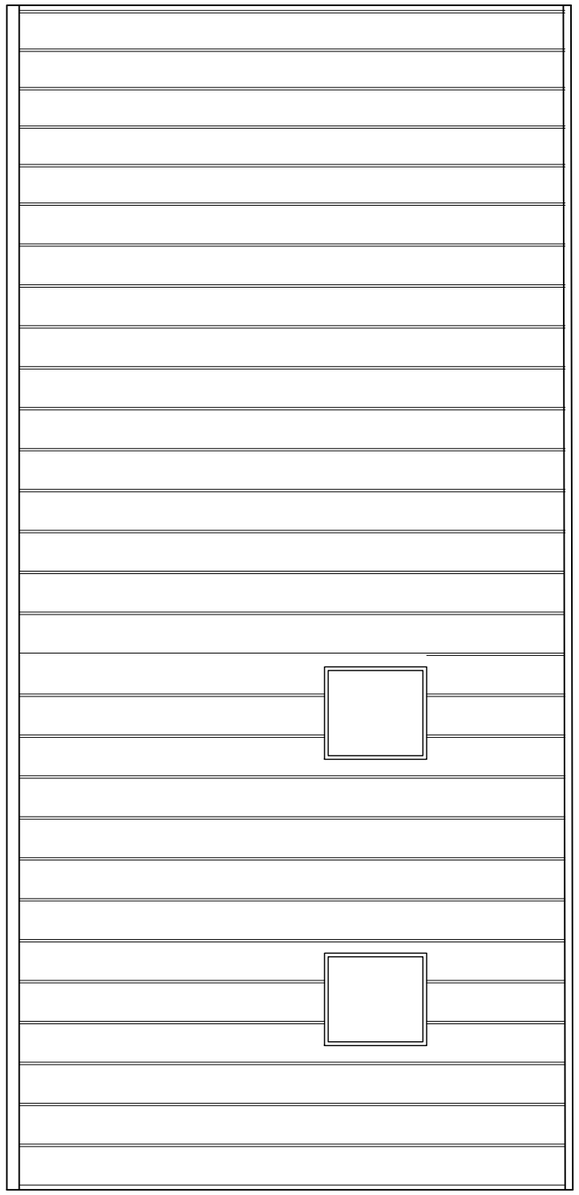
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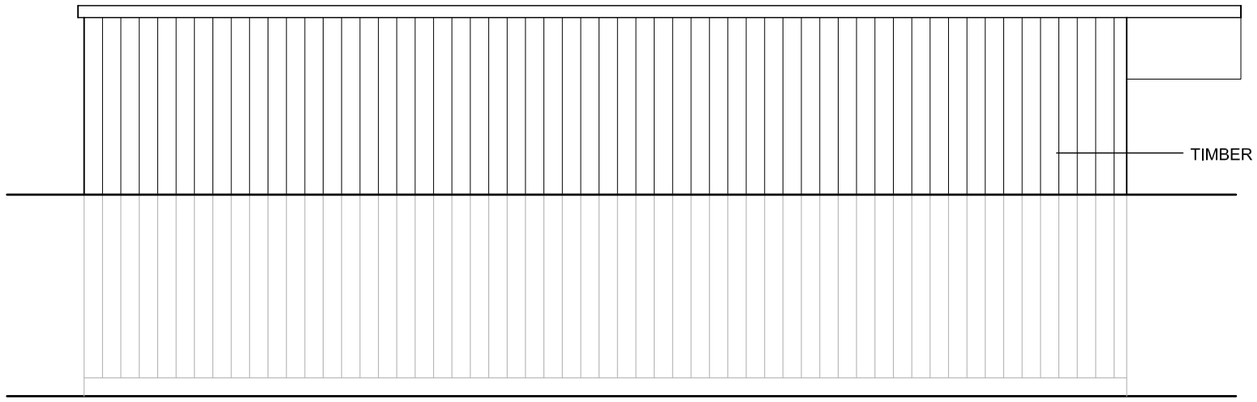
PLAN



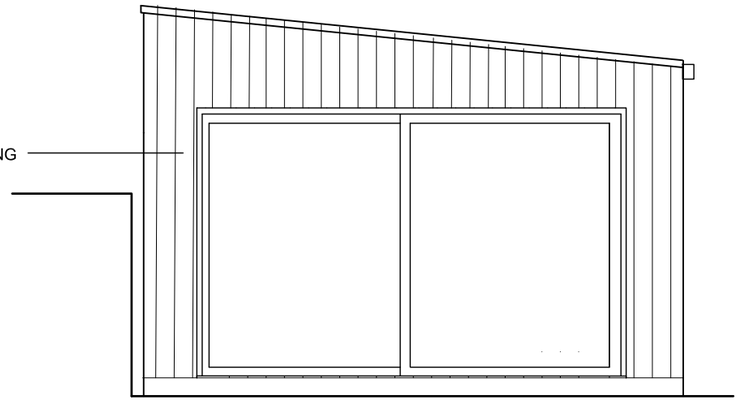
ROOF PLAN

0 1m 2 3 4 5

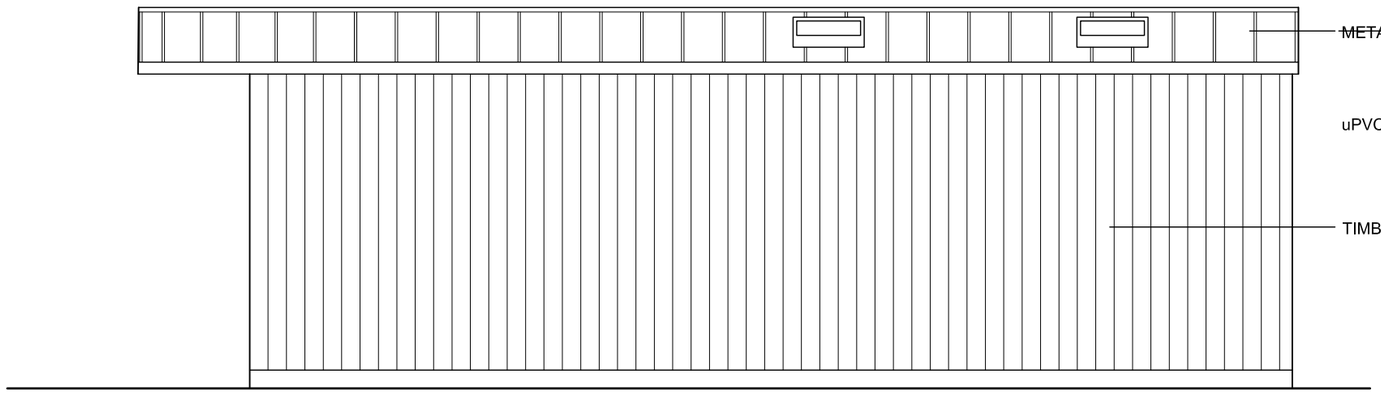
Client D.IRESON & M.KAMIS Job Title 44 BRIGHTON ROAD - CABIN LANCING BN15 8ET	Drawing Title PROPOSED PLANS Drawing Status FOR PLANNING Drawn By / Checked By LT	Scale / Date 1:50 @ A3 / FEB 2023 Drawing No. / Rev. 2794 - 03 / A	Revisions Rev. Date. Description A 07.02.23 MINOR AMENDMENTS		All site dimensions and levels to be verified by contractors and subcontractors on site prior to manufacture Do not Scale from this drawing apart for planning purposes To be read In conjunction with all other drawings and contract documentation Contractor to refer to all relevant consultants and engineers drawings throughout the course of the works All works to comply to local authority requirements Any errors, dimensional discrepancies or omissions to be reported to Inature prior to manufacture Drawing is for design intent only	inature architecture & design www.inature.co.uk T. 0207 223 8100 T. 01273 710 056 © inature



