

Proposed dwelling

at

**86 Ancton Way
Bognor Regis
PO22 6JP**

**Flood Risk Assessment &
Management of Surface Water Run-off**

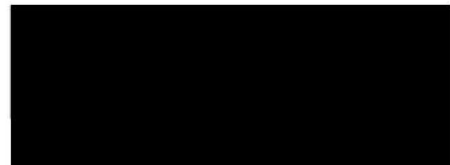
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FLOOD RISK ASSESSMENT & THE MANAGEMENT OF SURFACE WATER RUN-OFF

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FLOOD RISK ASSESSMENT & THE MANAGEMENT OF SURFACE WATER RUN-OFF

1. INTRODUCTION

Herbert Stumpp Limited have been appointed to prepare this document in respect of a proposed replacement dwelling at 86 Ancton Way, Bognor Regis, PO22 6JP.

The purpose of this document is to demonstrate:

- (a) that flood risk to and from the development has been properly considered; and
- (b) that a surface water drainage system to serve the proposed development has been designed to meet the requirements of the relevant statutory guidance and publications.

The site occupies an area of approximately 240m² (0.024Ha). A site location plan is shown in **Figure 1.1** below.

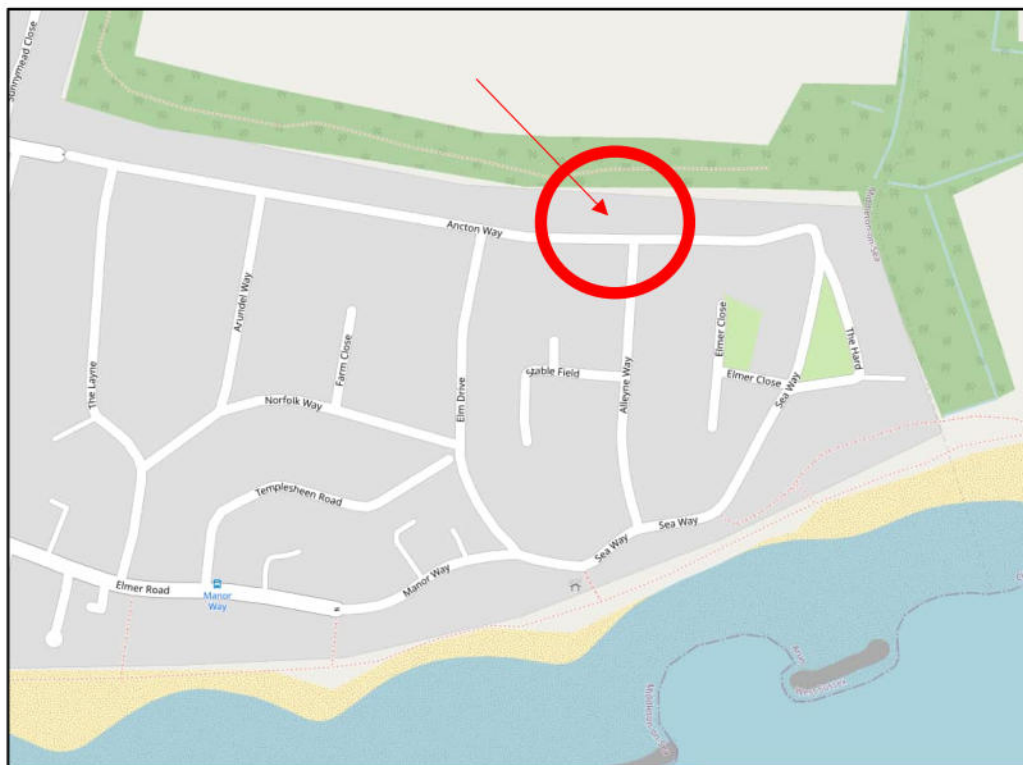


Figure 1.1: Site Location Plan © OpenStreetMap contributors

This document has been prepared in line with guidance found in the following:

- *Flood Risk Mapping*
- *Arun District Council Level 1 & Level 2 Strategic Flood Risk Assessments (SFRA)*
- *West Sussex LLFA policy for the management of surface water*
- *Arun District Council Surface Water Drainage Guidance*

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- *Code of practice for the structural design of pavements using modular paving units*
- Building Regulations Approved Document H
- CIRIA Report 753 – *'The SuDS Manual'*
- *'National standards for sustainable drainage systems (SuDS)'* Published by the Department for Environment, Food & Rural Affairs (DEFRA) July 2025
- *Tools for the design and evaluation of sustainable drainage systems (SuDS) published by UKSuDS (HR Wallingford)*
- *'Flood risk assessments: Climate change allowances'* published by the Environment Agency • BS 8582:2013. *'Code of practice for surface water management for development sites'*

The proposed surface water drainage layout and associated construction details are shown on Drawing 006 included in **Appendix 1**.

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2. FLOOD RISK

Interrogation of flood mapping (<https://flood-map-for-planning.service.gov.uk>) shows that the site is located in Flood Zone 3 and is at risk of flooding from the sea. Sites located in Flood Zone 3 have a 1 in 200 (0.5%) or greater chance of flooding each year. An extract from the mapping is shown in **Figure 2.1**.

The proposed development is residential in nature and as can be seen in **Figure 2.2**, is classed as 'More Vulnerable Development' (source: <https://www.gov.uk/guidance/flood-risk-and-coastal-change>).

