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Flood Risk Assessment

Proposed Residential Development at

64 Old Fort Road, Shoreham-by-Sea

On behalf of

Mr & Mrs Brownlow-Davies

September 2022

Document History and Status

Project Number 23748

Date	Version	Prepared By	Reviewed By	Approved By
1 Sept 2022	1.0	Steve Doughty Director	Stuart Magowan IEng MICE	Stuart Magowan IEng MICE
2 Sept 2022	1.1	Steve Doughty Director	Stuart Magowan IEng MICE	Stuart Magowan IEng MICE

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1 Non Technical Summary

1.1 This Flood Risk Assessment has been undertaken in accordance with the National Planning Policy Framework on behalf of Mr & Mrs Brownlow-Davies in support of a Planning Application for the demolition of the existing property and the construction of a new residential dwelling.

1.2 This Assessment is to be read in conjunction with all planning, architectural and other reports that accompany the Planning Application for the proposed development.

1.3 The site is located in Tidal Flood Zone 3.

1.4 The proposed development will incorporate a sustainable drainage system which will discharge surface water by infiltration to ground and provide storage for all storm return periods up to and including the 1:100 year rainfall event with an allowance for climate change.

1.5 The proposed development will discharge foul water to the existing public foul sewer located beneath Old Fort Road immediately north of the site using the existing onsite connection.

1.6 This report concludes that the site can suitably mitigate the risk of flooding from tidal sources and is not at risk of flooding from other sources.

2 Planning Policy Context

2.1 National Planning Policy Framework

2.1.1 The National Planning Policy Framework was updated in July 2021.

2.1.2 With regard to planning and flood risk the policy framework states that *'when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment.*

Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b) the development is appropriately flood resistant and resilient, such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;

c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.'

2.1.3 With regard to minor developments the NPPF states that *'applications for some minor development and changes of use (reference footnote 56) should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55.'*

2.1.4 Footnote 55 reads *'a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.'*

2.1.5 Footnote 56 reads *'this includes householder development, small non-residential extensions (with a footprint of less than 250m^2) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park*

home site, where the sequential and exception tests should be applied as appropriate.'

2.2 Lead Local Flood Authority

2.2.1 West Sussex County Council became a Lead Local Flood Authority under the Flood and Water Management Act 2010 and was given a series of new responsibilities to coordinate the management of local flood risk.

2.2.2 As part of its role West Sussex County Council has commissioned and produced the following documents:

- Strategic Flood Risk Assessment - January 2010
- Preliminary Flood Risk Assessment - May 2011
- Preliminary Flood Risk Assessment Addendum – December 2017
- Local Flood Risk Management Strategy - May 2014

2.2.3 In addition to the above documents the West Sussex Policy for the Management of Surface Water was updated in November 2018.

2.2.4 The above documents have been reviewed in the preparation of this report.

2.3 Adur District Council

2.3.1 Adur and Worthing Councils commissioned and produced a Strategic Flood Risk Assessment dated July 2020. This has been reviewed in the preparation of this report.

2.4 Local Planning Policy

2.4.1 The Adur District Council Local Plan was adopted in December 2017.

2.4.2 **Policy 35** states that *'Development will be permitted provided that:*

It does not have an unacceptable impact on the quality and potential yield of local water resources and the water environment; also

It protects and enhances groundwater, surface water features and controls aquatic pollution to help achieve the objectives of the Water Framework Directive; and

It has an adequate means of water supply (even in a drought), sufficient foul and surface water drainage and adequate sewage treatment capacity.

Development must be phased to take into account the timing of any water and/or wastewater infrastructure required which must be in place prior to the occupation of development.

A preliminary risk assessment will be required for any development where there is potential risk of contamination of controlled waters.

New development within Groundwater Source Protection Zones will only be permitted provided that it has no adverse impact on the quality of the groundwater source or a risk to its ability to maintain a public water supply.'

2.4.3 **Policy 36** states that *'The Council will work with relevant bodies to ensure that flood risk in Adur is reduced.*

A site specific flood risk assessment must be submitted with planning applications for:

Proposals of 1 hectare or greater in Flood Zone 1

All development or changes of use to a more vulnerable use in Flood Zones 2 and 3.

All development or changes of use to a more vulnerable use, regardless of flood zone or size, where flood risk from other sources (surface water, sewer, groundwater) is identified by the Strategic Flood Risk Assessment.'

3 Existing Site

3.1 Site Location

3.1.1 The development site is located at 64 Old Fort Road, Shoreham-by-Sea, West Sussex BN43 5HA and centred on Ordnance Survey reference TQ 223 045.



Image 1: Site Location

3.1.2 The site is bounded on its east and west sides by residential properties, on its north side by Old Fort Road and on its southern side by Shoreham Beach.

3.1.3 The tidal estuary of the River Arum is located 370m to the north of the site.

3.1.4 A copy of the site location plan is located in Appendix 1 at the rear of this report.

3.2 Site Description

3.2.1 The site is approximately 720m^2 in area and currently comprises a detached two storey 4 bedroom chalet bungalow with garage and tarmac drive.

3.2.2 Two bedrooms are located at ground floor level and two at first floor level.

3.2.3 Existing ground levels are highest at the 6.15m at the approximate midpoint of western site boundary. The site falls towards its northern and southern boundaries to a levels of approximately 5.6 and 5.9m AOD respectively.

3.2.4 The existing bungalow has a finished floor level of 5.65m AOD

3.2.5 A copy of the existing site layout plan is located in Appendix 2 at the rear of this report.

3.3 Existing Drainage

3.3.1 The existing surface water drainage system is unknown but given the lack of surface water sewers in the locality is anticipated to be by infiltration to ground via traditionally constructed soakaways.

3.3.2 Foul water from the existing property is currently discharged by gravity to the existing 150mm diameter foul sewer located beneath Old Fort Road.

3.3.3 A copy of the sewer records is located in Appendix 3 at the rear of this report.

3.4 Geology and Groundwater

3.4.1 British Geological Survey maps and borehole information confirm that the site is within an area underlain by sands and gravel to a depth of at least 5m below ground level.

3.4.2 Groundwater was not encountered within the local boreholes.

3.4.3 The online “Magic Map” available from Defra confirms that the site is located above a secondary aquifer classified as having a medium to high vulnerability.

3.4.4 A copy of the geological borehole data is located in Appendix 4 at the rear of this report.

4 Flood Zone, Flood Defences and Flood History

4.1 Tidal Flood Zone

4.1.1 The Environment Agency's mapping indicates that the site is located in present day Tidal Flood Zones 1, 2 and 3 and by the future year 2115 will be exclusively within Flood Zone 3.

4.1.2 Tidal flood level data has been supplied by the Environment Agency and is based on the data model from 2012. The predicted climate change models were updated in October 2021.

4.1.3 Reference has been made to the Environment Agency's latest predicted sea level rise data at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances in order to establish the present day and future year tidal flood levels using the updated climate change predictions.

4.1.4 These are presented by the Environment Agency as a higher central allowance (70th percentile exceeded by 30% of the projections in the range) and an upper end allowance (95th percentile exceeded by 5% of the projections in the range).

4.1.5 1:200 year tidal flood levels have been supplied by the Environment Agency at five locations across the site and are based on the data model from 2012.

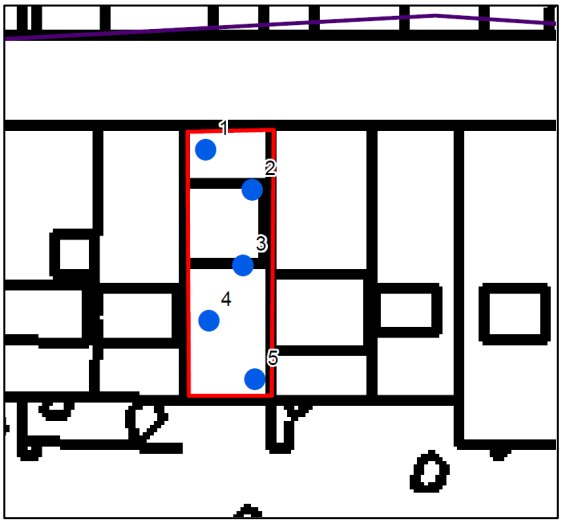

Image 2: Tidal Flood Node Locations

4.1.6 The predicted tidal flood levels based on the updated climate change Higher Central increase predictions (2000 to 2035 5.7mm per annum, 2036 to 2065 8.7mm per annum, 2066 to 2095 13.1mm per annum and 2096 to 2125 13.1mm to per annum) are as follows:

	2012 Model Data	2022 Prediction	2115 Prediction
Node 1	5.75m AOD	5.807m AOD	6.752m AOD
Node 2	5.74m AOD	5.797m AOD	6.742m AOD
Node 3	6.02m AOD	6.077m AOD	7.022m AOD
Node 4	6.05m AOD	6.107m AOD	7.052m AOD
Node 5	-	6.107m AOD	7.052m AOD

Table 1: 1:200 year Higher Central Increase Tidal Flood Level Predictions

4.1.7 It is not credible that there would be a 300mm difference in sea level across such a small area. Present day 2022 and future year 2115 levels have therefore been taken as 6.107m AOD and 7.052m AOD respectively.

4.1.8 Given the above and with reference to the topographical site survey it is clear that the site is located within both the present day and future year Tidal Flood Zone 3 albeit offered a level of protection by the existing raised beach defence.

4.2 Fluvial Flood Zone

4.2.1 The Environment Agency's mapping confirms that the site is located in Fluvial Flood Zone 1 and is not at risk of fluvial flooding from anything less extreme than a 1:1,000 year flood event.

4.3 Flood Defences

4.3.1 There are flood defences on the south bank of the River Adur to the north of the site in the form of a flood wall. The Environment Agency have confirmed that the crest level is 3.93m AOD and the estimated standard of protection is 1 in 2 years.

4.3.2 Higher ground between these defences and the site however affords greater protection then these defences.

4.3.3 There are flood defences on Shoreham Beach to the south of the site Adur in the form of beach shingle. The Environment Agency mapping confirms that the crest level is 7.10m AOD and the estimated standard of protection is 1 in 100 years.

4.3.4 The Environment Agency have subsequently confirmed by email that these defences have a crest height of 6.9m AOD

4.4 Flood History

4.4.1 Environment Agency

4.4.1.1 The Environment Agency maps confirm one incident of historic flood which occurred in August 1992 and affected the land to the south of the site fronting Shoreham Beach.

4.4.1.2 This incident did not directly affect the site.

4.4.2 West Sussex County Council

4.4.2.1 Neither the Strategic Flood Risk Assessment dated January 2010, the Preliminary Flood Risk Assessment dated May 2011, nor the Local Flood Risk Management Strategy dated May 2014 identify any additional flood incidents in the immediate vicinity of the site.

4.4.3 Adur District Council

4.4.3.1 The Strategic Flood Risk Assessment dated July 2020 does not identify any additional flood incidents in the immediate vicinity of the site.

4.4.4 Copies of the available flood maps and correspondence are located in Appendix 5 at the rear of this report.

5 Flooding Potential

5.1 Tidal Flooding

5.1.1 As previously noted the present day 2022 and future year 2125 predicted Higher Central tidal flood levels are as follows:

- 1:200 Year present day 2022 Flood level 6.107m AOD
- 1:200 future Year 2115 Flood level 7.052m AOD

5.1.2 The existing flood defences on Shoreham Beach have a crest level of 6.9m AOD and provide protection against wave overtopping. Based on the updated climate change predictions for sea level rise these defences should provide wave overtopping protection until at least the year 2104.

5.1.3 They are however shingle and therefore permeable and without additional flood defences the site will be vulnerable to tidal flooding from the sea and the tidal estuary to the north as the sea level rises due to climate change.

5.2 Fluvial Flooding

5.2.1 The area of the proposed site is within Fluvial Flood Zone 1 and is not at risk of fluvial flooding from anything less extreme than a 1:1,000 year flood event.

5.3 Groundwater Flooding

5.3.1 The British Geological Survey borehole log information did not record groundwater to a depth of at least 5m below ground level.