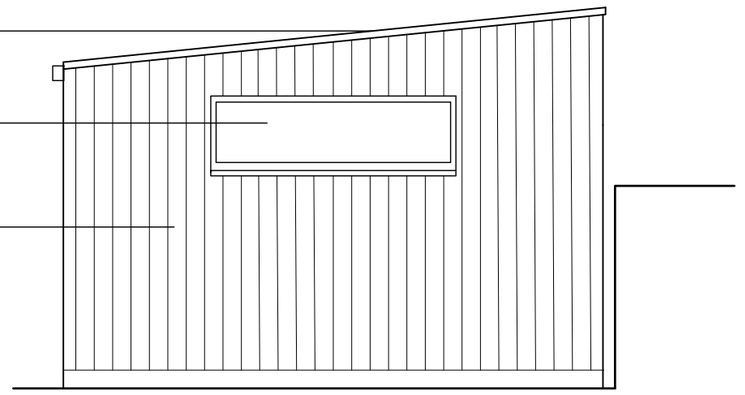
SIDE ELEVATION FACING BEACH - SOUTH



FRONT ELEVATION - WEST



SIDE ELEVATION FACING MAIN HOUSE - NORTH



REAR ELEVATION - EAST

0 1m 2 3 4 5

Client
D.IRESON & M.KAMIS

Job Title
44 BRIGHTON ROAD - CABIN
LANCING
BN15 8ET

Drawing Title
PROPOSED ELEVATIONS

Drawing Status
FOR PLANNING

Drawn By

Checked By
LT

Scale
1:50 @ A3

Date
FEB 2023

Drawing No.
2794 - 04

Rev.
A

Revisions

Rev.	Date.	Description
A	07.02.23	MINOR AMENDMENTS

All site dimensions and levels to be verified by contractors and subcontractors on site prior to manufacture
Do not Scale from this drawing apart for planning purposes
To be read In conjunction with all other drawings and contract documentation
Contractor to refer to all relevant consultants and engineers drawings throughout the course of the works All works to comply to local authority requirements
Any errors, dimensional discrepancies or omissions to be reported to Inature prior to manufacture
Drawing is for design intent only

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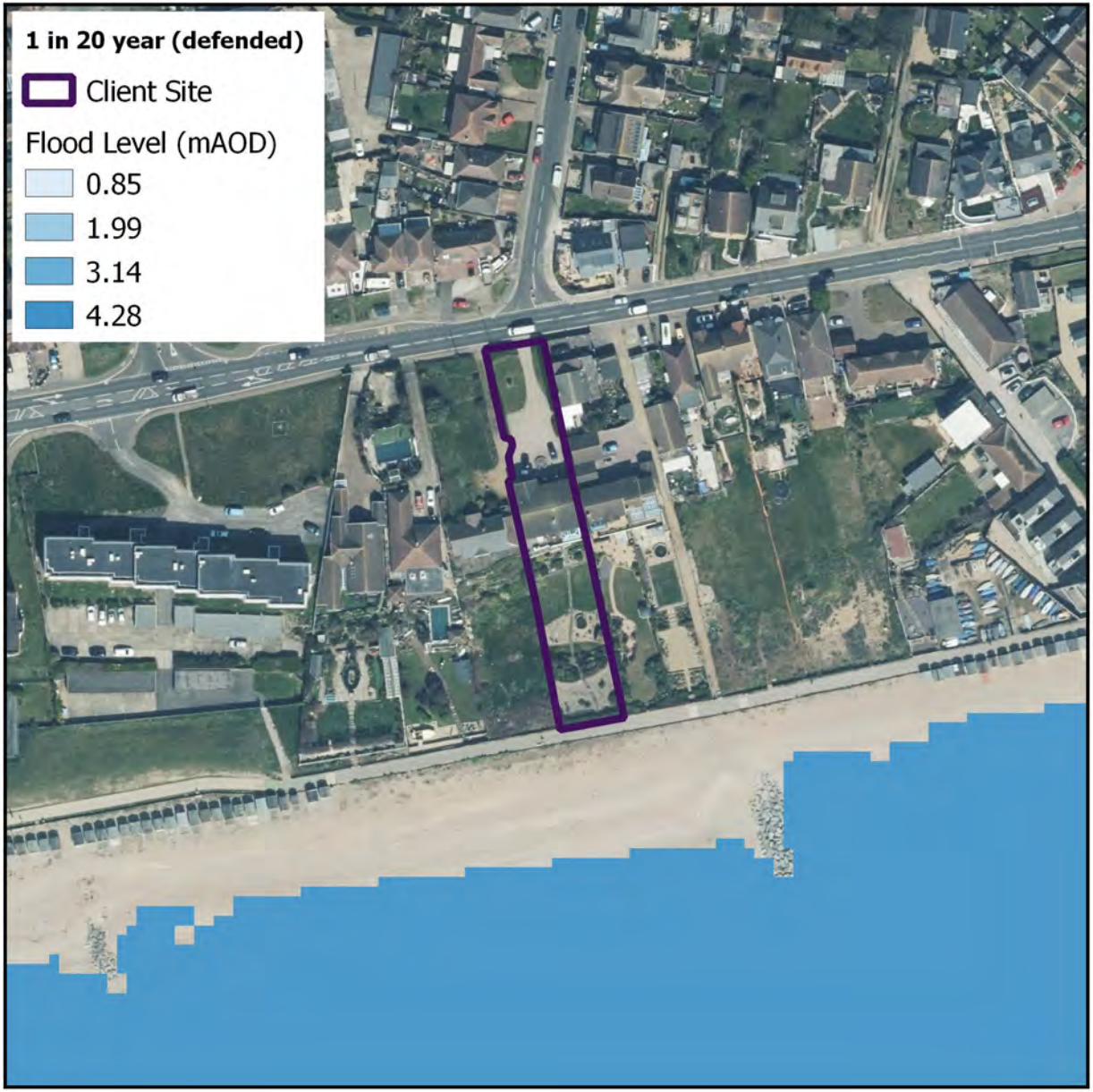
Appendix B