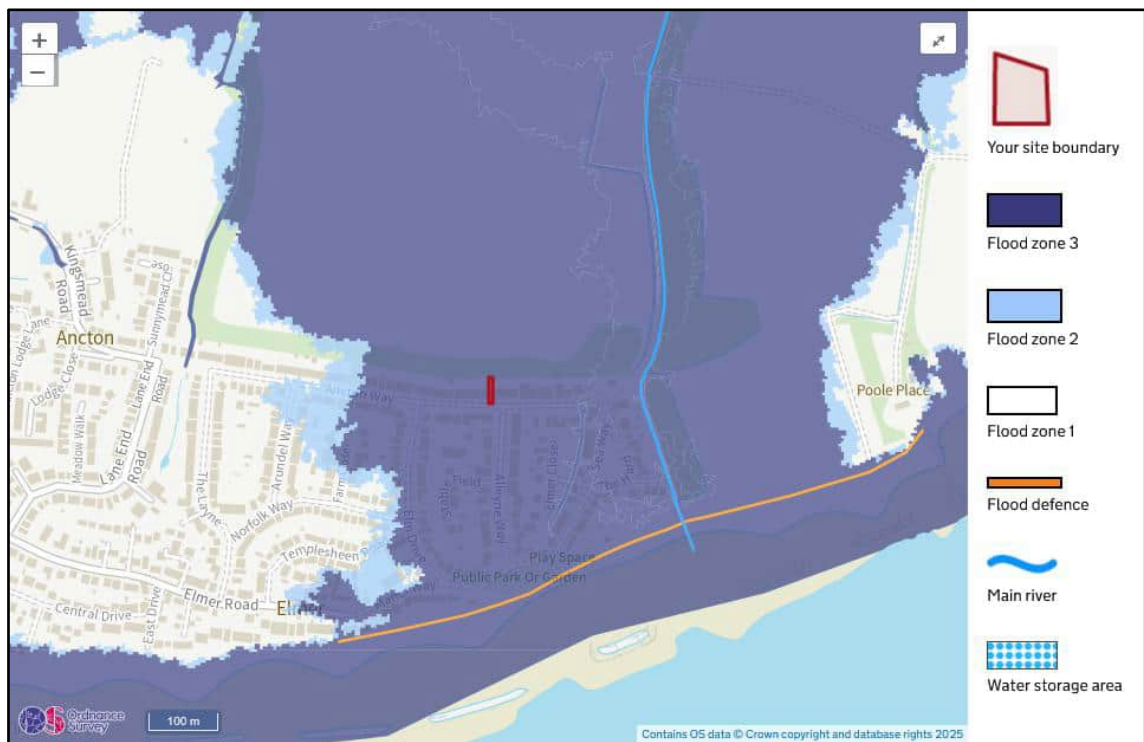


Figure 2.1 – extract from flood zone mapping

More vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non-residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Figure 2.2 – Development Classification

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Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓ *

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Figure 2.3: Flood risk compatibility

More vulnerable developments placed in Flood Zone 3 are considered appropriate development (source: <https://www.gov.uk/guidance/flood-risk-and-coastal-change>) only if the exception test can be passed, as can be seen in **Figure 2.3**. The Exception Test requires two additional elements to be satisfied (as set out in paragraph 164 of the National Planning Policy Framework) before allowing development to be allocated or permitted in situations where suitable sites at lower risk of flooding are not available following application of the sequential test. It should be demonstrated that:

- development that has to be in a flood risk area will provide wider sustainability benefits to the community that outweigh flood risk;
- and 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.

The following flood risks have been considered and are discussed in more detail in subsequent parts of this document:

- Flood risk from rivers or the sea
- Flood risk from surface water
- Flood risk from groundwater and reservoirs
- Flood risk from sewers
- Historic flood records
- Flood risk from the existing site
- Flood risk from the proposed development

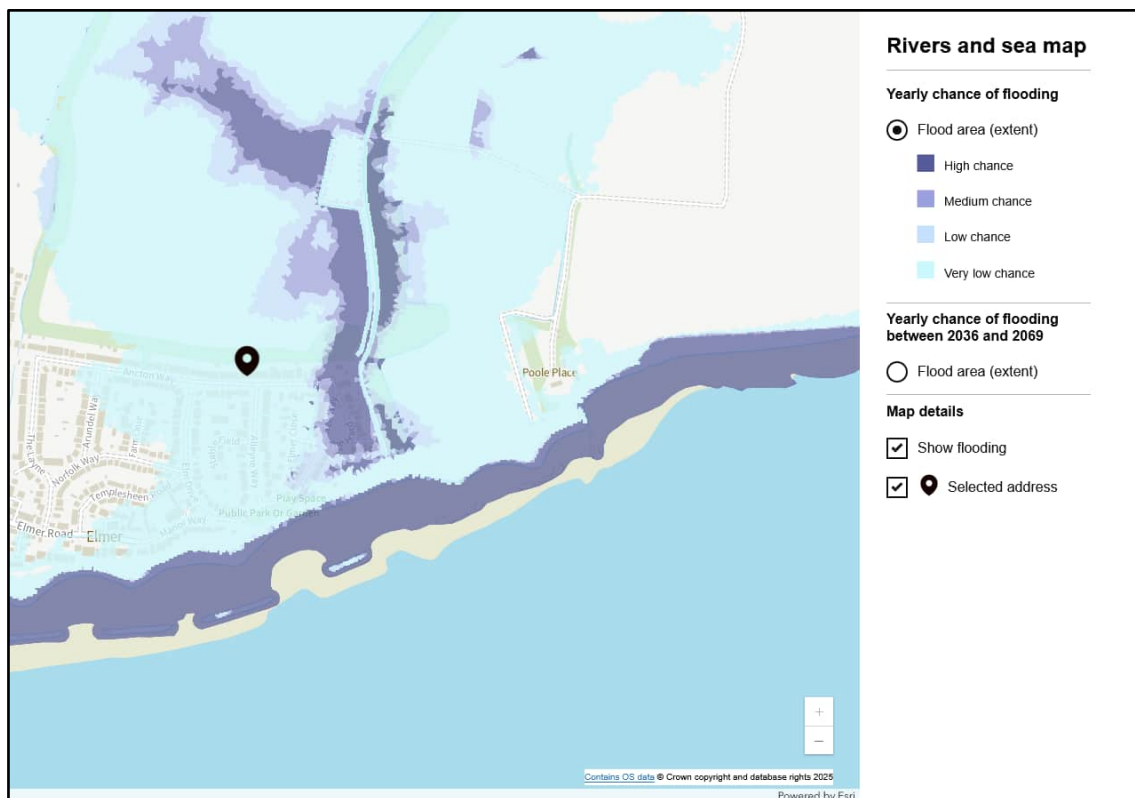
The flood risks and their flood risk frequencies are set out in **Table 2.1**