5.3.2 The groundwater flood risk map included in Appendix H of Adur District Council's Strategic Flood Risk Assessment confirms that the site lies within an area where groundwater levels are between 0.5m and 5m below the ground surface.

5.3.3 The groundwater flood risk map included in Appendix I of Adur District Council's Strategic Flood Risk Assessment confirms that the site not within an area at significant risk of an impact on groundwater levels due to sea level rise.

5.3.4 There are no records identified within West Sussex County Council's Strategic Flood Risk Assessment, Preliminary Flood Risk Assessment or Local Flood Risk Management Strategy nor in Adur District Council's Strategic Flood Risk Assessment of groundwater flooding affecting the site.

5.4 Overland Flow

5.4.1 The Environment Agency maps confirm that the site is not at risk of flooding from overland surface water.

5.4.2 The flood mapping contained within the various flood documents produced by West Sussex County Council and Adur District Council does not identify any flood risk associated with overland flow routes.

5.5 Flood Routing

5.5.1 The natural route for flood waters to dissipate, should any event occur on the site, is towards Old Fort Road at the northern site boundary and Shoreham Beach at the southern boundary.



Image 3: Local Topography

5.6 Flood Warnings

5.6.1 The site is located within a Flood Warning Area with alerts typically raised 5 days before a predicted tidal flood event.

5.6.2 Flood warnings can be signed up for at www.fws.environment-agency.gov.uk or by phone using the Environment Agency's Floodline service on 0345 988 1188.

6 Development Proposals

6.1 Description

6.1.1 The development proposals are for the demolition of the existing 4 bedroom bungalow and the construction of a three storey 4 bedroom residential dwelling with integral garage a permeable block paved drive and landscaping.

6.1.2 There will be no increase in occupants as a result of the new construction.

6.1.1 The areas of the various positively drained elements of the development are summarised as follows:

- Roof Area 220m^2
- Block Paved Drive 140m^2

6.2 Flood Mitigation Proposals

6.2.1 Flood mitigation is proposed with the provision of a flood defence wall surrounding the property and equipped flood gates so as to afford protection against a future year 2115 predicted 1:200 year tidal flood event with a 600mm freeboard on the east west and south elevations to combat potential wave action equating to a crest height of 7.652m AOD, and set at 7.06m AOD on the north elevation.

6.2.2 The ground floor of the proposed house will be raised 650mm above that of the existing dwelling and set at a minimum of 6.3m AOD.

6.2.3 Construction of the ground floor will be undertaken using flood resilient materials to a minimum level of 7.06m AOD

6.2.4 Sleeping accommodation will be located exclusively on the first and second floors at a minimum of 9.15m AOD (approximately 2m above the predicted future 2115 year tidal flood level).

6.2.5 The downstairs electrical ring main and plug sockets will be constructed with an isolation switch located at first floor level such that that circuit can be switched off in the event of a flood with power maintained to the floors above.

6.2.6 The outlet from the foul drainage at ground floor level will be fitted with a one way valve such that it is protected from ingress throughout a four hour high tide event.

6.2.7 A copy of the proposed site layout plan together with a drained areas plan is located in Appendix 6 at the rear of this report.

6.3 Residual Risk and Emergency Action Plan

6.3.1 There is a residual risk of tidal flooding of the property in the event that the proposed perimeter flood wall is breached.

6.3.2 In the event of a flood warning being issued the residents should enact the following process:

- Seek alternative temporary accommodation or
- Retreat to first floor and above during the four hour duration of the high tide event

6.3.3 In the event of a breach of flood defences the residents should enact the following process:

- Retreat to first floor and above during the four hour duration of high tide events
- Isolate the ground floor electricity supply via the isolation switch located at first floor level
- Remain within safe refuge at first floor and above until flood waters have dicipated

6.4 Surface Water Drainage

6.4.1 CIRIA report C753 The SuDS Manual-v6 provides guidance on surface water drainage. The aim for surface water runoff is to match greenfield runoff rates and volumes where reasonably achievable.

6.4.2 For surface water discharge, the drainage hierarchy notes the following list of drainage options in order of preference:

1 Infiltration to ground

2 Discharge to a watercourse

3 Discharge to a surface water sewer

4 Discharge to a foul water sewer

6.4.3 The proposed surface water drainage strategy will be based on infiltration to ground with sufficient storage provided to accommodate a 1:100 year storm event including an additional 45% to account for the predicted effects of future climate change.

6.4.4 Preliminary calculations have been prepared based on an infiltration rate of $1x10^{-5}$m/s which is typical of sands and gravels in order to demonstrate that surface

water drainage can be adequately accommodated within the site without any increased flood risk elsewhere.

6.4.5 An additional 10% of roof area has been included within the calculations to account for potential future urban creep amounting to a total potential impermeable site area of 382m^2.

6.4.6 Preliminary Calculations indicate that a depth of 580mm of 30% voided stone subbase beneath the proposed permeable parking area will be sufficient to accommodate surface water collected on the site during a 1:100 year +45% rainfall event and discharge this to ground.

6.4.7 The proposed drainage design will be confirmed at detailed design stage and may include a surface water discharge to the beach to the south of the site.

6.5 Foul Drainage

6.5.1 Foul water will be discharged to the existing public foul sewer located beneath Old Fort Road immediately north of the site using the existing onsite connection.

6.5.2 Copies of the preliminary drainage strategy plan and calculations are located in Appendix 7 at the rear of this report.

6.6 Water Quality

6.6.1 The proposed development is for residential use. In accordance with CIRIA SuDS Manual 2015 (Report C753), the pollution hazard level for this type of development is classified as between very low and low depending on the use / area of the site.

6.6.2 The surface water scheme will include mitigation to ensure that surface water is suitably treated and any pollution risk adequately managed prior to discharge.

6.6.3 Table 26.2 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Pollution Hazard Indices for varying land types. Those of relevance to the development proposals are as follows:

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car park, low-traffic roads	Low	0.5	0.4	0.4

Table 2: Pollution Hazard Indices

6.6.4 The use of permeable paving is sufficient to meet the target treatment level required.

	Total suspended solids (TSS)	Metals	Hydrocarbons
Permeable paving	0.7	0.6	0.7

Table 3: Pollution Mitigation Provision

7 Safe Development

7.1 Flood Zone Compatibility

7.1.1 The site is located in the present day and future year 2115 Flood Zone 3.

7.1.2 With reference to Annex 3 of the National Planning Policy Framework and Table 2 of the Government Guidance on Flood Risk and Coastal Change at https://www.gov.uk/guidance/flood-risk-and-coastal-change and:

- Annex 3: Flood Risk Vulnerability Classification

  Residential development is classified as More Vulnerable

- Table 2: Flood Risk Vulnerability and Flood Zone Compatibility

  More Vulnerable development is considered appropriate in Flood Zones 1 and 2 with the Exception Test required for development in Flood Zone 3

7.1.3 As previously noted, with regard to minor developments the NPPF states that *'applications for some minor development and changes of use (reference footnote 56) should not be subject to the sequential or exception tests.'*

7.1.4 Footnote 56 reads *'this includes householder development, small non-residential extensions (with a footprint of less than 250m^2) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate.'*

7.1.5 Given that the proposed development is to replace the existing dwelling with another dwelling accommodating the same number of bedrooms and will maintain occupancy rates at their present level while incorporating measures which will reduce the risks associated with tidal flooding to the occupants it is considered that the development proposals are akin to householder development and should not be subject to the sequential or exception tests.

7.1.6 In order to safeguard the ongoing residential use of the site improvements are proposed with the incorporation of a flood defence wall surrounding the property, the relocation of sleeping accommodation such that it is exclusively located above future year predicted tidal flood levels.

7.1.7 Safe refuge will be available on the first and second floor levels throughout the duration of a tidal storm event which typically lasts for approximately 4 hours at the peak of high tide.

7.1.8 Construction of the ground floor will be undertaken using flood resilient materials.

7.1.9 These proposals will safeguard the existing residential use of the site and reduced the magnitude of risk affecting the site in its present form.

7.2 Risk to Others

7.2.1 The proposed surface water drainage system will be designed to current standards incorporating SuDS elements providing treatment, attenuation and storage which will minimise runoff leaving the site during times of heavy rain.

7.2.2 Allowance has been made for a 45% increase in rainfall intensities which accords with the latest figures published by the Environment Agency and in accordance with the requirements under the National Planning Policy Framework.

7.2.3 The proposed drainage system will incorporate sufficient treatment prior to final discharge thus mitigating the risk of pollution from the site.

7.2.4 The risk of surface water flooding to others due to the development proposals is reduced and the resultant risk is negligible.

7.2.5 Sewerage undertakers have an obligation to upgrade the existing networks if a connection to an equivalent or larger sized public sewer is technically achievable.

7.2.6 The residual risk of sewer flooding from this development for the foreseeable future is therefore negligible.

8 Conclusions

8.1 The site is located within Tidal Flood Zone 3 and without additional flood defences the site will be vulnerable to tidal flooding from the sea and the tidal estuary to the north as the sea level rises due to climate change.

8.2 There will be no increase of occupancy as a result of the development proposals.

8.3 In order to mitigate against future sea level rise and continue to use the site for residential accommodation the following works are proposed:

- Provision of a flood defence wall surrounding the property and equipped flood gates so as to afford protection to the site against a future year 2115 predicted 1:200 year tidal flood event.
- The ground floor of the proposed new dwelling will be raised 650mm above that of the existing dwelling and set at a minimum of 6.3m AOD.
- Construction of the ground floor will be undertaken using flood resilient materials.
- Sleeping accommodation will be located exclusively on the first and second floors at a minimum of 9.15m AOD (approximately 2m above the predicted future 2115 year tidal flood level) rather than at ground and first floor level as is presently the case.
- Safe refuge will be available through the duration of a tidal storm event which typically lasts for approximately 4 hours at the peak of high tide.
- The downstairs electrical ring main and plug sockets will be constructed with an isolation switch located at first floor level such that that circuit can be switched off in the event of a flood with power maintained to the floors above.
- The outlet from the foul drainage at ground floor level will be fitted with a one way valve such that it is protected from ingress throughout a four hour high tide event.

8.4 These proposals will safeguard the existing residential use of the site and will reduce the magnitude of risk affecting the site in its present form.

8.5 In the event of a breach of flood defences the residents should:

- Retreat to first floor and above during the four hour duration of high tide events
- Isolate the ground floor electricity supply via the isolation switch located at first floor level
- Remain within safe refuge at first floor and above until flood waters have dissipated

8.6 One incident of historic flood occurred locally in August 1992 and affected the land to the south of the site fronting Shoreham Beach. This incident did not directly affect the site.

8.7 The site is within an area underlain by sands and gravel to a depth of at least 5m below ground level and a suitable SuDS drainage system is proposed which will discharge surface water to ground by infiltration in accordance with the requirements of national and local policy.

8.8 Storage provided beneath the new onsite permeable paving will be sized with sufficient volume to accommodate a 1:100 year rainfall event including a suitable allowance for climate change thereby providing an improvement over the existing situation and providing a benefit to the surrounding properties.

8.9 Preliminary calculations confirm that surface water runoff generated by the proposed development can be attenuated on site for all rainfall events up to the 1:100 year event including an allowance for climate change.

8.10 Water quality improvement will be provided to mitigate against any risk to any receiving waterbody.

8.11 Foul water will be discharged to the existing public foul sewer located beneath Old Fort Road immediately north of the site using the existing onsite connection.

8.12 The risk of flooding to the site from tidal sources can be suitably mitigated and the site is not at risk of flooding from any other sources.

8.13 In terms of flood risk planning the proposed development will safeguard the existing residential use of the site and reduced the magnitude of risk affecting the site in its present form.

8.14 The development will not increase flood risk elsewhere and will provide improvement to immediately adjacent sites by managing surface water from all rainfall events up to the 100 year plus climate change event.