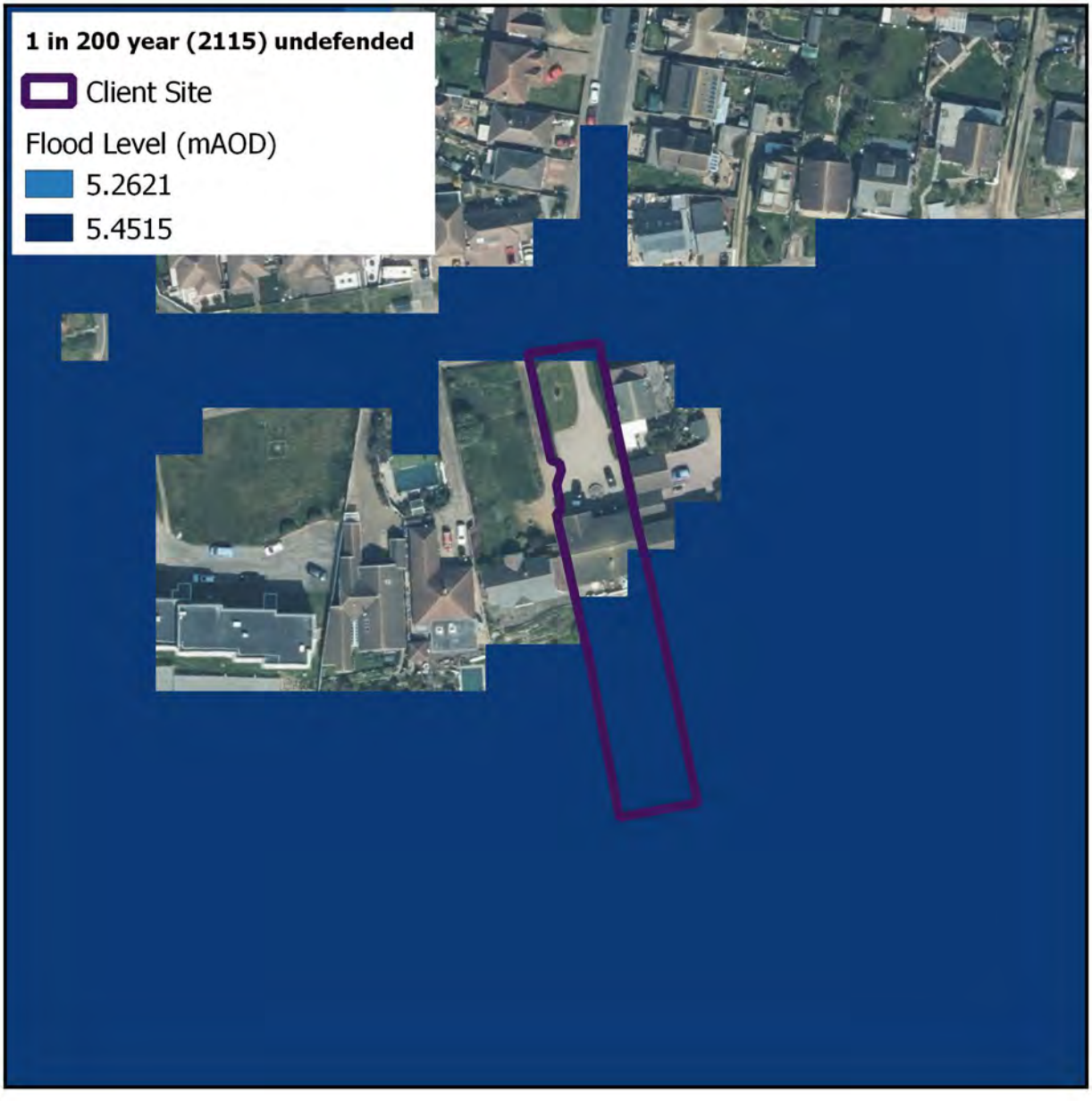
Environment Agency data

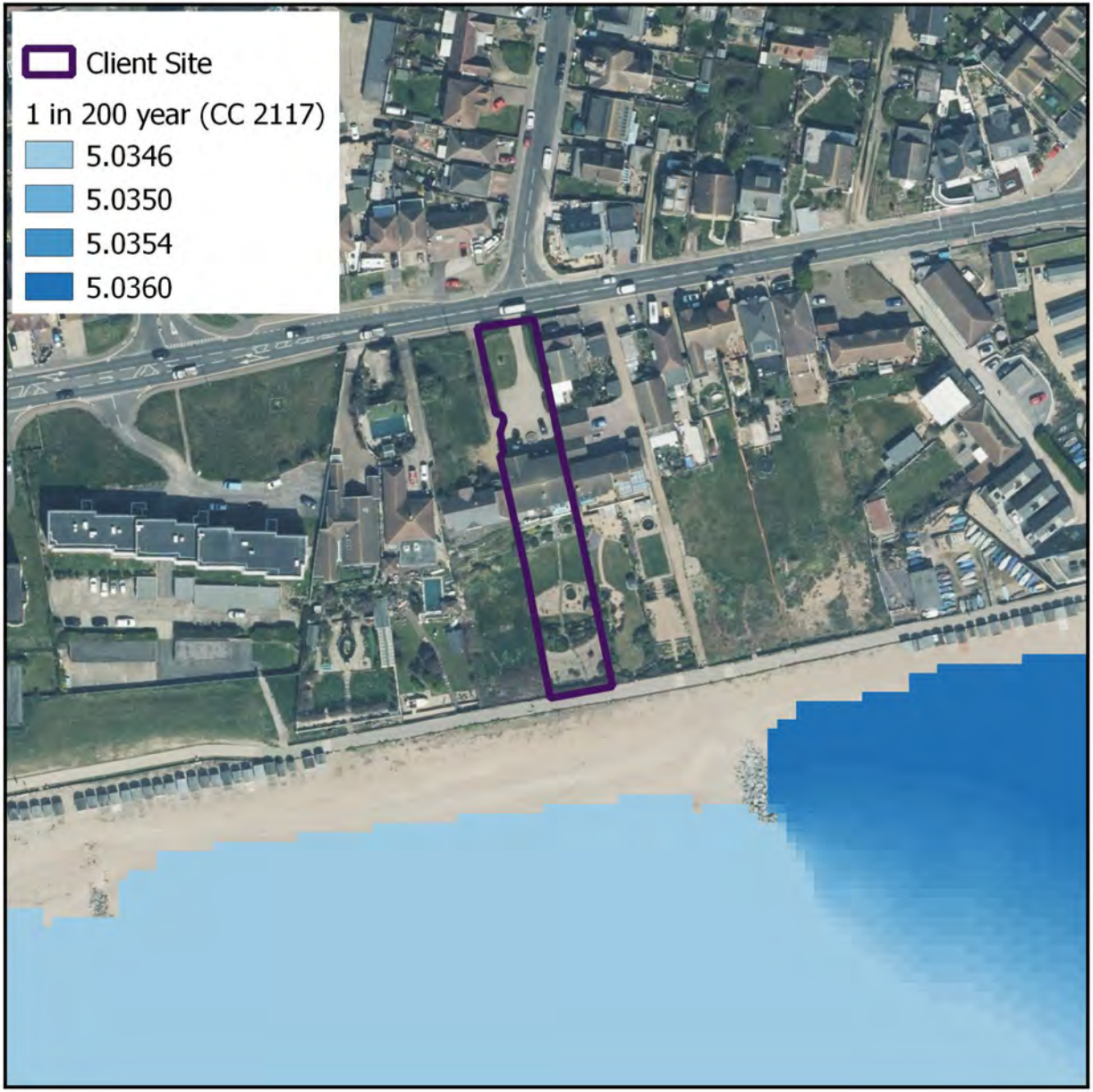
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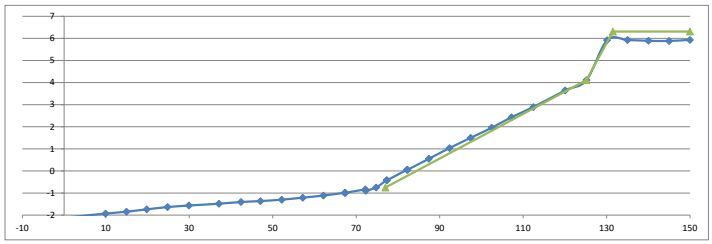