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Risk of flooding	Yearly chance of flooding
Very low risk	<0.1% (less frequently than once in 1000 years)
Low risk	0.1% to 1% (once in every 100 – 1000 years)
Medium risk	1% to 3.3% (once in every 30 – 100 years)
High risk	>3.3% (more frequently than once in 30 years)

Table 2.1: Flood risk & flood risk frequency**2.1 Flood risk from rivers or the sea**

Interrogation of flood mapping shows that the site is located in an area where there is very low yearly risk of flooding from rivers or the sea, and a low risk of flooding from rivers or sea between 2036 and 2069. This is shown in **Figures 2.4 & 2.5**.

**Figure 2.4 – Yearly chance of flooding (rivers and sea)**

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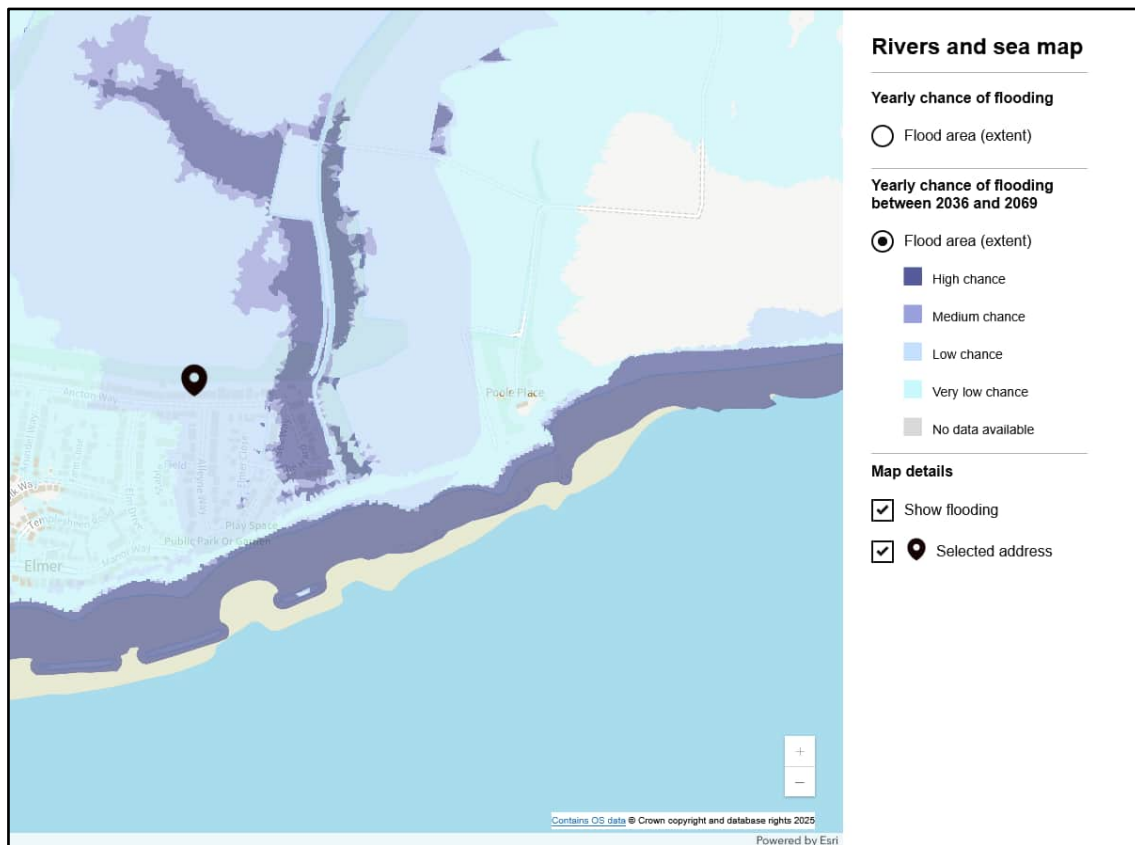


Figure 2.4 – Chance of flooding (rivers and sea) 2036-2069

Interrogation of the Arun DC Strategic Flood Risk Assessment (SFRA) and also Product 4 data from the Environment Agency (EA) confirm that the site is not at risk from fluvial flooding but is at risk from flooding from the sea.

Extracts from SFRA mapping are included in **Appendix 2**.

Product 4 data, which was obtained for a site 50m to the west of No. 86 Ancton Way in 2021, is included in **Appendix 3**. Updated Product 4 data has been requested from the EA but may not be received from them by 19th November 2025, the date requested by Arun DC planning department for this revised document. This is due to the 20 working days needed by the EA to provide this data from the date it was requested of them.

2.2 Flood risk from surface water

Interrogation of flood mapping shows that the site is located in an area where there is very low yearly risk of flooding from surface water, and a low risk of flooding from surface water between 2036 and 2069. This is shown in **Figures 2.6 & 2.7**.