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Appendix 5	Flood Maps and Correspondence
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Image 1	Site Location
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Table 1	1:200 year Higher Central Increase Tidal Flood Level Predictions
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Appendix 1

Site Location Plan



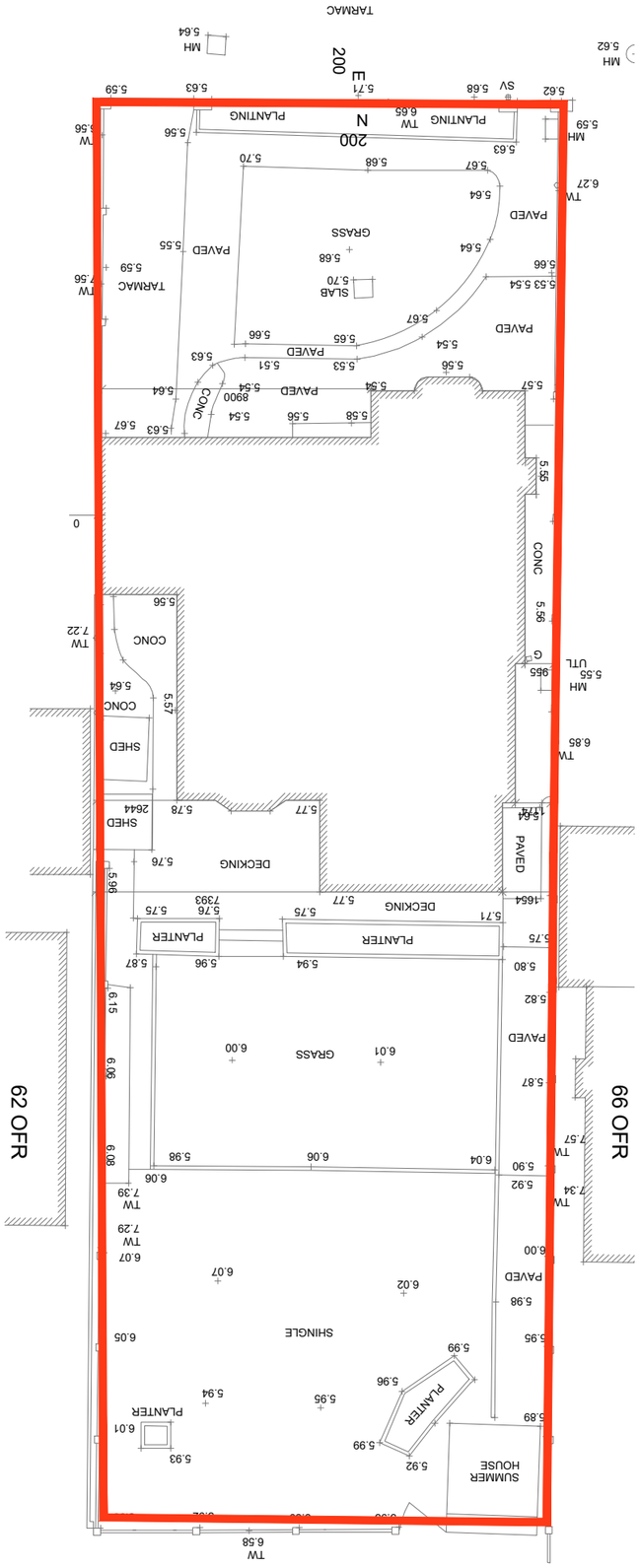
TITLE: Site Location Plan - 64 Old Fort Road
Shoreham Beach BN43 5HA
OS Reference TQ 223 045

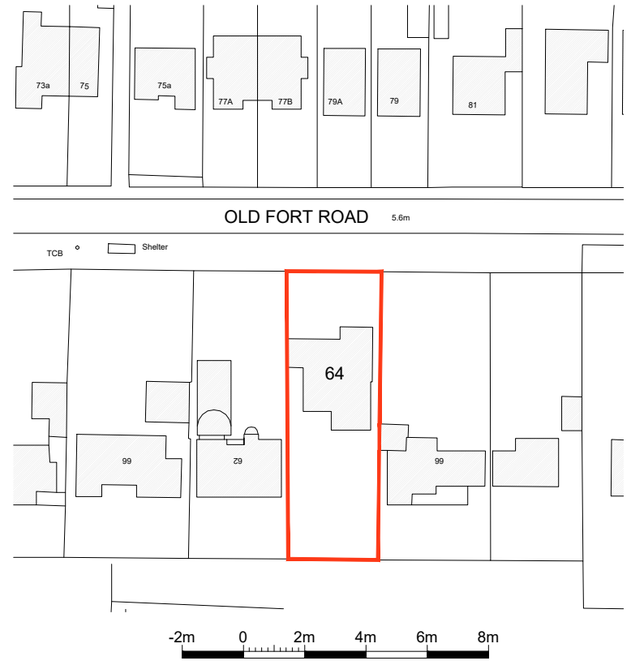
SCALE	PROJECT. No.
1:10000 @ A3	23748
REPORT TYPE	DRG. No.
FRA	01 -

Appendix 2

Existing Site Layout Plan







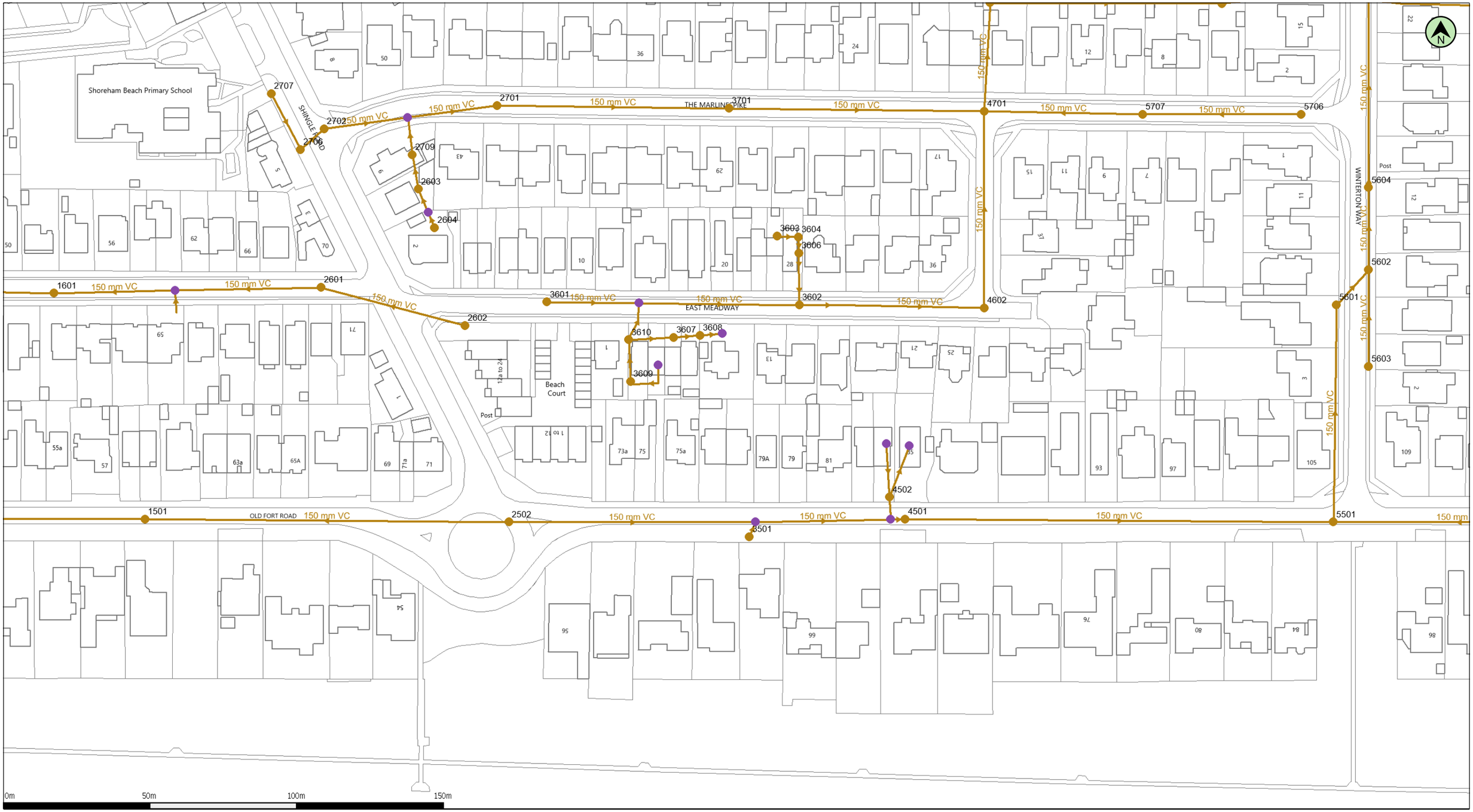


TITLE: Existing Site Layout Plan

SCALE	PROJECT. No.
1:200, 1:1000 @ A3	23748
REPORT TYPE	DRG. No.
FRA	02 -

Appendix 3

Sewer Records

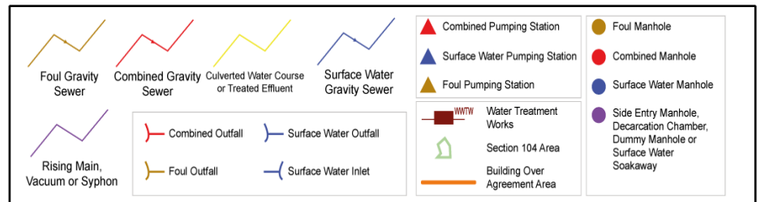


(c) Crown copyright and database rights 2022 Ordnance Survey 100031673 | Date: 31/08/22 | Scale: 1:1250 | Map Centre: 522367,104618 | Data updated: 16/08/22 | Our Ref: 938312 - 1 | Wastewater Plan A3