1 in 20 year (defended)
Client Site
Flood Level (mAOD)
0.85
1.99
3.14
4.28


1 in 200 year (2115) undefended
Client Site
Flood Level (mAOD)
5.2621
5.4515


Client Site
1 in 200 year (CC 2117)
5.0346
5.0350
5.0354
5.0360

Dist	Elev	slope
149.9846	5.934	0.560405
144.975	5.885	-0.08116
140.0332	5.892	-0.37631
135.0088	5.925	0.035165
130.1208	5.922	20.06313
125.1676	4.113	5.228104
120.0748	3.647	5.639652
112.4292	2.892	5.032687
107.2057	2.432	5.745922
102.4851	1.957	5.168412
97.4216	1.499	5.228885
92.3842	1.038	5.595638
87.4237	0.552	5.588907
82.3039	0.051	-0.37944
82.1529	0.052	5.68785
77.3637	-0.425	-5.05169
77.2732	-0.417	7.558261
74.756	-0.751	3.389898
72.2912	-0.897	-32.6054
72.1974	-0.837	1.864369
67.4049	-0.993	-0.98437
67.2303	-0.99	1.381978
62.1318	-1.113	1.124871
57.1917	-1.21	1.020257
52.138	-1.3	0.730272
47.0385	-1.365	0.503789
42.3757	-1.406	0.839063
37.1181	-1.483	0.6591
29.9032	-1.566	0.795552
24.7901	-1.637	1.163124
19.8155	-1.738	1.261844
14.9578	-1.845	0.982052
9.9408	-1.931	1.054561
4.9972	-2.022	1.123482
0	-2.12	

2150



x	y	
76.7	-0.751	
95	1.499	7.009384
125.1676	4.113	4.952267
130.1208	5.922	20.06313

	58	JH	
Toe	77	-0.751	9.902878
Berm	125.1676	4.113	2.882294
Ac	131.5	6.31	
Rc	149.98	6.31	18.48

Average Crest	6.31
Toe	-0.75

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Normal	-0.75	-0.75	0	9.9	4.11	0	0	2.88	6.31	18.48	6.31	0.8	-1.00	169.48
Risk														

1 Level in Front of Toe
2 Toe Level
3 Width of Toe
4 Slope downward of Berm (cotangent)
5 Berm level (m)
6 Width of Berm (m)
7 Slope of Berm (tangent)
8 Slope upward of Berm (cotangent)
9 Armour crest level (m)
10 Width of Armour crest (m)
11 Crest level (m)
12 Roughness 1
13 Roughness 2
14 Normal angle of defence (degrees from North)

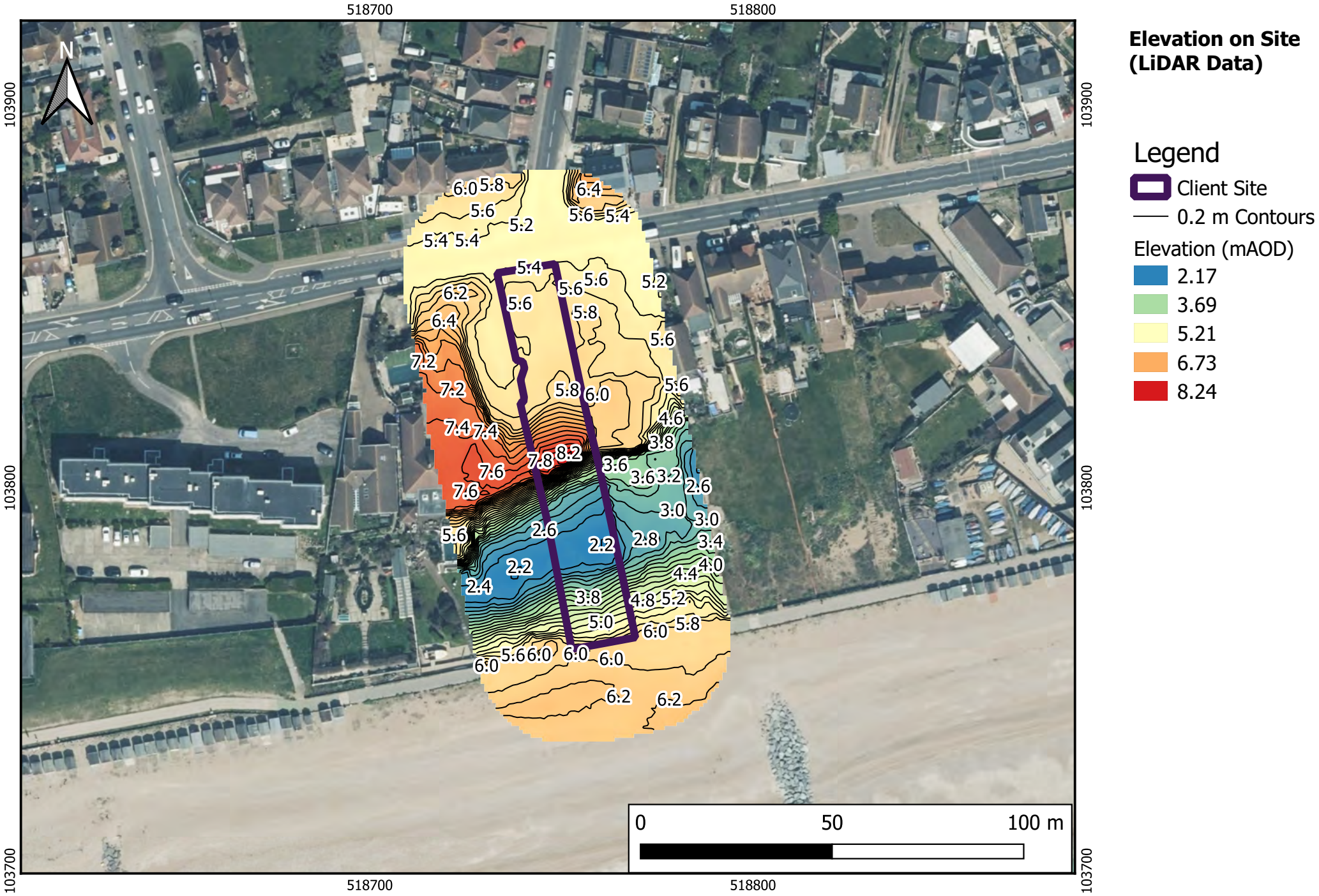
Re Risk Profile
Low lying land behind beach.
Average elevation of land behind beach sampled using points at 10m intervals is 2.70mOD.