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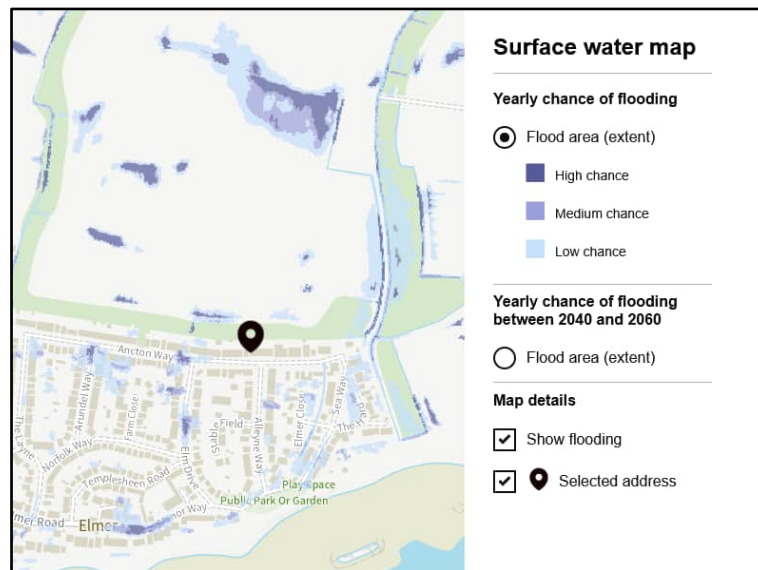


Figure 2.6 – Yearly chance of flooding from surface water

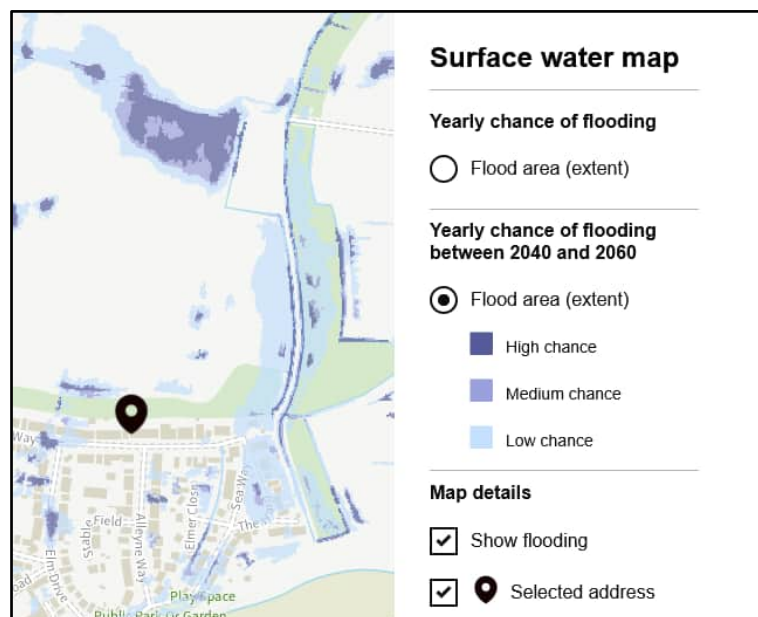


Figure 2.7 – Chance of flooding from surface water 2036-2069

2.3 Flood risk from groundwater and reservoirs

Interrogation of flood mapping shows that the site is located in an area flooding from either of these sources is unlikely. This is summarised in **Figure 2.8**

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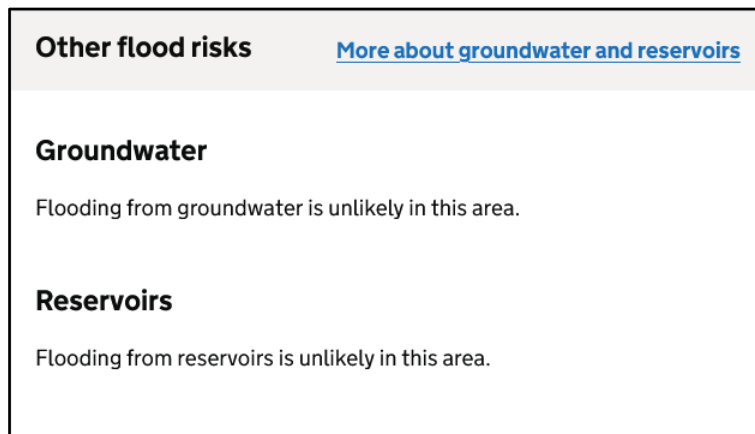


Figure 2.8 – summary of flood risk from other sources

2.4 Flood risk from sewers

The SFRA contains no record of any sewer flooding at the site. According to the landowner, there have been no records of sewer flooding in the past two years.

2.5 Historic flood records

Interrogation of the SFRA indicates that the site is located in an area where incidents of flooding have been recorded although not at the site address.

2.6 Flood risk from the existing site

The existing site comprises a single residential dwelling with the usual hard and soft landscaping. The total impermeable area (dwelling + outbuilding + hard landscaping) is approximately 150 sq.m.

The roof of the existing dwelling presently drains to a soakaway. The hardstanding at the front of the property drains to the road.

2.7 Flood risk from the proposed development

Following development of the site, the impermeable area will total approximately 95 sq.m. The increase in risk of overland (exceedance) flows reaching adjacent properties will be mitigated against by designing the surface water drainage system to cater for flows arising from the 1 in 100 year storm event plus an allowance for climate change, and the resultant risk of flooding to properties off-site will be low.

2.8 Impact of climate change

The site is located within an area influenced by tidal flooding, so climate change allowances for peak river flow and rainfall are not directly relevant to the assessment of flood risk from the sea.

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2.9 Mitigation measures

It is important to recognise the effects of climate change and for the design of new developments to consider and to build in, resilience to flooding of all forms. **Figure 2.9** shows the approach to design, which is required by current guidance. It has been reproduced from *Improving the Flood Performance of New Buildings (flood resilient construction)*, published by Department for Communities and Local Government.