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



mat@civil.co.uk
23748 64 Old Fort Ro

WATER for LIFE from Southern Water

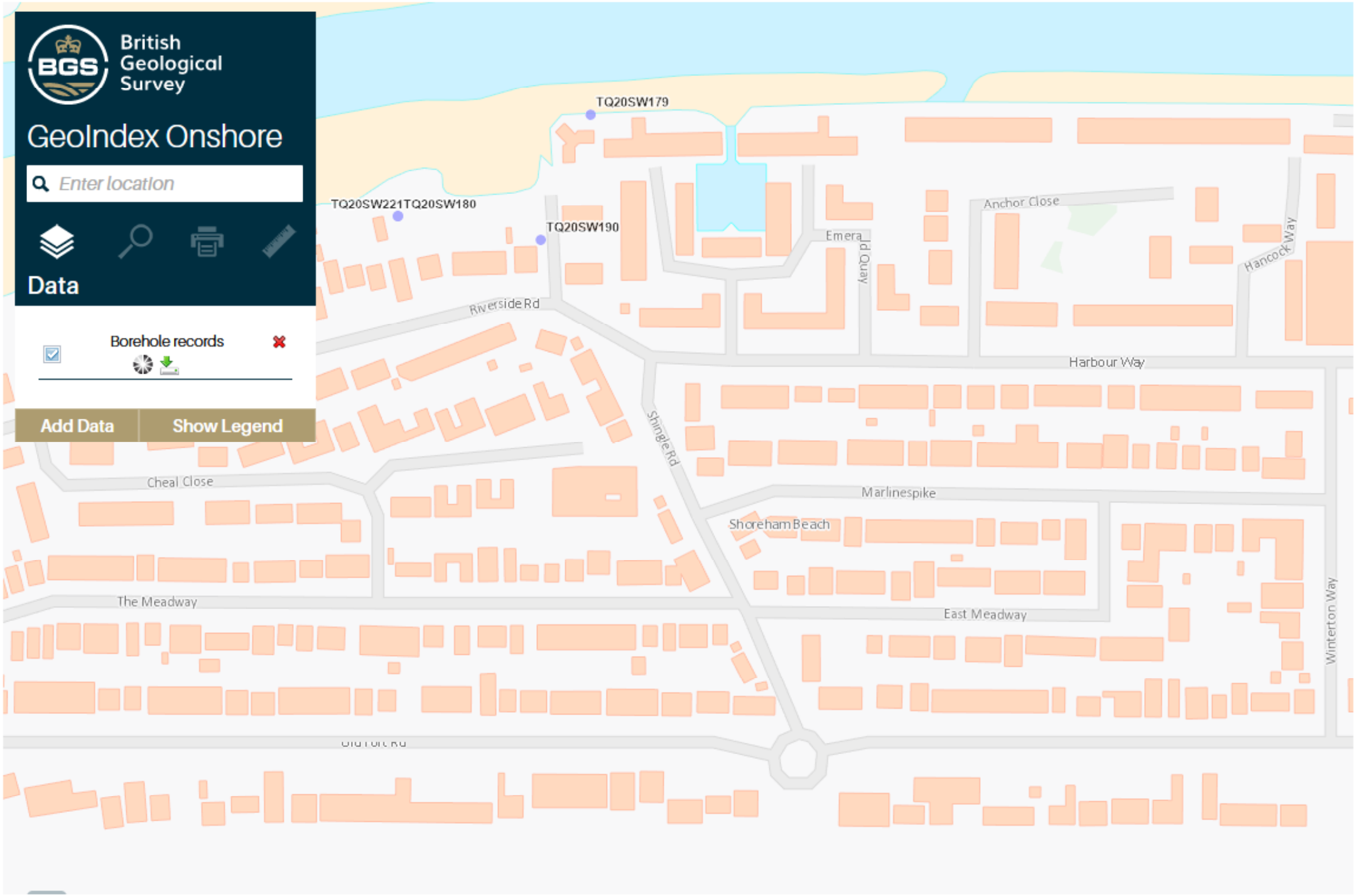
Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
1501	F	5.59	0.00	
1601	F	5.07	0.00	
2502	F	5.73	4.48	
2601	F	5.23	3.78	
2602	F	0.00	0.00	
2603	F	0.00	0.00	
2604	F	0.00	0.00	
2701	F	5.19	3.37	
2702	F	5.31	3.71	
2706	F	0.00	3.86	
2707	F	0.00	4.06	
2709	F	0.00	0.00	
3501	F	0.00	0.00	
3601	F	5.02	3.51	
3602	F	4.55	0.00	
3603	F	0.00	0.00	
3604	F	0.00	0.00	
3606	F	0.00	0.00	
3607	F	0.00	0.00	
3608	F	0.00	0.00	
3609	F	0.00	0.00	
3610	F	0.00	0.00	
3701	F	4.70	2.32	
4501	F	5.54	3.76	
4502	F	0.00	0.00	
4602	F	5.02	2.18	
4701	F	4.28	1.54	
4702	F	4.90	0.00	
5501	F	5.64	3.14	
5601	F	5.29	2.74	
5602	F	5.14	2.49	
5603	F	5.34	4.02	
5604	F	4.95	0.00	
5705	F	4.63	0.00	
5706	F	0.00	0.00	
5707	F	0.00	0.00	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix 4

Geological Borehole Data


British Geological Survey
GeoIndex Onshore
Enter location
Data
Borehole records
Add Data
Show Legend
TQ20SW179
TQ20SW221TQ20SW180
TQ20SW190
Riverside Rd
Emera
d Quay
Anchor Close
Hancock Way
Harbour Way
Shingle Rd
Cheal Close
Marlinespike
Shoreham Beach
The Meadway
East Meadway
Winterton Way

SHOREHAM ADUR TIDAL WALLS OCTOBER 2013 CP301 CP

X: 522136 Y: 104861 Level: 3.75

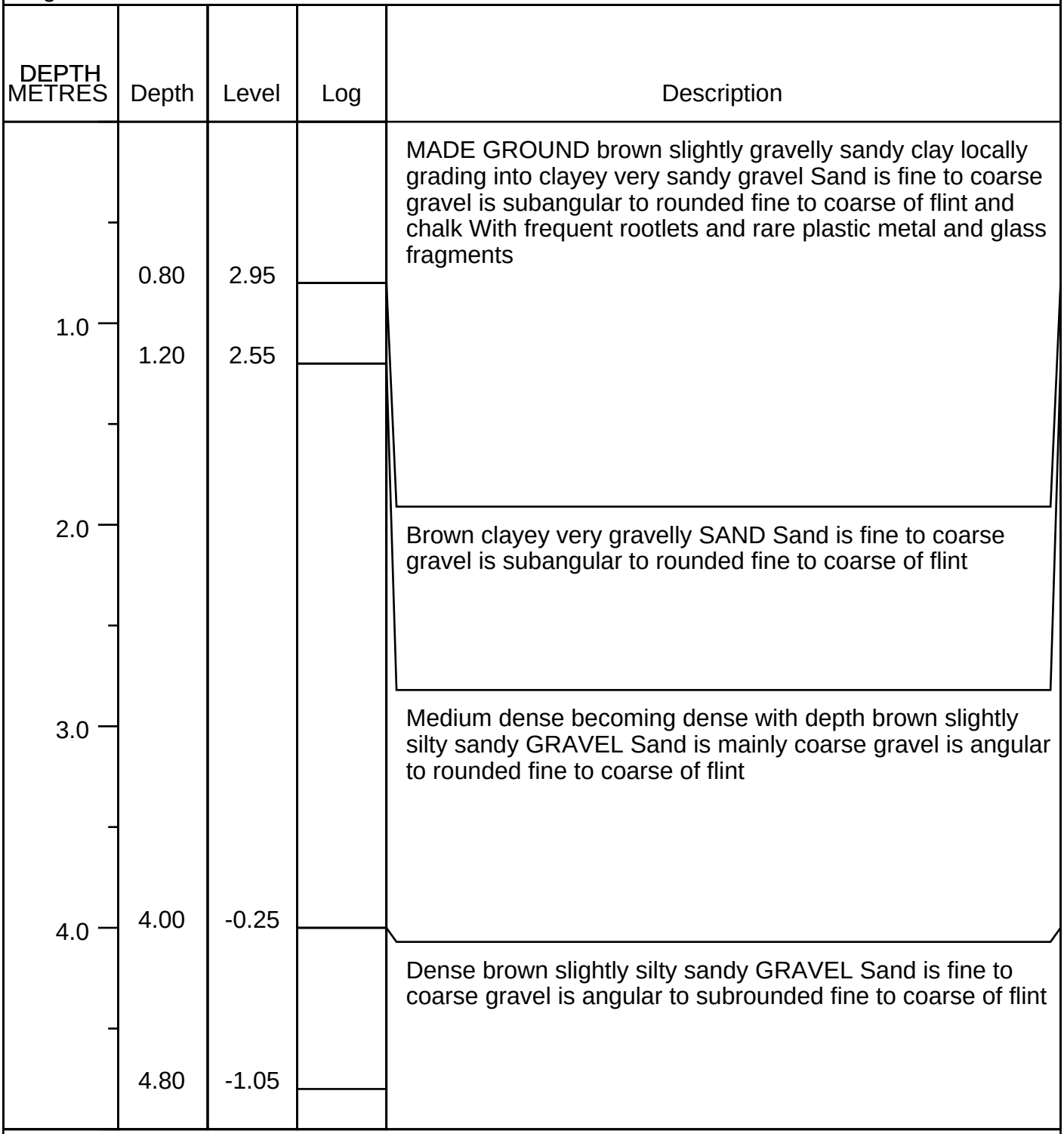
Start: 2010-02-08 End: 2010-02-08

Client: ENVIRONMENT AGENCY

Contractor: Fugro Engineering Services

Engineer:

Page 1



IMPORTANT: This is a basic log auto-generated from AGS data held by the National Geoscience Data Centre (NGDC) and does not necessarily include all of the information supplied in the original AGS file. If you wish to deposit AGS files to the NGDC please see www.bgs.ac.uk/services/ngdc. Generated 30-08-2022 at 12:25 by BGS Groundhog (BETA). BGS Reference 20200203141144103 09

GENERAL REMARKS

The borehole was terminated at a depth of 4.80m on the instruction of the Engineer due to residents' concern about drilling vibrations.;Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located. ;A falling head permeability test was attempted at 4.50m.;An amount of water was added to facilitate boring and to maintain a positive hydrostatic head in granular strata below 1.20m.;

SHOREHAM ADUR TIDAL WALLS OCTOBER 2013 WB3/WS1 WLS

X: 522056 Y: 104874 Level: 3.6

Start: 2013-11-27 End: 2013-11-27

Client: ENVIRONMENT AGENCY

Contractor: Fugro Engineering Services

Engineer:

DEPTH METRES	Depth	Level	Log	Description
				MADE GROUND grey mottled brown slightly clayey gravelly sand with occasional rootlets 2mm and 1 No fragment 300mm x 250mm of slate tile Sand is fine to coarse Gravel is subangular to subrounded fine to coarse of flint and other mixed lithologies
1.0	1.20	2.40		Soft dark brown sandy gravelly locally very gravelly CLAY Gravel is angular and subangular fine to coarse of flint quartz and other mixed lithologies Rare cobbles
	1.80	1.80		Light brown SAND and GRAVEL locally tending to very sandy gravel Sand is fine to coarse Gravel is angular to subrounded fine to coarse of flint and other mixed
2.0				Light brown gravelly locally very gravelly SAND Sand is fine to coarse Gravel is rounded to subangular fine to coarse of flint and other mixed lithologies
	2.75	0.85		Multicoloured mainly light brown very sandy GRAVEL Sand is fine to coarse Gravel is subangular to subrounded fine and medium locally fine of flint and other mixed lithologies
3.0	3.00	0.60		
	3.40	0.20		Multicoloured sandy GRAVEL Sand is fine to coarse Gravel is angular to subrounded fine to coarse of flint and other mixed lithologies
	3.84	-0.24		Light brown gravelly locally slightly gravelly locally very gravelly SAND Sand is fine to coarse Gravel is subangular to subrounded fine to coarse of flint and other mixed
4.0				Multicoloured mainly dark brown very gravelly SAND Sand is fine to coarse Gravel is subangular to subrounded fine to coarse of flint and other mixed lithologies
	5.00	-1.40		

IMPORTANT: This is a basic log auto-generated from AGS data held by the National Geoscience Data Centre (NGDC) and does not necessarily include all of the information supplied in the original AGS file. If you wish to deposit AGS files to the NGDC please see www.bgs.ac.uk/services/ngdc. Generated 30-08-2022 at 12:27 by BGS Groundhog (BETA). BGS Reference 20200203141144102 79

SHOREHAM ADUR TIDAL WALLS OCTOBER 2013 WB3/WS1 WLS

X: 522056 Y: 104874 Level: 3.6

Start: 2013-11-27 End: 2013-11-27

Client: ENVIRONMENT AGENCY

Contractor: Fugro Engineering Services

Engineer:

DEPTH METRES	Depth	Level	Log	Description
	5.00	-1.40		
	5.40	-1.80		Light brown gravelly locally slightly gravelly locally very gravelly SAND Sand is fine to coarse Gravel is subangular to subrounded fine to coarse of flint and other mixed lithologies
6.0	6.00	-2.40		
7.0				Multicoloured mainly dark brown very gravelly SAND Sand is fine to coarse Gravel is subangular to subrounded fine to coarse of flint and other mixed lithologies
8.0				
9.0				Assumed zone of no recovery

IMPORTANT: This is a basic log auto-generated from AGS data held by the National Geoscience Data Centre (NGDC) and does not necessarily include all of the information supplied in the original AGS file. If you wish to deposit AGS files to the NGDC please see www.bgs.ac.uk/services/ngdc. Generated 30-08-2022 at 12:27 by BGS Groundhog (BETA). BGS Reference 20200203141144102 79

GENERAL REMARKS

Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located. ;Blowing sand encountered at 6.00m; sand rose to 5.85m; borehole terminated.;

Appendix 5

Flood Maps and Correspondence

Nathanael Wright
ECE Architecture

Our ref: SSD260590
Your ref: ARVK24MMFWFD
Date: 07/07/2022

Dear Nathanael Wright,

Enquiry Regarding Product 4 for Flood Risk Assessment for 64 Old Fort Road, Shoreham-by-Sea, BN43 5RA.