GeoSmart Information

Appendix C

Environment Agency LiDAR ground elevation data

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518700
518800
103900
103800
103700
N
0
50
100 m
Elevation on Site
(LiDAR Data)
Legend
Client Site
0.2 m Contours
Elevation (mAOD)
2.17
3.69
5.21
6.73
8.24

GeoSmart Information

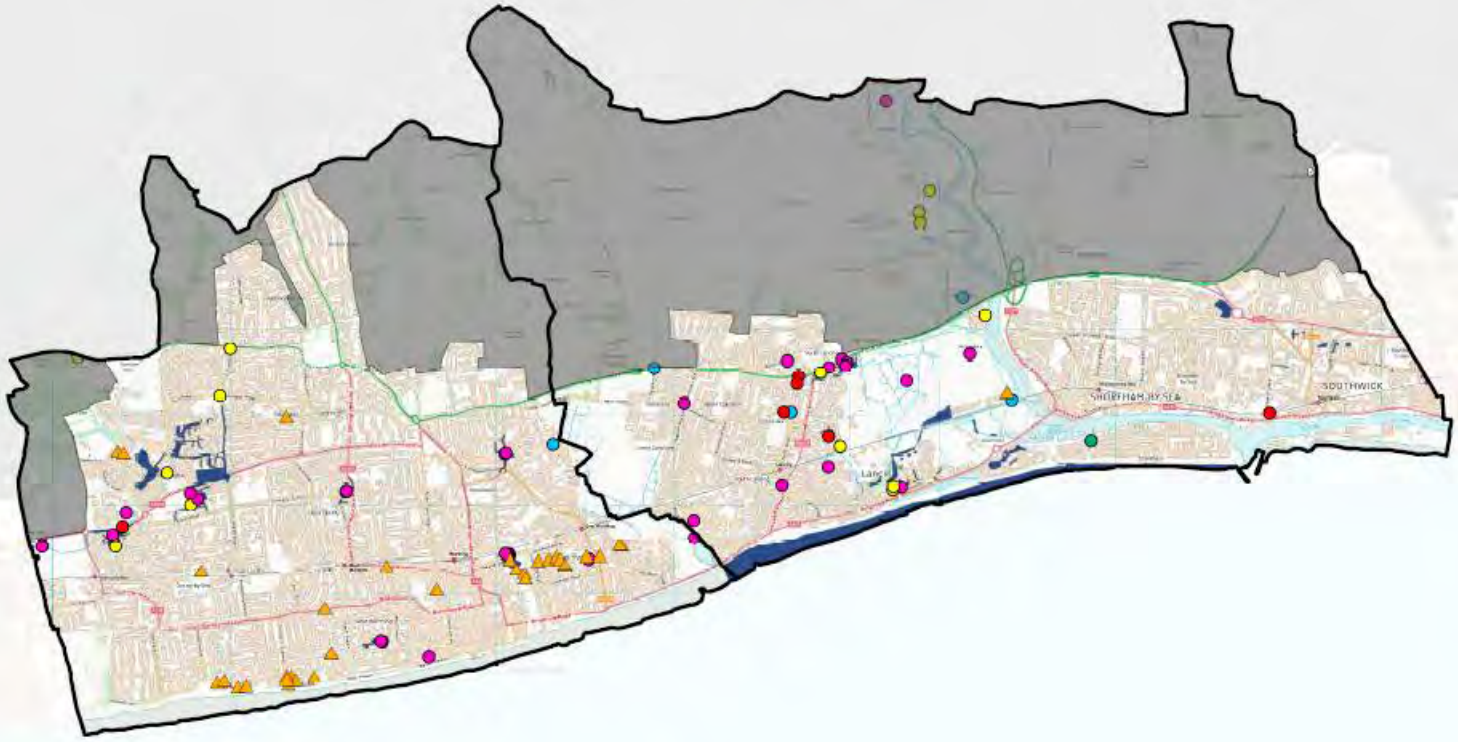
Appendix D

Local Council document mapping

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www.geosmartinfo.co.uk





Legend

- Adur District and Worthing Borough
- South Downs National Park
- EA Recorded Flood Outlines
- Properties flooded in June 2012 surface water flood event

WSCC recorded flood incidents

- Unknown
- Drainage (sewer or surface water)
- Failure
- River
- Tidal

Notes

The Historic Flood Map shows the recorded incidents and flood outlines provided by West Sussex County Council and Environment Agency.
Flooding incidents provided have been categorised based upon the details provided in the records.
Unknown flood points could not be determined from the information provided, and therefore could be from a number of sources. Please note that not all historical records may be shown on this map, and that it is therefore advised you contact the Enviornment Agency or West Sussex County Council for updated information.