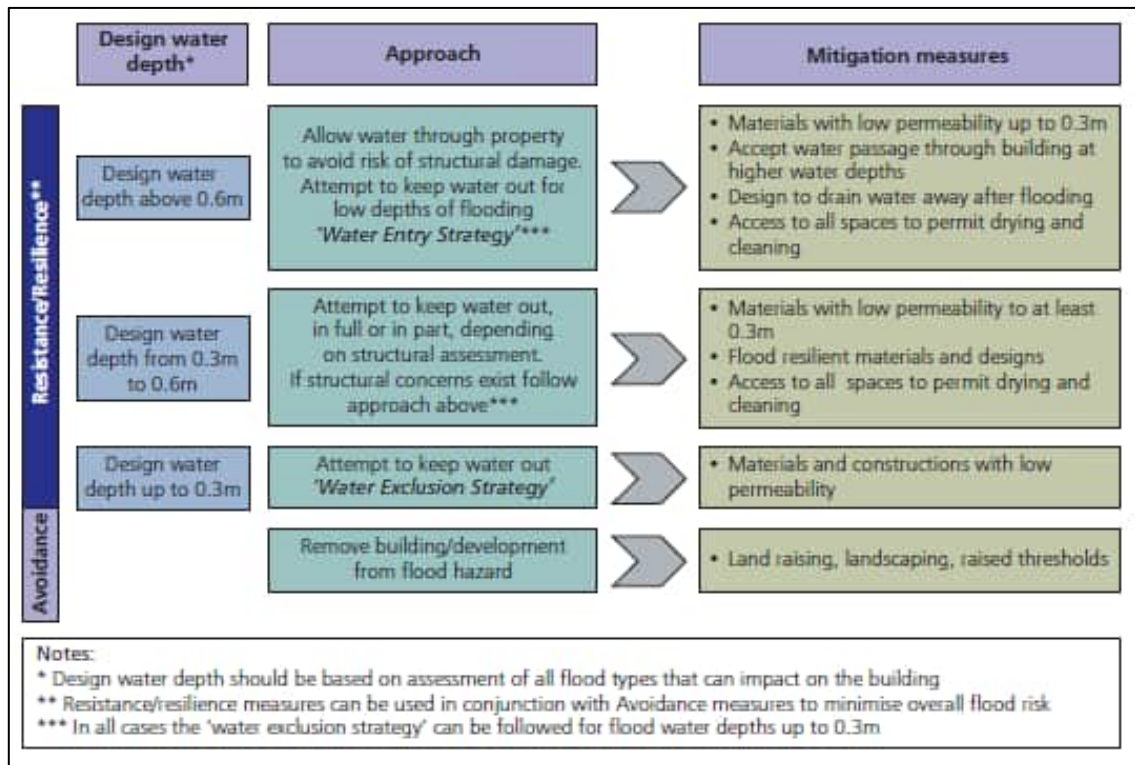


Figure 2.9 – Design Approach

The proposed development is classed as more vulnerable and the standing advice for such developments covers the following:

- floor levels
- flood resistance and resilience measures
- access and escape
- surface water management

2.9.1 Floor levels

Standing advice recommends that finished floor levels are set 300mm above the 0.5% AEP plus an allowance for climate change, and if this is not possible to raise the floor level as much as possible, consider moving vulnerable uses to upper floors and to include extra flood resistance and resilience measures.

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The proposal is to construct a replacement dwelling, and the finished floor level of the proposed dwelling will be set at the same level as the existing finished floor level, reflecting the floor levels of the existing and adjacent properties.

2.9.2 Flood resistance and resilience measures

Standing advice requires that the design should be appropriately flood resistant and resilient by incorporating the following measures:

- 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 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 valve.

To protect the dwelling from the risk of flooding from fluvial sources, the intention is to adopt a water exclusion strategy. Flood resilient construction (masonry) will be used. There are two possible entry points for water into the extension and these are:

- **Air vents**
Air vents will be fitted with covers to prevent water ingress which would be fixed in place to prevent water entering the sub floor voids. As an alternative, self-closing vents could be installed
- **Doors.**
To prevent water ingress via the door openings, the doors will either be specialist manufactured flood-resistant doors, or a flood barrier will be provided, held in situ by channels fixed to the wall on each side of the door opening. The barrier would be dropped into place when needed.

2.9.3 Access and escape

The site is located within a flood zone and it is necessary to ensure that the occupants are fully aware of flood risk. The occupants will be advised to sign up to the Environment Agency's Flood Warning Service.

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Standing advice requires details of emergency escape plans to be provided for any parts of a building that are below the estimated flood level. These plans should show that any single storey buildings or ground floors without access to upper floors can access a safe refuge above the estimated flood level; that any basement rooms have clear internal access (for example a staircase) to an upper floor above the estimated flood level; a safe route of access and escape which is set above the estimated flood level and connects the site to an area away from flood risk. The property has no basement and there is stair access from ground floor level to the first floor. The first floor provides a safe refuge should it be required. There are two entry/exit points at the property: the front door (which gives access to Ancton Way) and the back door (which gives access into the rear garden).

2.9.4 Surface water management

Standing advice requires that Sustainable Drainage Systems (SuDS) should be provided for all developments involving surface water drainage in flood risk areas; and for major developments involving surface water drainage. The standing advice also states that in the event SuDS are not included, the local planning authority (LPA) should be provided with clear evidence of why their use would be inappropriate. The management of surface water is discussed in sections 3 & 4.

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3. SURFACE WATER DRAINAGE – DESIGN PRINCIPLES

CIRIA Report 753 – The SuDS Manual sets out the design approach and the design criteria to be used when preparing the designs for a sustainable drainage system; and *‘National standards for sustainable drainage systems (SuDS)’* Published by the Department for Environment, Food & Rural Affairs (DEFRA) July 2025 sets out the standards for sustainable drainage systems. These standards are used in conjunction with the National Planning Policy Framework (NPPF) and Planning Practice Guidance and have been applied when preparing the design for this development.

In order to meet the requirements of these publications, planning policy and current best practice guidance, the following are now considered and discussed:

- Underlying geology
- Groundwater pollution
- Climate change
- Sustainability and SuDS hierarchy and standards
- Storm frequency climate change and urban creep
- Timetable for implementation
- Management and maintenance
- Exceedence flows

3.1 Underlying geology

Interrogation of British Geological Survey Mapping indicates that the site is underlain by chalk (bedrock geology) with superficial deposits of river terrace deposits and raised beach deposits. An extract from the mapping is shown in **Figure 3.1**.