Thank you for your enquiry which was received on 14 April 2022.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information is attached.

The information on Flood Zones in the area relating to this address is as follows:

The site is in an area located within Flood Zones 1, 2 & 3 as shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named property is in and is not specific to the property itself as it is influenced by factors such as the height of door steps, air bricks or the height of surrounding walls. We do not have access to this information and is not currently used in our flood modelling.

Flood Zone definitions can be found at www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones

Flood Defences
There are no formal raised flood defences in the vicinity of the site.

Model Information
The model used was the 2012 Arun to Adur Coastal Modelling which was completed by JBA Consulting in 2012.

Flood History
An area close to this site experienced flooding in 1992 as a result of the overtopping of defences (Flood ID: 7451).

Please note our records are not comprehensive and may not include all events. I recommend contacting the Lead Local Flood Authority, **West Sussex County Council** or the Local Authority, **Adur District Council** for a more comprehensive flood history check.

FRA advisory text

Name	Product 4
Description	Detailed Flood Risk Assessment Map for **64 Old Fort Road, Shoreham-by-sea, BN43 5RA.**
Licence	Open Government Licence
Information Warnings	The flood risk data provided is based on existing EA hydraulic models with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 27 July 2021. You should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
Information Warning - OS background mapping	*The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.*
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2022 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

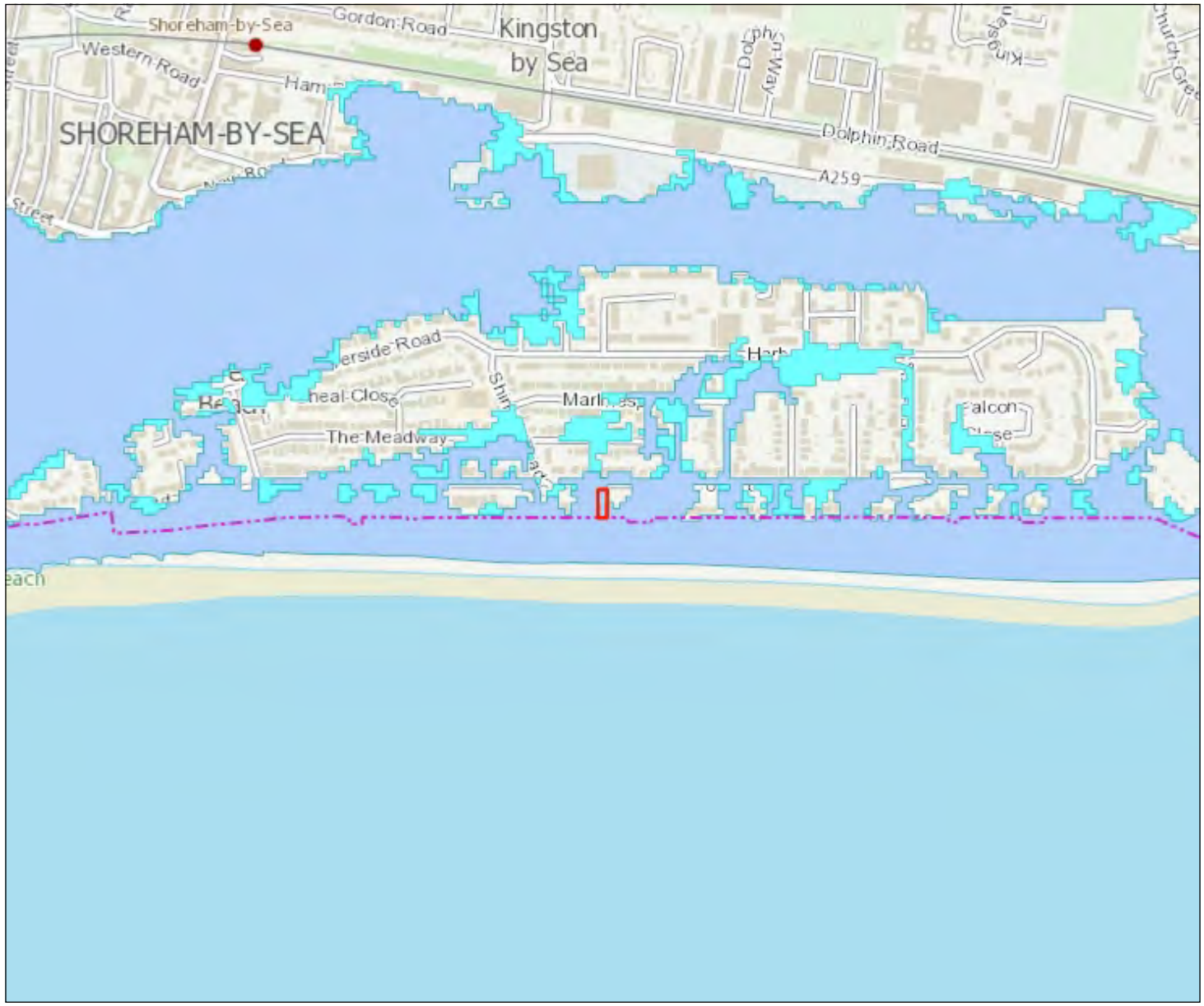
- Flood Map For Planning (Flood Zone 2, Flood Zone 3 ,Flood Storage Areas, Flood Defences, Areas Benefiting from Defences)
- Risk of Flooding from Rivers and Sea
- Historic Flood Map
- Current Flood Warnings

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely,

Amy O'Donnell
MA to Kate Donlon: Area Environment Manager (Coast), Solent and South Downs Area
MA to Nick Gray: Flood and Coastal Risk Manager, Solent and South Downs Area
Environment Agency | Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD

Flood Map for Planning (Rivers and Sea). Centred BN43 5RA. Created 07/07/2022.



Environment Agency

1: 10,000

0 Metres 250

N W E S

Flood Map for Planning (Rivers & Sea)

- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occuring each year.

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Environment Agency

Defended modelled fluvial extent

Location (easting/northing)
522375/104546

Scale
1:10,000

Created
14 Apr 2022

Model name
River Adur Climate Change

Selected location

Main river

Modelled flood extent

1% AEP

0.5% AEP

Flood extents may not be visible where they overlap other return periods

0 100 200 300 400 500
metres



Environment Agency

No defences exist modelled fluvial extent

Location (easting/northing)
522375/104546

Scale
1:10,000

Created
14 Apr 2022

Model name
River Adur

Selected location

Main river

Modelled flood extent

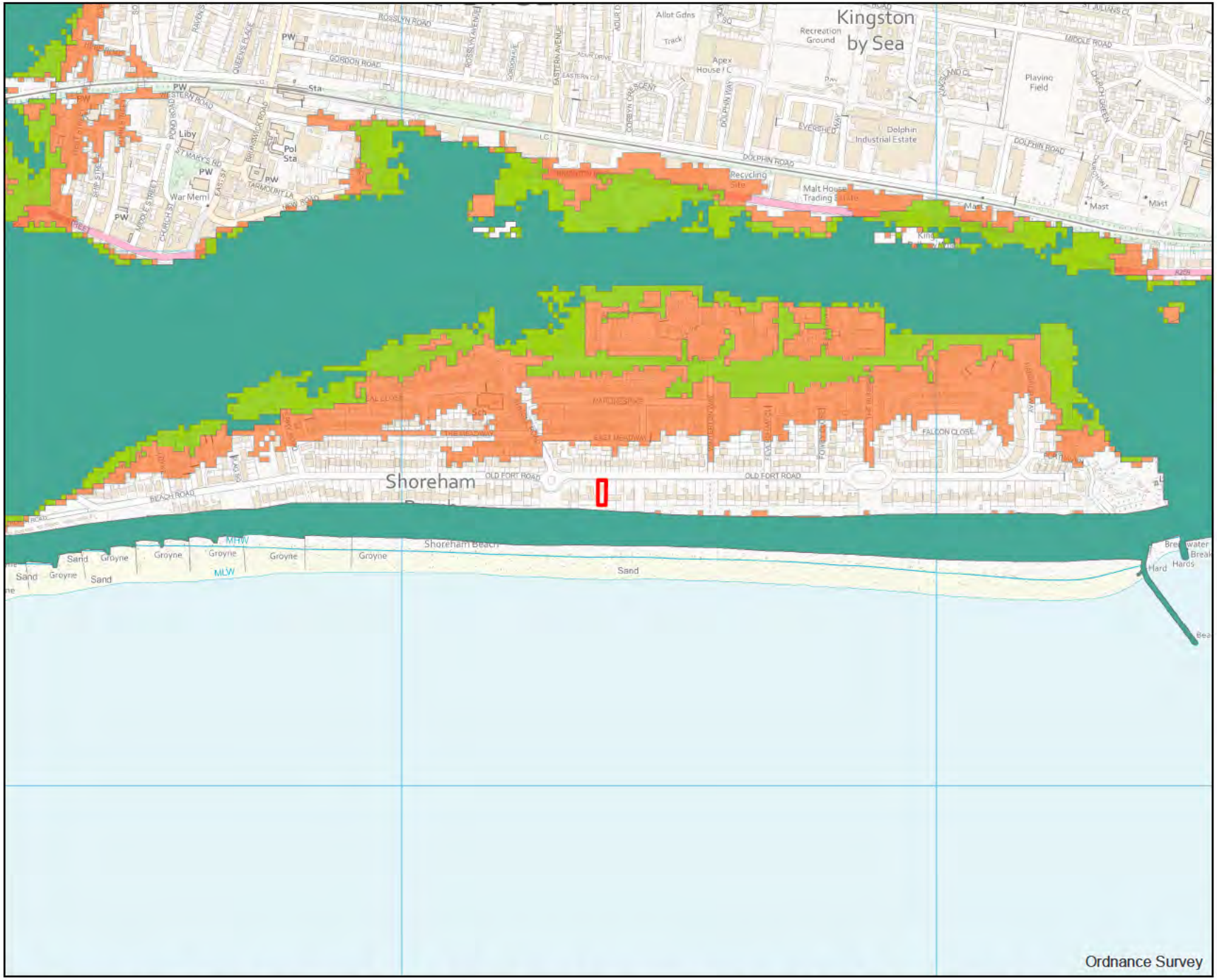
1.33% AEP

0.5% AEP

Flood extents may not be visible where they overlap other return periods

0 100 200 300 400 500
metres

Modelled Flood Outlines. Undefended Tidal. Centred BN43 5RA. Created 07/07/2022.



Environment Agency

N

Legend

- Polygon
- 0.5% AEP (2012) (Undefended)
- 0.5% AEP (2070) (Undefended)
- 0.5% AEP (2115) (Undefended)
- 0.1% AEP (2012) (Undefended)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000

0 0.225 0.45
Kilometers

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Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Modelled Flood Outlines. Defended Tidal. Centred BN43 5RA. Created 07/07/2022.



Environment Agency

N

Legend

- Polygon
- 0.5% AEP (2012) (Defended)
- 0.5% AEP (2070) (Defended)
- 0.5% AEP (2115) (Defended)
- 0.1% AEP (2012) (Defended)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000

0 0.225 0.45
Kilometers

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FRA Site Boundary & Node Points. Centred BN43 5RA. Created 07/07/2022.