0 1.25 2.5 Kilometres

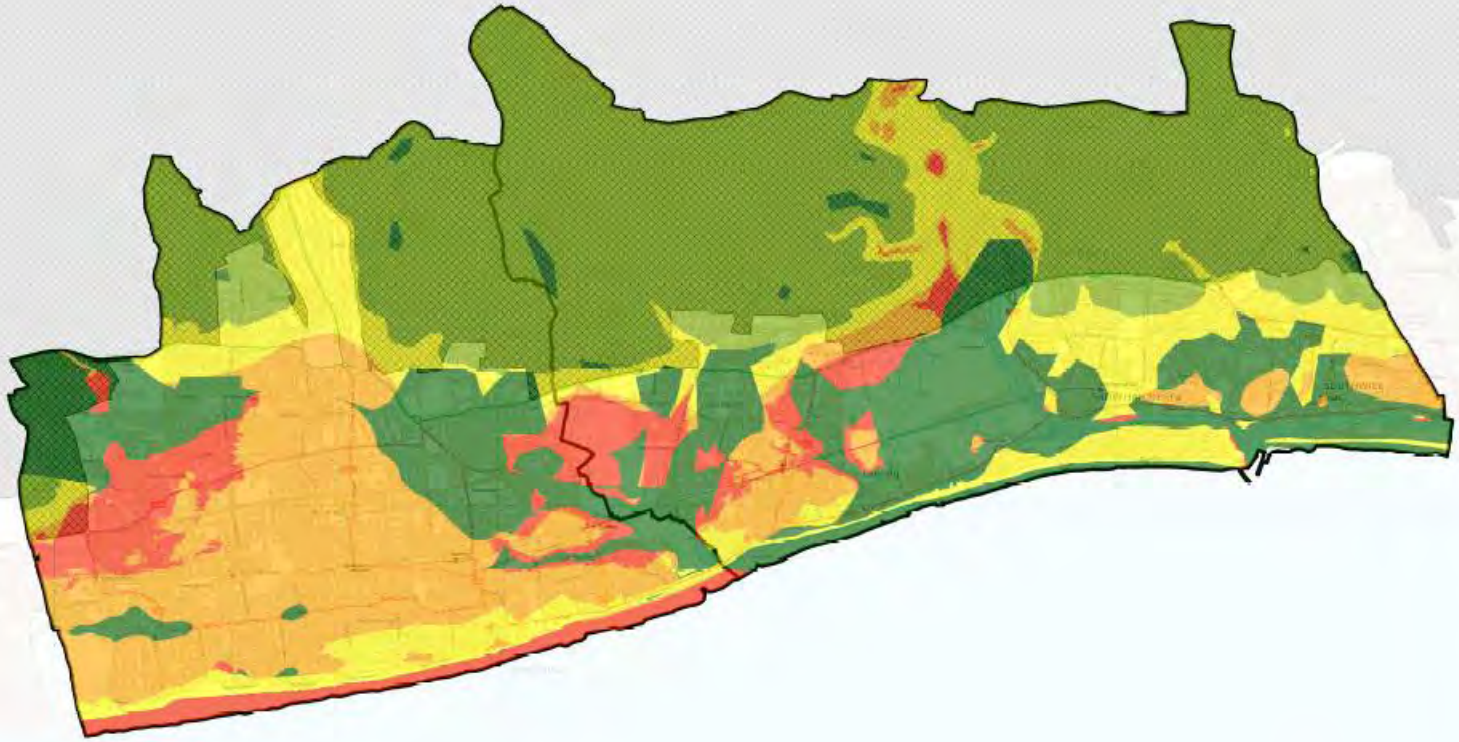
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Adur and Worthing Councils

SFRA: APPENDIX A
HISTORIC FLOODING

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ADUR & WORTHING COUNCILS





Legend

- Adur District and Worthing Borough
- South Downs National Park

JBA Groundwater Map

- No risk.
- Groundwater levels are at least 5m below the ground surface.
- Groundwater levels are between 0.5m and 5m below the ground surface.
- Groundwater levels are between 0.025m and 0.5m below the ground surface.
- Groundwater levels are either at or very near (within 0.025m of) the ground surface.

Notes

JBA has developed a range of Groundwater Flood Map products at the national scale. It should be noted that the JBA Groundwater Flood Map is suitable for general broad-scale assessment of the groundwater flood hazard in an area, but is not explicitly designed for the assessment of flood hazard at the scale of a single property. In high risk area a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding.

0 1.25 2.5 Kilometres

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SFRA: APPENDIX H
JBA GROUNDWATER FLOOD RISK MAPPING

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ADUR & WORTHING COUNCILS



Legend

- Adur District and Worthing Borough
- South Downs National Park

Tidal Groundwater Risk Zones

- Low Risk
- Zone GW 1
- Zone GW 2
- Zone GW 3
- Zone GW 4

Notes

Technical assessment of the impact of sea level rise upon surface water. Zone categories are outlined as follows:

Low Risk - Above future tidal level
GW1 - GW level more than 0.5m below the surface and region is above the current tidal level but below the future tidal level
GW2 - GW level more than 0.5m below the surface and region is below the present-day tidal level OR GW level between 0.025m and 0.5m below the surface and region is above the current tidal level but below the future tidal level
GW3 - GW level between 0.025m and 0.5m below the surface and region is below the present-day tidal level OR GW level within 0.025m of the surface and region is above the current tidal level but below the future tidal level
GW4 - GW level within 0.025m of the surface and region is below the present-day tidal level

0 1.25 2.5 Kilometres

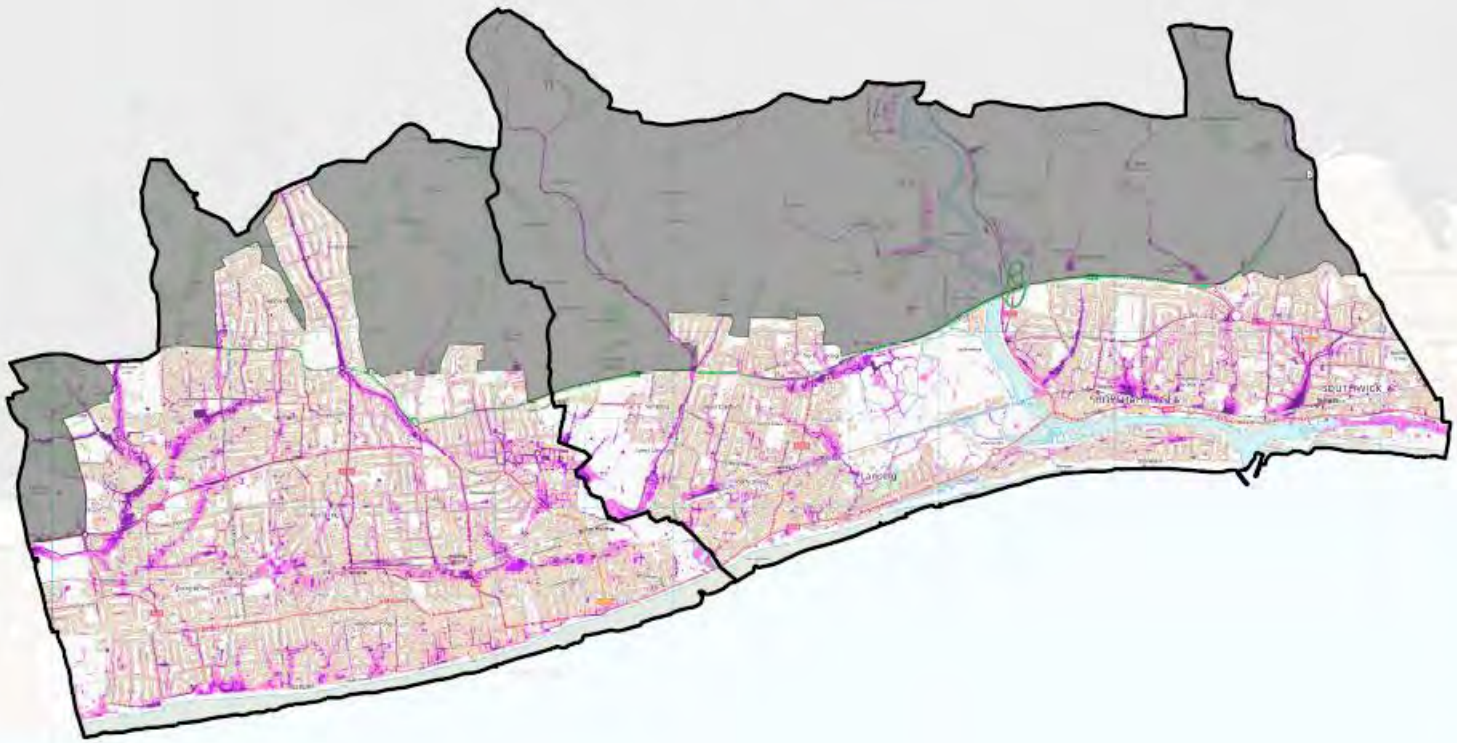
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SFRA: APPENDIX I
IMPACT OF SEA LEVEL RISE UPON GROUNDWATER

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Legend

- Adur District and Worthing Borough
- South Downs National Park
- 3.33% AEP (1 in 30-
- 1% AEP (1 in 100-
- 0.1% (1 in 1000-year)

Notes

The Environment Agency's Risk of Flooding from Surface Water (RoFSW) model is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. They provide a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water.