Excavations carried out for foundations for the newly-built adjacent property at No.88 Ancton Way confirmed that chalk is present at shallow depth. This can be seen in the photograph included in **Appendix 4**.

Inspections of the trial pits to assess the underlying geology, and witnessing of the soakage tests were carried out by Herbert Stumpp Ltd.

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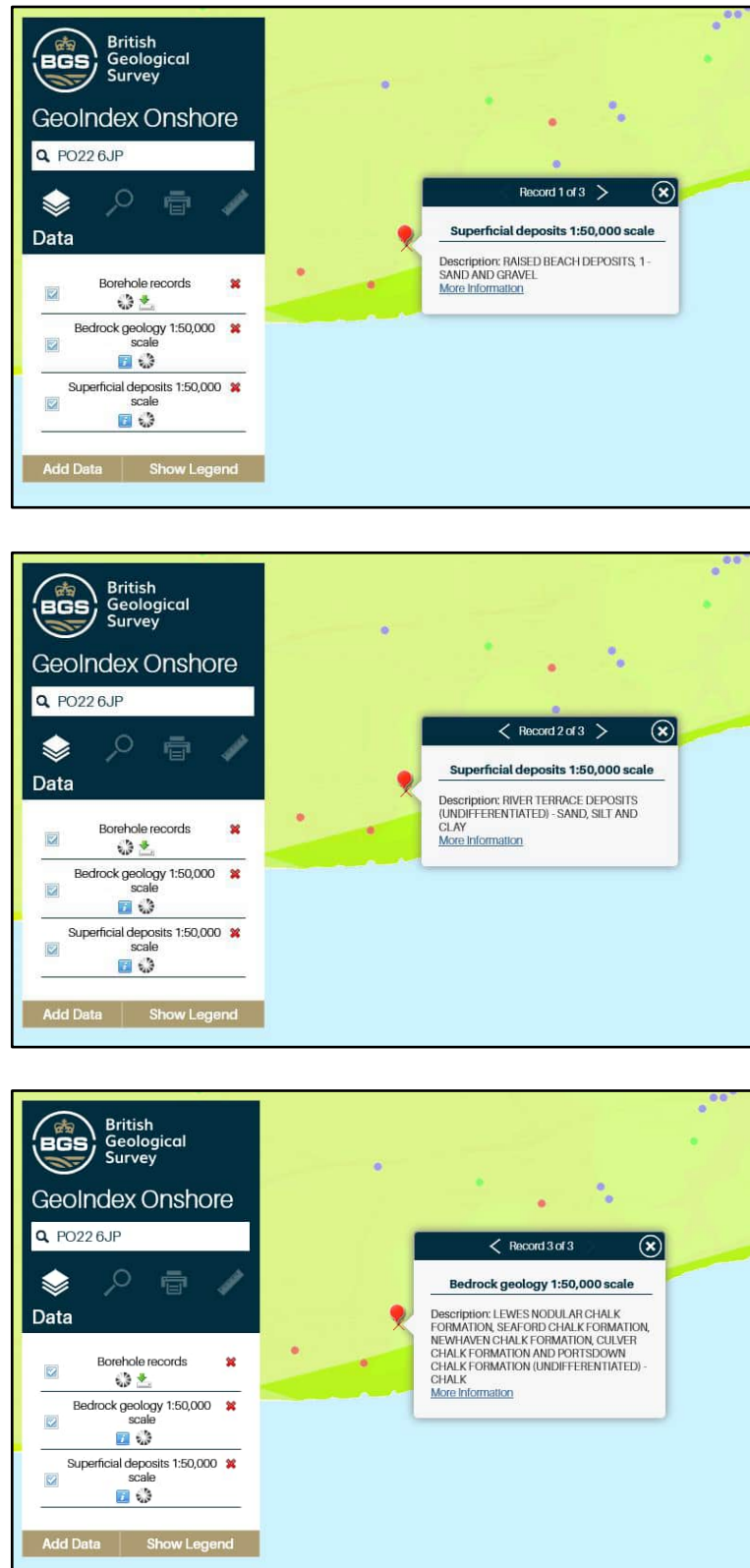


Figure 3.1 – extract from British Geological Survey mapping
© British Geological Survey

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3.2 Groundwater pollution

The site is not located within a Source Protection Zone (SPZ) and this can be seen from the extract from MAGIC Map published by DEFRA reproduced as **Figure 3.2**. In broad terms, SPZs are defined according to how long it will take a pollutant to travel from the point under consideration to the source from where groundwater is taken. These definitions are: inner zones (SPZ1), outer zones (SPZ2) and total catchments (SPZ3).

The sources of surface water run-off into the ground are from the roof and from the areas of hard landscaping around the site. Surface water run-off from roofs is generally considered 'safe' in terms of pollutant types and levels of pollutants, although airborne particles which settle on these areas can contain elevated levels of pollutants and these particles are generally washed off with the first flush of rainfall and conveyed into the drainage system.

The patio to the rear of the proposed dwelling and the parking area to the front will be permeably surfaced and beneath these permeable surfaces will be an aggregate drainage blanket.

The parking area is a potential source of pollutants such as hydrocarbons, phosphates, glycols, alcohols and heavy metals. Engines can leak, and accidental spillages can occur. It is well-documented that drainage blankets assist with removing pollutants such as these. The majority of silt and the pollutants which become attached to it are usually trapped within the top 30mm of the drainage blanket, and organic pollutants such as petrol and diesel tend to biodegrade due to the length of time they are retained, during which microbial and natural action break down these pollutants into their less harmful components

It is therefore considered that the risk of groundwater pollution is low.