Environment Agency

N

Legend

- Site Nodes
- Site Boundary

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:1,000

0 0.0225 0.045
Kilometers

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Product 4 Flood Risk Data Requested by: ECE Architecture

Site: 64 Old Fort Road, Shoreham-by-sea, BN43 5RA

Table 1: Water Levels: Tidal Undefended

	NGR		Modelled Flood Levels in Metres AOD Undefended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	522370	104567	-	-	-	-
2	522379	104560	-	-	-	-
3	522377	104547	-	-	-	-
4	522370	104537	-	-	-	-
5	522379	104528	-	-	-	-

Table 2: Water Levels: Tidal Defended

	NGR		Modelled Flood Levels in Metres AOD Defended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	522370	104567	5.75	-	5.91	5.78
2	522379	104560	5.74	5.81	5.89	5.79
3	522377	104547	6.02	5.94	6.15	6.04
4	522370	104537	6.05	-	6.21	6.07
5	522379	104528	-	6.10	6.22	6.07

Table 3: Water Depths: Tidal Undefended

	NGR		Modelled Flood Depths in Metres Undefended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	522370	104567	-	-	-	-
2	522379	104560	-	-	-	-
3	522377	104547	-	-	-	-
4	522370	104537	-	-	-	-
5	522379	104528	-	-	-	-

Office Address: Guildbourne House, Chatsworth Road, Worthing BN11 1LD.
Customer services line: 03708 506 506. Email: enquiries@environment-agency.gov.uk
www.gov.uk/government/organisations/environment-agency

Table 4: Water Depths: Tidal Defended

	NGR		Modelled Flood Depths in Metres			
			Defended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	522370	104567	0.10	-	0.26	0.13
2	522379	104560	0.06	0.13	0.21	0.11
3	522377	104547	0.04	0.08	0.13	0.04
4	522370	104537	0.08	-	0.23	0.09
5	522379	104528	-	0.12	0.25	0.10

All levels taken from: Arun to Adur Coastal Modelling.

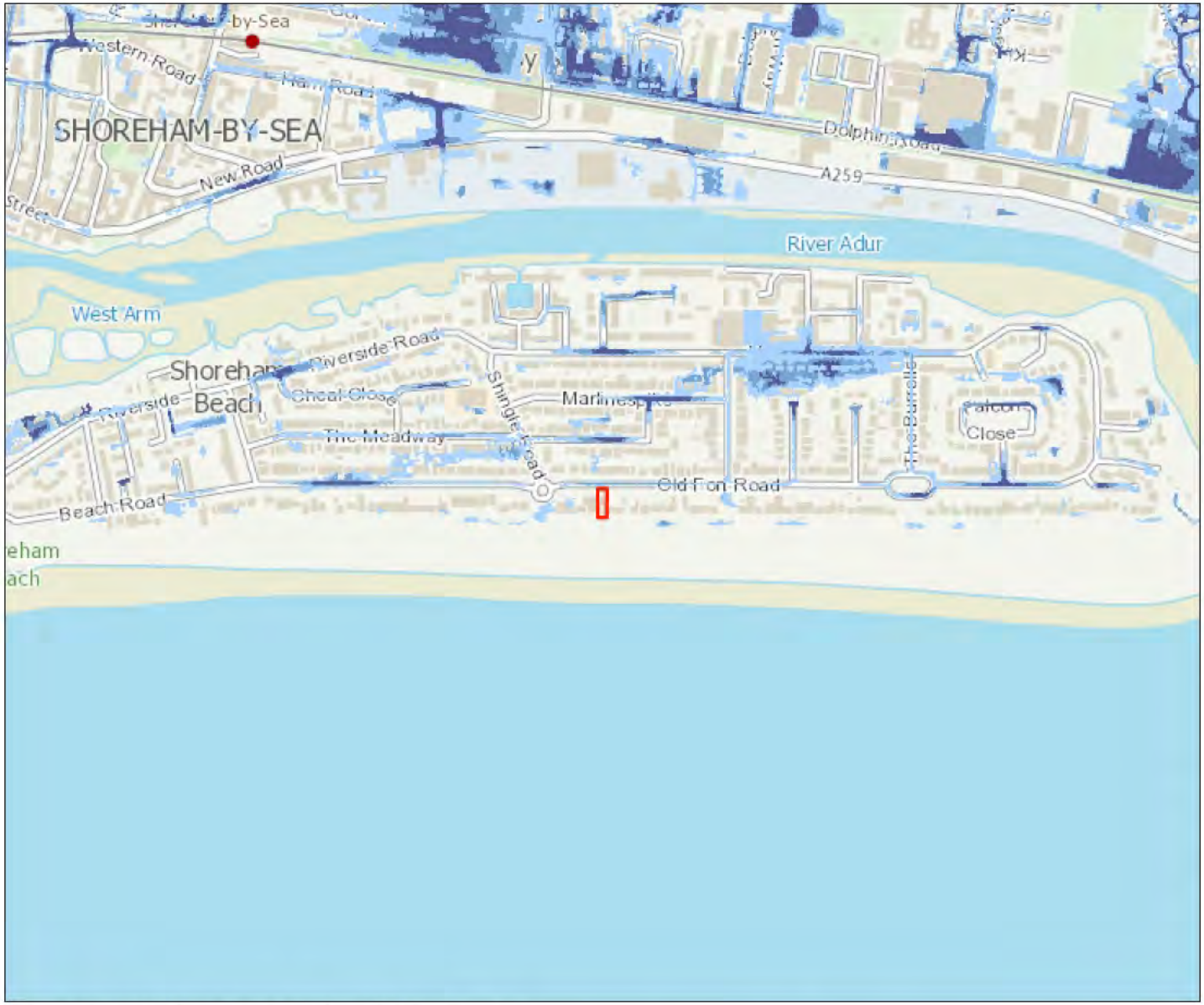
Produced on: 07/07/2022

**** The flood risk data provided is based on existing EA hydraulic models with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 27 July 2021.**

You should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

There is no additional information or health warnings for these levels/depths or the model from which they have been produced.

Risk of flooding from Surface Water. Centred BN43 5RA. Created **07/07**/2022.



Environment Agency

1: 10,000

0 Metres 250

N W E S

Likelihood of flooding from Surface Water

- High (>=3.3%)
- Medium (3.3% - 1%)
- Low (1% - 01%)
- Very Low

Likelihood of flooding from Surface Water

High:	Greater than or equal to 3.3% (1 in 30) chance in any given year
Medium:	Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
Low:	Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
Very Low:	Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on GOV.UK.

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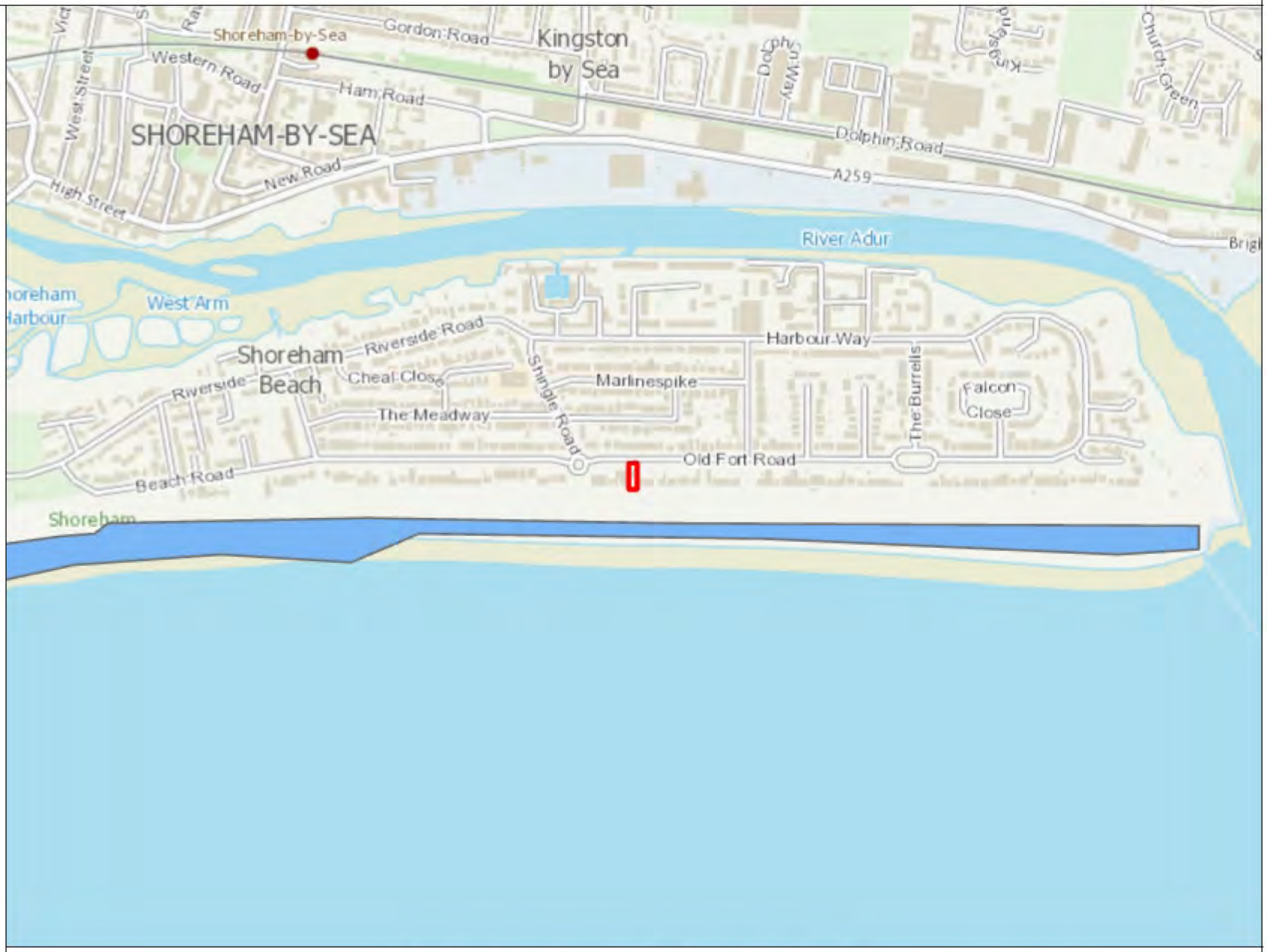
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). E-mail: enquires@environment-agency.gov.uk

Recorded Flood Outlines. Centred BN43 5R**A**. Created **07/07**/2022.

Environment Agency

Legend

All recorded flood outlines



1: 10,000

0 250

Metres

N W E S

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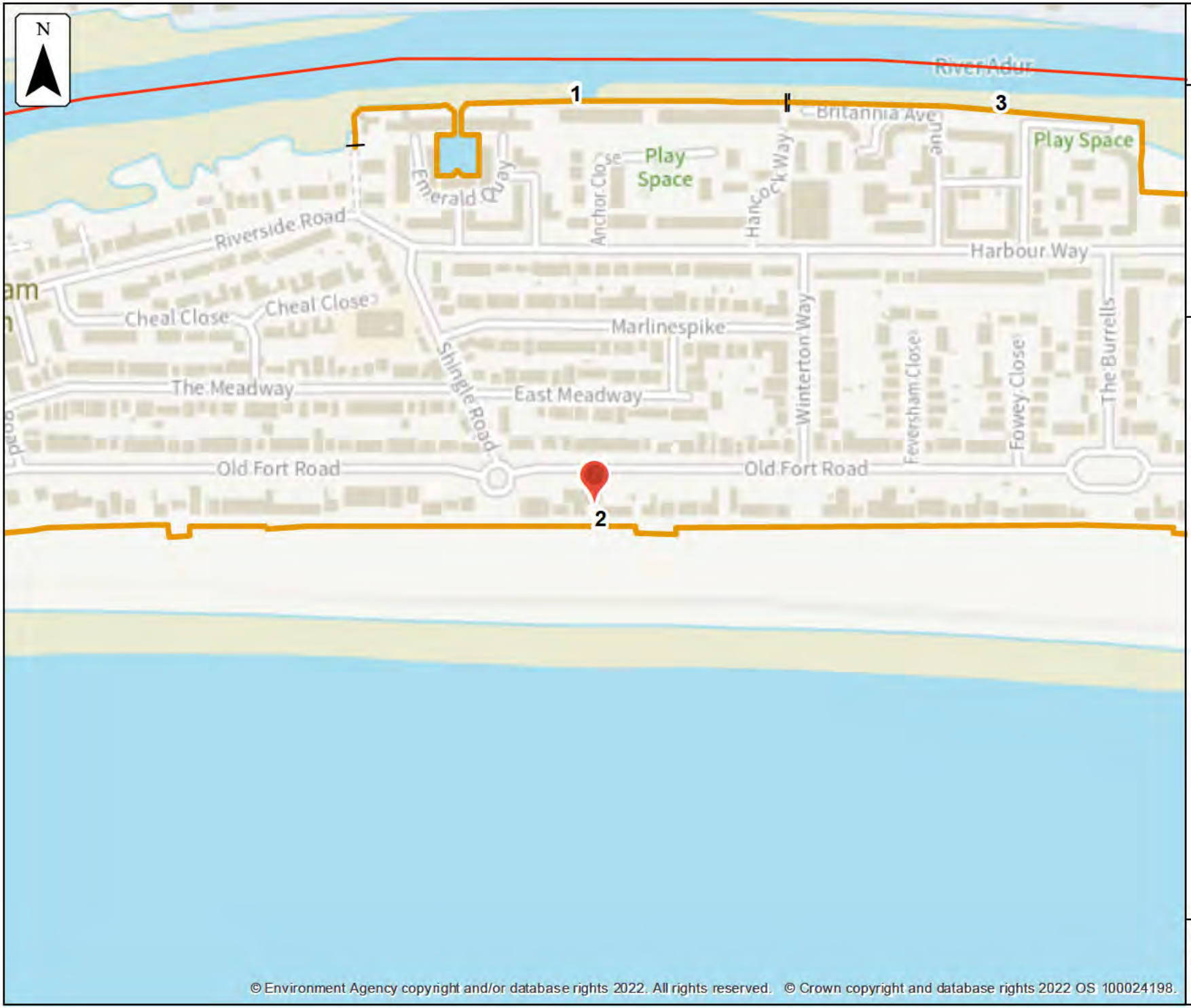