The results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to more accurately illustrate the flood risk at a site-specific scale.

0 1.25 2.5 Kilometres

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SFRA: APPENDIX E
RISK OF FLOODING FROM SURFACE WATER

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ADUR & WORTHING COUNCILS



Legend

- Adur District and Worthing Borough
- South Downs National Park

Defence protection type

- Coastal
- Fluvial
- Fluvial and tidal
- Tidal
- Defence under construction

Notes

Environment Agency defences are shown with a standard of protection which is against a 5% AEP event or more. Man-made and natural defences which may arise, for instance due to the presence of naturally high ground adjacent to a settlement, have been considered.

The defences along the Adur District coastline are coastal defences. With climate change, it is likely that many of the coastal defences will need to become tidal defences in the future.

At the time of preparing this SFRA a section of defences for the Shoreham Tidal Walls Scheme was still under construction.

0 1.25 2.5 Kilometres

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Adur and Worthing Councils

SFRA: APPENDIX J.1
ENVIRONMENT AGENCY
FLOOD DEFENCES

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ADUR & WORTHING COUNCILS





Legend

- Adur District and Worthing Borough
- South Downs National Park

Defence type

- Beach
- Embankment
- Wall
- High ground
- Defence under construction

Notes

Environment Agency defences are shown with a standard of protection which is against a 5% AEP event or more. Man-made and natural defences which may arise, for instance due to the presence of naturally high ground adjacent to a settlement, have been considered.

At the time of preparing this SFRA a section of defences for the Shoreham Tidal Walls Scheme was still under construction.

0 1.25 2.5 Kilometres

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Adur and Worthing Councils
SFRA: APPENDIX J.2
FLOOD DEFENCE TYPE

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ADUR & WORTHING COUNCILS





Legend

- Adur District and Worthing Borough
- South Downs National Park
- Defence under construction

Defence standard of protection

- 0.1%
- 0.2%
- 0.5%
- 1%
- 2%
- 3.33%
- 4%
- 6.67%
- 10%
- 20%

Notes

Flood defences are designed to give a specific standard of protection, reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 1% AEP standard of protection means that the flood risk in the defended area is reduced to a 1% chance of flooding in any given year.

Although flood defences are designed to a standard of protection it should be noted the actual standard of protection provided by the defence may decrease over time, for example due to deterioration in condition or increases in flood risk due to climate change.

Environment Agency defences are shown with a standard of protection which is against a 5% AEP event or more. Man-made and natural defences which may arise, for instance due to the presence of naturally high ground adjacent to a settlement have been considered.

At the time of preparing this SFRA a section of defences for the Shoreham Tidal Walls Scheme was still under construction.

0 1.25 2.5 Kilometres

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Adur and Worthing Councils

SFRA: APPENDIX J.3
FLOOD DEFENCE STANDARD OF PROTECTION

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ADUR & WORTHING COUNCILS





Legend

- Adur District and Worthing Borough
- South Downs National Park

Defence condition

- Very good
- Good
- Fair
- Poor
- Defence under construction

Notes

Environment Agency defences are shown with a standard of protection which is against a 5% AEP event or more. Man-made and natural defences which may arise, for instance due to the presence of naturally high ground adjacent to a settlement, have been considered.

Formal structural defences are given a rating by the Environment Agency based on a grading system for their condition from very poor to very good.

At the time of preparing this SFRA a section of defences for the Shoreham Tidal Walls Scheme was still under construction.

0 1.25 2.5 Kilometres

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Adur and Worthing Councils
SFRA: APPENDIX J.4
FLOOD DEFENCE CONDITION

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ADUR & WORTHING COUNCILS

GeoSmart Information

Appendix E

Correspondence with the EA

From: Emilia Doncic
To: PSO West Sussex
Subject: RE: SSD288714 - Product 5,6,7 Data - 44 Brighton Road, Lancing, BN15 8ET
Date: 25 January 2023 11:43:54
Attachments: image001.png
image002.jpg
image003.png
image004.jpg
image005.gif
image006.gif
image007.gif
image008.gif
image009.gif
image010.gif
image011.png
image012.gif
image013.jpg
site location.PNG
image014.png

Hi Jon,

Thank you for the email.

I'm not entirely sure I understand some aspects of the spreadsheets you sent over so I was wondering if I could get some clarity on a few things. The polyline you sent over has the label 'OV_58' adjacent to the Site, am I right to assume that corresponds to tab 58 within the spreadsheet you sent over? Am I right to think that the blue line in the graph below corresponds to the profile of the beach and that the green line includes the crest height of the defences? The average crest of 6.31 mAOD seems to match with the LiDAR data I have been using.



You mentioned in the below email that the defended outputs include wave overtopping. From the data we received, we have outputs for the Arun 'defences with waves' and 'WO' (wave overtopping, I assume). The Adur model is the one that is relevant for the site I am working on – I've attached a screenshot of where it is). The only files we received for the Adur are the 'new defended outputs' with the file names starting with 'ADUR_ATW_CD5m'. Am I right to assume that these outputs have accounted for wave overtopping? Or should we have received some other files too (e.g. Adur defences with waves)? We also did not receive undefended outputs for the Adur.

Apologies for all of the questions, I would just like to understand the data before finalising the FRA.
I hope to hear from you soon.

Kind regards,
Emilia

Emilia Doncic
Environmental Consultant

t. +44 (0)1743 298 100
e. emiliadoncic@geosmartinfo.co.uk
@geosmartinfo
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Please consider the environment before printing this email.

From: PSO West Sussex <PSOWestSussex@environment-agency.gov.uk>
Sent: 17 January 2023 14:45
To: Emilia Doncic <EmiliaDoncic@geosmartinfo.co.uk>
Cc: PSO West Sussex <PSOWestSussex@environment-agency.gov.uk>
Subject: RE: SSD288714 - Product 5,6,7 Data - 44 Brighton Road, Lancing, BN15 8ET

Hi Emilia,

The grid data supplied included modelled outputs for both the undefended and defended scenarios. Only the defended scenarios included wave overtopping and so to quantify the risk from overtopping please use the defended outputs.

I have also included comprehensive wave overtopping calculation inputs and outputs for your information.