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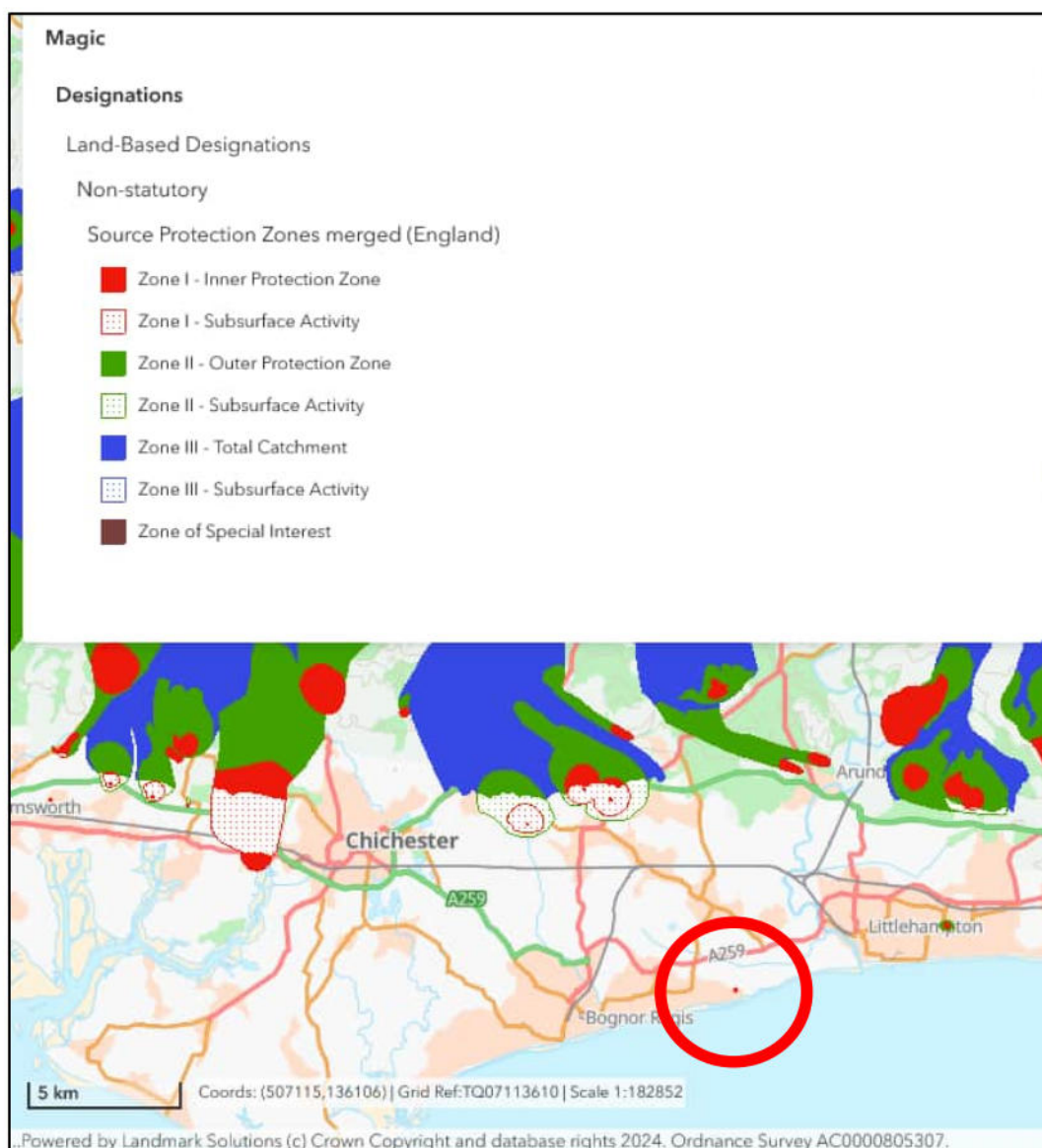


Figure 3.2 – extract from Magic Map
© DEFRA

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3.3 Climate change

'Flood risk assessments: climate change allowances' prepared by the Environment Agency recommends varying levels of allowance for climate change and requires that allowances for climate change are applied to the peak rainfall intensities used in the design storms to be considered.

The allowances to be used are obtained directly from that publication and it can be seen from the extract reproduced as **Figure 3.3** that the allowances vary between 20% and 45%, depending upon the lifespan of the development and the exceedance rainfall event. It is considered that as the development is of a residential nature, a life span for the development of 100 years is appropriate, which means that the development will be in use until, say, 2125. The 1% annual exceedance rainfall event is appropriate and the central and upper end allowances for this event are 25% and 45%. An allowance of 45% will therefore be used.