Environment Agency

Flood defences

Location (easting/northing)
522375/104546

Scale
1:5,000

Created
14 Apr 2022

Selected location

Main river

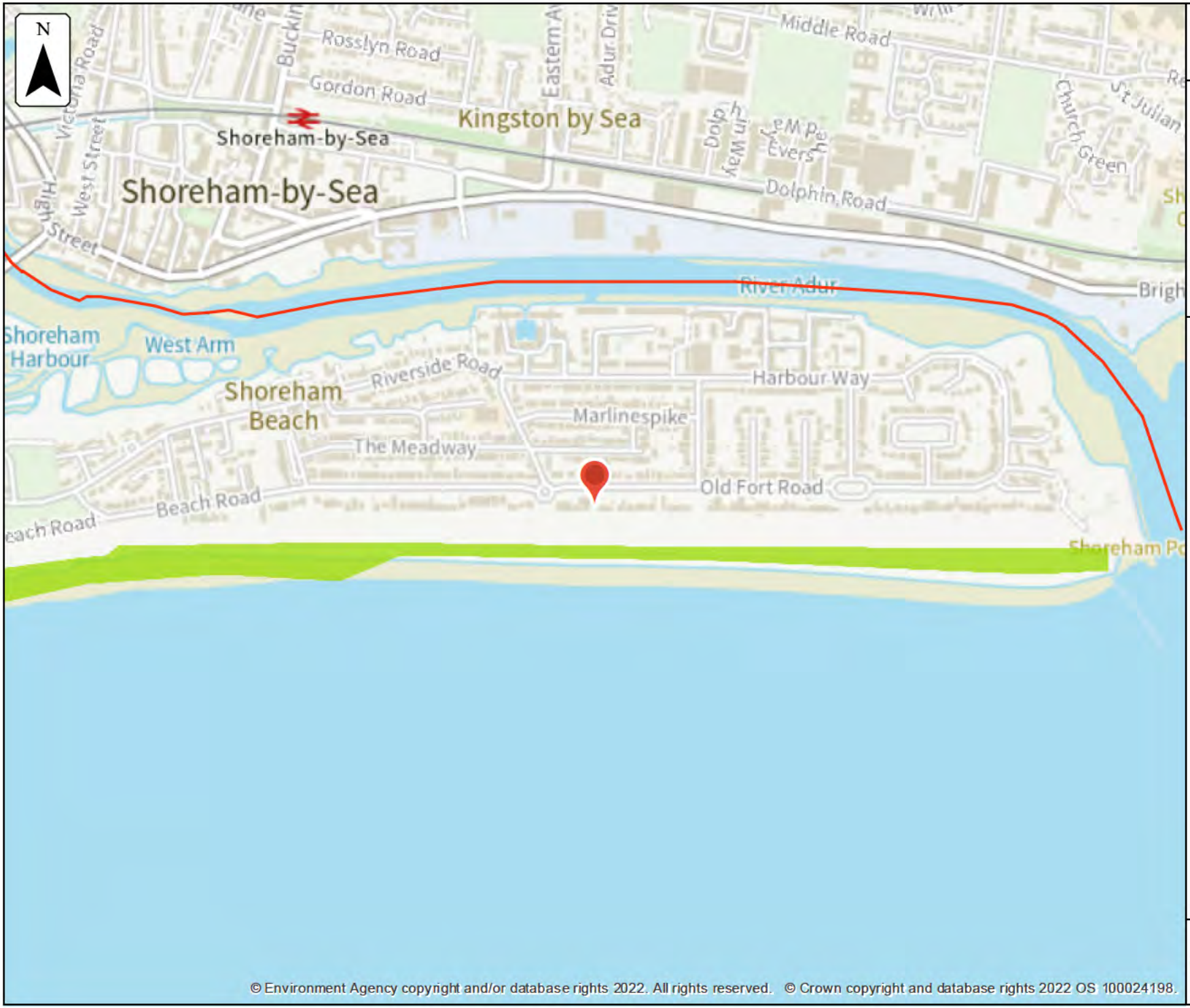
Flood defence

0 50 100 150 200 250
metres

Flood defences data

Label	Asset ID	Asset Type	Standard of protection (years)	Current condition	Downstream actual crest level (mAOD)	Upstream actual crest level (mAOD)	Effective crest level (mAOD)
1	172966	Wa	2		4.60	3.97	
2	149939	Beach	100	Good			7.10
3	172965	Wa	2		4.72	4.02	3.93

Any b ank ce s show where a particu ar va ue has not been recorded for an asset.



Environment Agency

Historic flood map

Location (easting/northing)
522375/104546

Scale
1:10,000

Created
14 Apr 2022

Selected location

Main river

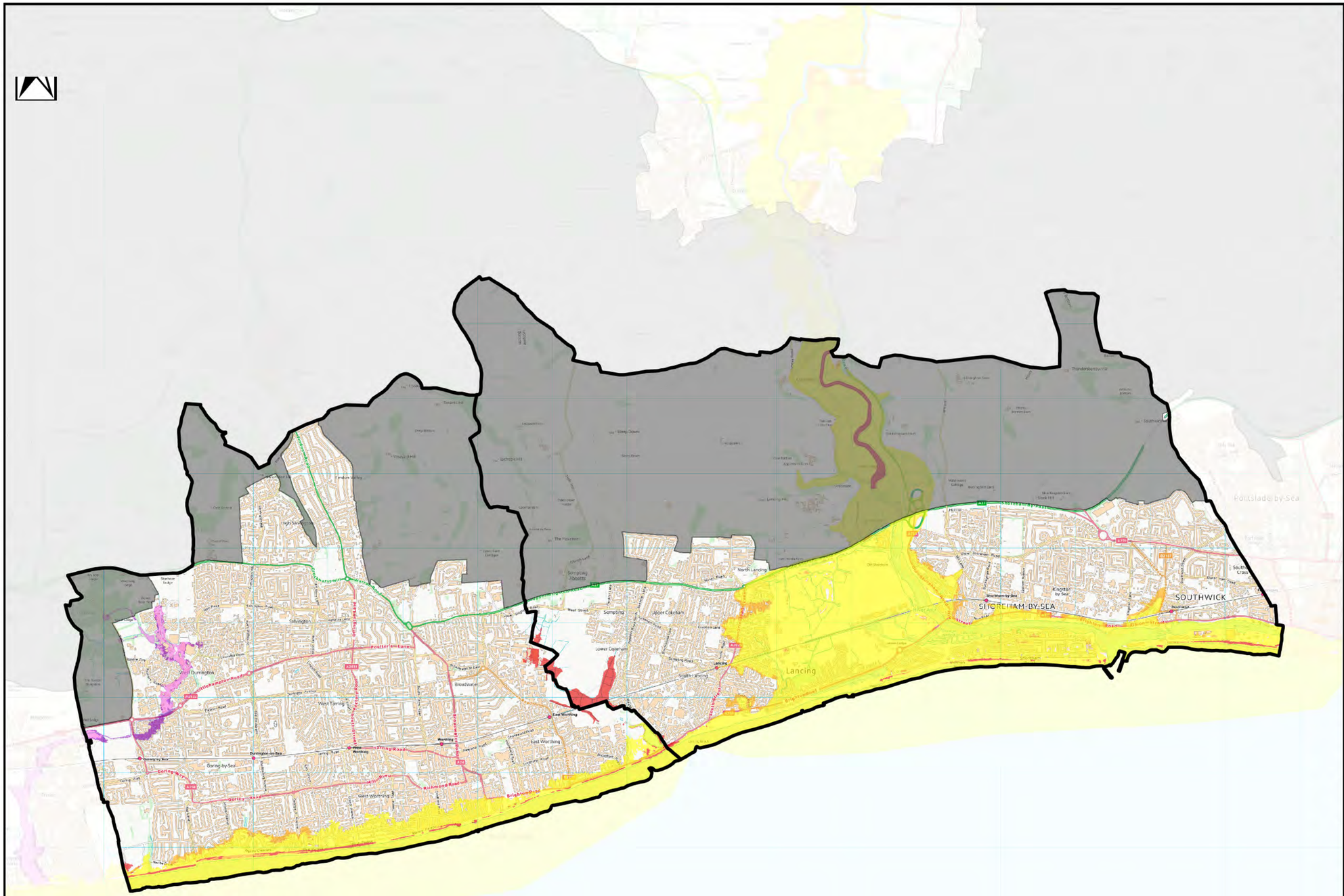
Date of flood event

August, 1992

0 100 200 300 400 500
metres

Historic flood event data

Start date	End date	Source of flood	Cause of flood	Affects location
26 August 1992	26 August 1992	other	overtopping of defences	No



Legend

- Adur District and Worthing Borough
- South Downs National Park
- 1% AEP Fluvial event plus 35%
- 1% AEP Fluvial event plus 45%
- 1% AEP Fluvial event plus 105%
- 0.5% AEP Higher Central Tidal event (2115 EPOCH)
- 0.5% AEP Upper End Tidal event (2115 EPOCH)
- Flood Zone 2 (Proxy)

Notes

The Environment Agency 2016 climate change guidance shows that for watercourses in the South East River Basin District the 35%, 45% and 105% allowances should be considered. This been applied to the 100-year fluvial events.
The Tidal 200-year event with uplifts for 2070 and 2115 have been used to assess future tidal flood risk within Adur and Worthing. Where there are no fluvial model available, Flood Zone 2 has been used to provide indicative information on the potential effects of climate change.