Regards
Jon

Jon Denman – FCRM Advisor
Partnership and Strategic Overview, West Sussex
Environment Agency | Guildbourne House, Chatsworth Road, Worthing BN11 1LD

From: Emilia Doncic <EmiliaDoncic@geosmartinfo.co.uk>
Sent: 13 January 2023 12:39
To: PSO West Sussex <PSOWestSussex@environment-agency.gov.uk>
Subject: RE: SSD288714 - Product 5,6,7 Data - 44 Brighton Road, Lancing, BN15 8ET

You don't often get email from emiliadoncic@geosmartinfo.co.uk. Learn why this is important

Dear Amy,

I'm just emailing in regards to the Product 5, 6 and 7 data in the below email that you sent us last week for 44 Brighton Road, Lancing, BN15 8ET. I have been analysing the grid data you sent us and the modelling report references Adur data for the wave overtopping scenario. We have only received WO data for the Arun, which is not relevant to the Site. I was just wondering if maybe there was an error when sending the Adur WO data and if you would be able to resend it to us? As it is crucial for the FRA we are compiling.

I hope to hear from you soon.

Kind regards,
Emilia

Emilia Doncic
Environmental Consultant

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From: PSO West Sussex <PSOWestSussex@environment-agency.gov.uk>
Sent: 04 January 2023 15:48
To: Jasmine Spender <JasmineSpender@geosmartinfo.co.uk>
Cc: SSD Enquiries <SSDEnquiries@environment-agency.gov.uk>
Subject: RE: SSD288714 - Product 5,6,7 Data - 44 Brighton Road, Lancing, BN15 8ET

Dear Jasmine,

Thank you for your Product 5 and 6 data request for **44 Brighton Road, Lancing, BN15 8ET**. Apologies for the extended delay in responding to your request.

You can download the Product 5, 6 & 7 data from this link: https://ea.sharefile.com/d-s4acc43afcf0e49f78fdc06053d431022
Please note the link will expire in 30 days.

To confirm, there are currently no plans to update the model data included in the above Product 5 and 6.

There are flood defences raised within the vicinity of this site in the form of groynes, and a sand and shingle beach. This frontage is maintained by the Environment Agency.

For FRA and pre-planning advice please see attached 'FRA Advisory Text' and 'SSD Pre-app advice note September 2019'.

For information on flooding from other sources such as surface water please contact the Lead Local Flood Authority, West Sussex County Council.

If you have any further queries about this request, please do not hesitate to contact us at psowestsussex@environment-agency.gov.uk.

Kind regards,

Amy O'Donnell (*she/her*)
Partnership and Strategic Overview West Sussex, Solent and South Downs
Environment Agency | Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD
PSOWestSussex@environment-agency.gov.uk

From: Jasmine Spender <JasmineSpender@geosmartinfo.co.uk>
Sent: 17 November 2022 16:40
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Cc: Data <data@geosmartinfo.co.uk>
Subject: 78204 44 Brighton Road, BN15 8ET Flood Data Request

To whom it may concern,

We are currently undertaking a Flood Risk Assessment for the following Site (location plan attached):

Address: 44 Brighton Road, BN15 8ET
Easting and Northings: X: 518749 , y: 103829 (NGR: TQ 18749 03829)

Please can we obtain:

- the most up to date flood risk data relevant to the Site in the form of Product 6 (model output data) and Product 5 (model report).
- confirmation on whether you are planning to update this model data and when;
- any existing or proposed flood defence schemes and the standard of protection provided to the Site.

We are working to tight timescales, we would greatly appreciate if you could expedite our request.

Best Regards,
GeoSmart

Disclaimer

This report has been prepared by GeoSmart in its professional capacity as soil, groundwater, flood risk and drainage specialists, with reasonable skill, care and diligence within the agreed scope and terms of contract and taking account of the manpower and resources devoted to it by agreement with its client and is provided by GeoSmart solely for the internal use of its client.

The advice and opinions in this report should be read and relied on only in the context of the report as a whole, taking account of the terms of reference agreed with the client. The findings are based on the information made available to GeoSmart at the date of the report (and will have been assumed to be correct) and on current UK standards, codes, technology and practices as at that time. They do not purport to include any manner of legal advice or opinion. New information or changes in conditions and regulatory requirements may occur in future, which will change the conclusions presented here.

This report is confidential to the client. The client may submit the report to regulatory bodies, where appropriate. Should the client wish to release this report to any other third party for that party's reliance, GeoSmart may, by prior written agreement, agree to such release, provided that it is acknowledged that GeoSmart accepts no responsibility of any nature to any third party to whom this report or any part thereof is made known. GeoSmart accepts no responsibility for any loss or damage incurred as a result, and the third party does not acquire any rights whatsoever, contractual or otherwise, against GeoSmart except as expressly agreed with GeoSmart in writing.

For full T&Cs see http://geosmartinfo.co.uk/terms-conditions

Important consumer protection information

This search has been produced by GeoSmart Information Limited, Suite 9-11, 1st Floor, Old Bank Buildings, Bellstone, Shrewsbury, SY1 1HU.

Tel: 01743 298 100

Email: info@geosmartinfo.co.uk

GeoSmart Information Limited is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom.
- sets out minimum standards which firms compiling and selling search reports have to meet.
- promotes the best practice and quality standards within the industry for the benefit of consumers and property professionals.
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.
- By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports.
- act with integrity and carry out work with due skill, care and diligence.
- at all times maintain adequate and appropriate insurance to protect consumers.
- conduct business in an honest, fair and professional manner.
- handle complaints speedily and fairly.
- ensure that products and services comply with industry registration rules and standards and relevant laws.
- monitor their compliance with the Code.

GeoSmart Information

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award up to £5,000 to you if the Ombudsman finds that you have suffered actual financial loss and/or aggravation, distress or inconvenience as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs contact details:

The Property Ombudsman scheme

Milford House

43-55 Milford Street

Salisbury

Wiltshire SP1 2BP

Tel: 01722 333306

Fax: 01722 332296

Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk. Please ask your search provider if you would like a copy of the search code

Complaints procedure

GeoSmart Information Limited is registered with the Property Codes Compliance Board as a subscriber to the Search Code. A key commitment under the Code is that firms will handle any complaints both speedily and fairly. If you want to make a complaint, we will:

- Acknowledge it within 5 working days of receipt.
- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
- Keep you informed by letter, telephone or e-mail, as you prefer, if we need more time.
- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

If you are not satisfied with our final response, or if we exceed the response timescales, you may refer the complaint to The Property Ombudsman scheme (TPOs): Tel: 01722 333306, E-mail: admin@tpos.co.uk.

We will co-operate fully with the Ombudsman during an investigation and comply with his final decision. Complaints should be sent to:

Martin Lucass

Commercial Director

GeoSmart Information Limited

Suite 9-11, 1st Floor,

Old Bank Buildings,

Bellstone, Shrewsbury, SY1 1HU

Tel: 01743 298 100

martinlucass@geosmartinfo.co.uk

12. Terms and conditions, CDM regulations and data limitations

Terms and conditions can be found on our website:

http://geosmartinfo.co.uk/terms-conditions/

CDM regulations can be found on our website:

http://geosmartinfo.co.uk/knowledge-hub/cdm-2015/

Data use and limitations can be found on our website:

http://geosmartinfo.co.uk/data-limitations/