0 1.25 2.5 Kilometres

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Adur and Worthing Councils

SFRA: APPENDIX D
FLUVIAL AND TIDAL CLIMATE CHANGE FLOOD RISK MAPPING

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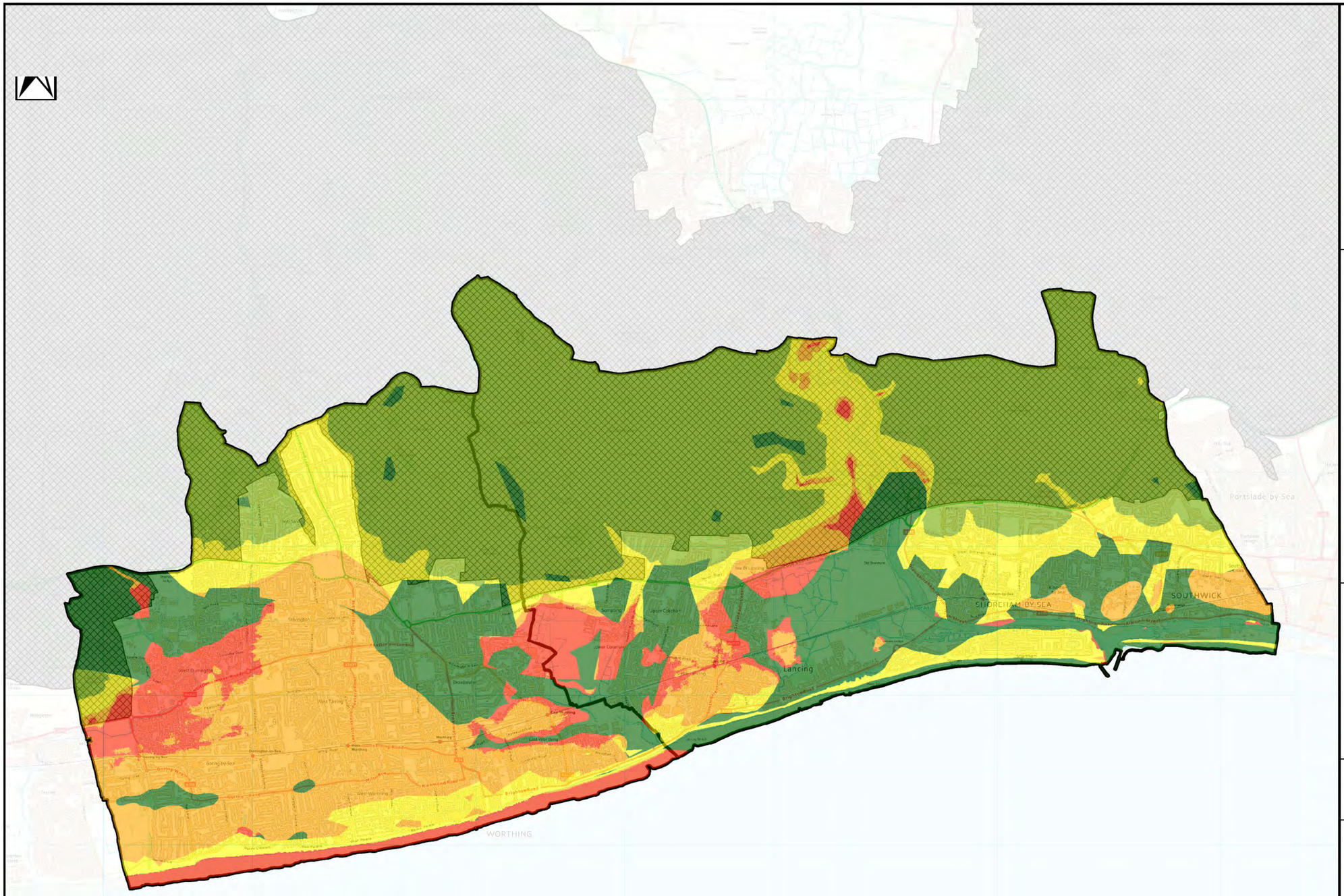
JBA consulting

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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Adur and Worthing Councils

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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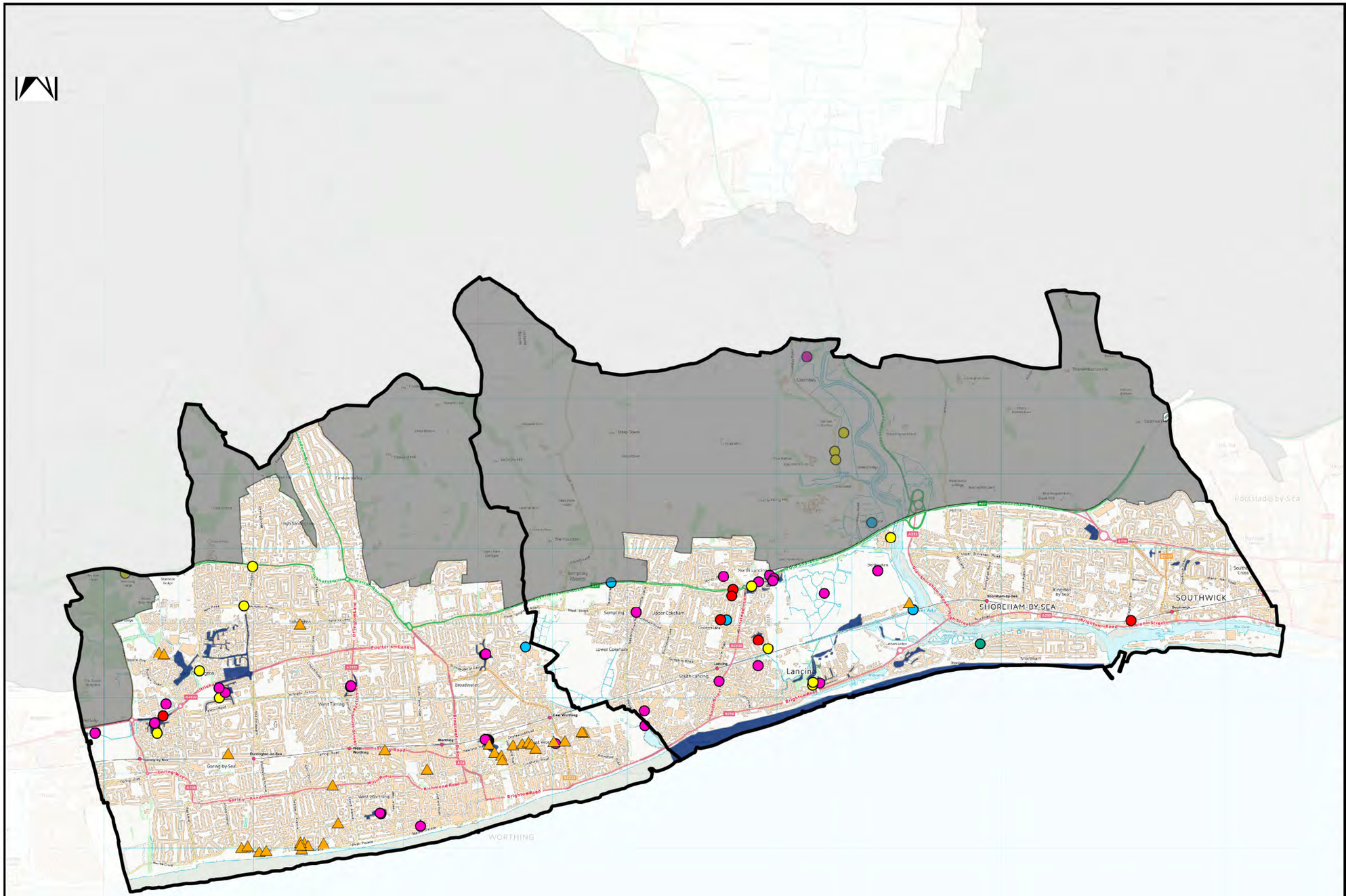



Legend

- Adur District and Worthing Borough
- South Downs National Park
- 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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SFRA: APPENDIX A
HISTORIC FLOODING

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Legend

- Adur District and Worthing Borough
- South Downs National Park
- EA Flood Warning Areas
- EA Flood Alert

Notes

Flood Alerts are used by the Environment Agency to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. Flood Alerts are issued earlier than a flood warning to give notice of the possibility of flooding but before the Environment Agency are fully confident that flooding in Flood Warning Areas is expected.

Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

0 1.25 2.5 Kilometres

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SFRA: APPENDIX K

FLOOD ALERT AND WARNING AREAS

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Appendix 6

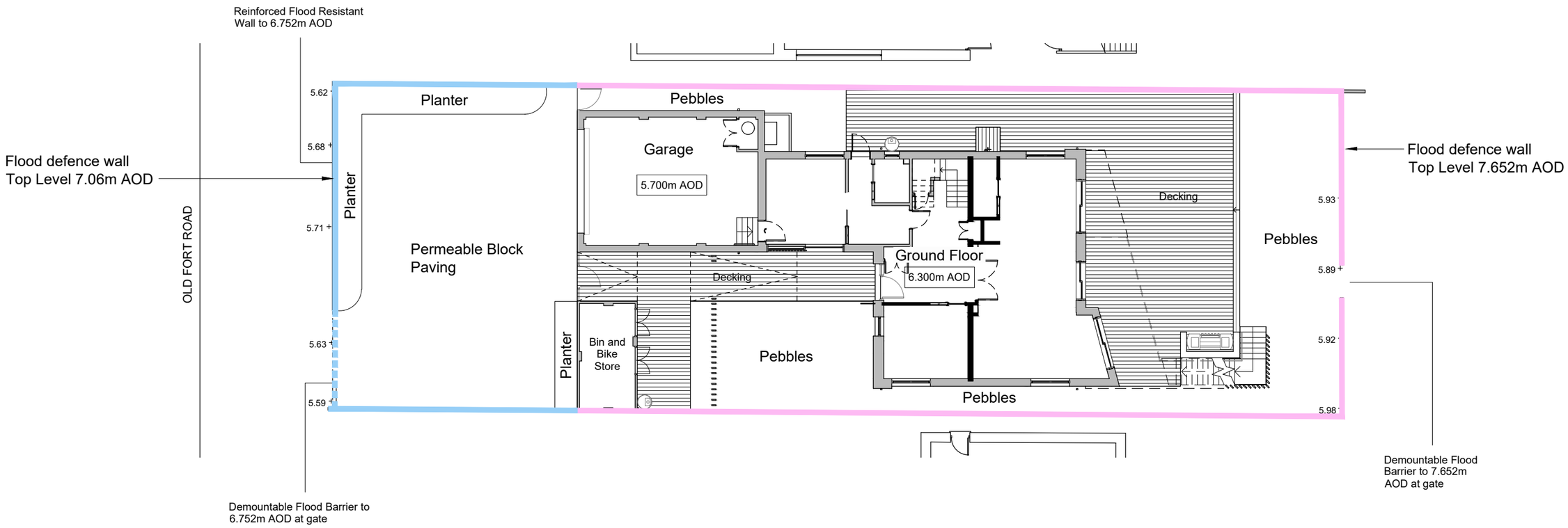
Proposed Site Layout Plan

N

Key:

Flood defence wall
Top Level 7.652m AOD

Flood defence wall
Top Level 7.06m AOD



-2m 0 2m 4m 6m 8m

TITLE
Proposed Site Layout Plan

SCALE	PROJECT. No.
1:200 @ A3	23748
REPORT TYPE	DRG. No.
FRA	03 -

Appendix 7

Preliminary Drainage Strategy Plan and Calculations

N

Key

- Permeable paving with minimum 580mm 30% voided subbase beneath IL 4.92
- Existing Southern Water Foul Sewer
- Proposed private foul drianage
- dt — Proposed diffuser tank discharging to subbase
- Proposed private foul drianage

OLD FORT ROAD

3501
CL ≈5.50
IL ≈4.01

Non return valve to private foul drainage

cp
dt
RE
5.700m AOD
6.300m AOD
Decking
Bin and Bike Store
5.62
5.68
5.71
5.63
5.59
5.93
5.89
5.92
5.98

-2m 0 2m 4m 6m 8m

TITLE
Preliminary Drainage Strategy Plan

SCALE	PROJECT. No.
1:200 @ A3	23748
REPORT TYPE	DRG. No.
FRA	04 -

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.850	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	Cover Level (m)	Depth (m)
Permeable Paving	0.038	5.600	0.680

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	0.850	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.900	Drain Down Time (mins)	2160	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node Permeable Paving Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03600	Safety Factor	2.0	Invert Level (m)	4.920
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	190

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	140.0	140.0	0.580	140.0	140.0	0.581	0.0	140.0

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	Permeable Paving	232	5.496	0.576	5.8	24.8154	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
240 minute winter	Permeable Paving	Infiltration	0.7

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