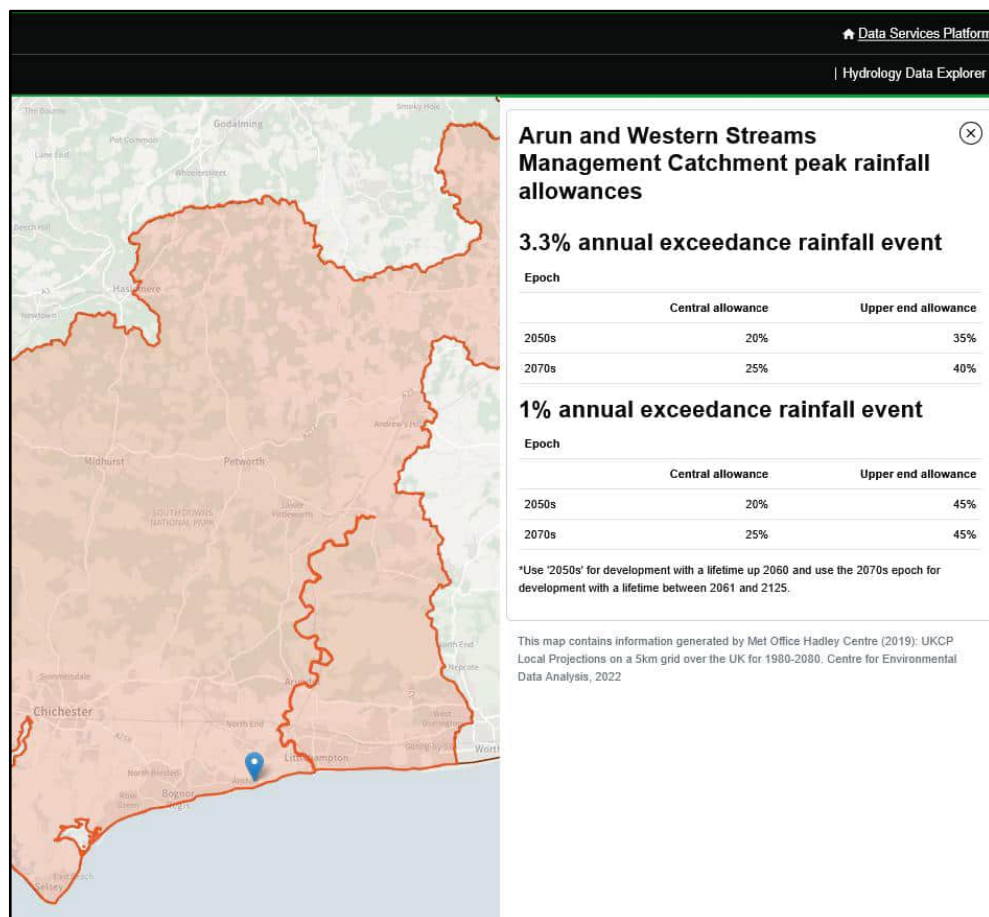


Figure 3.3 – peak rainfall allowances

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3.4 Sustainability and SuDS standards and hierarchy

'National standards for sustainable drainage systems (SuDS)' state and give guidance on the seven standards to be considered and they are:

- Run-off destination
- Interception drainage
- Extreme rainfall and flooding
- Water quality
- Amenity
- Biodiversity
- Construction, operation, maintenance, decommissioning and structural integrity

3.4.1 Run-off destination

Soakage tests at two depths have confirmed that infiltration is viable and it is therefore not necessary to offer an alternative disposal location. Standards require at least 1m between the base of any SuDS feature and the peak winter groundwater table.

3.4.2 Interception drainage

2nr rainwater downpipes will be provided on the rear of the proposed dwelling to pick up surface water run-off from the roof. Each downpipe will flow into a rainwater butt and then into a rain garden instead of into a drainage blanket located beneath a permeable surface. Two rain gardens will be provided - one alongside each side boundary in the rear garden. The roof area is 75 sq.m (82.5 sq.m. with 10% allowance for urban creep) and a total area of 16.5 sq.m. of rain garden is required (20% of the roof area). Each rain garden will be 10.4m long and will be 0.8m wide, providing a total area of 16.6 sq.m. 8.3 sq.m. will be provided on each side. All paved surfaces will be laid so as to be permeable.

3.4.3 Extreme rainfall and flooding

A flood risk assessment has been prepared and this is included in Section 2 of this document. The site is at low risk of flooding from surface water and this is shown in Figures 2.6 & 2.7 of the FRA/surface water design document and is also confirmed by inspection of Arun DC's own SFRA. Flooding is from tidal sources and there is no evidence that the site is at risk from flooding by fluvial sources.

3.4.4 Water quality

Water quality has been considered and groundwater pollution is discussed in section 3.2 of this document. The principal source of surface water run-off is from the roof of the proposed dwelling. Surface water run-off from roofs is generally considered 'safe' in terms of pollutant types and levels of pollutants, although airborne particles which settle on these areas can contain elevated levels of pollutants and these particles are generally washed off with the first flush of rainfall and conveyed into the drainage system. The roof will discharge into rain gardens where the planting, retention of the

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surface water run-off, and subsequent microbial and natural action will break down the pollutants into their less harmful components. This is well-documented. Any new hard landscaping around the site will be permeable, and again any pollutants will be treated by microbial and natural action in the drainage media beneath them.

3.4.5 Amenity

The rain gardens will slow surface water run-off and will provide a garden feature for the use and enjoyment by the occupants of the dwelling. A project of this size has little potential to offer amenity on a wider scale, e.g. beyond the confines of the site.

3.4.6 Biodiversity

The rain gardens will be planted with native, nectar-rich plants, which will provide food for pollinators such as butterflies and bumblebees, and will attract birds. It will also enhance the natural habitat.

3.4.7 Construction, operation, maintenance, decommissioning & structural integrity

Construction details and maintenance requirements are considered in this document, with various details shown on Drawing 006. Management and maintenance are discussed in section 3.7. Structural design is discussed in section 4.

'National standards for sustainable drainage systems (SuDS)' also state and give guidance on the drainage hierarchy to be followed and this is:

Runoff from the development shall be discharged to the following final destinations, to the maximum extent practicable, in accordance with the below hierarchy:

- priority 1: collected for non-potable use
- priority 2: infiltrated to ground
- priority 3: discharged to an above ground surface water body
- priority 4: discharged to a surface water sewer, or another piped surface water drainage system
- priority 5: discharged to a combined sewer

Note 1: priority 1 is the highest priority and priority 5 is the lowest.

- **Priority 1: Collected for non-potable use**
2nr rainwater butts will be provided to the rear of the property to store rainwater for garden use. These will overflow when full into a rain garden. The storage of rainwater for larger-scale re-use has been discounted because the area that would receive surface water is relatively small and to serve the property reliably, an overly large tank would be required to be sited below ground. This is considered impractical.
 - **Priority 2: Infiltrated into the ground**
British Geological Survey maps shows that the underlying geology of the site is chalk.
-

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Surface water run-off from the existing site and other properties in the area presently drains to soakaways.

Testing to establish the soil infiltration rate was carried out for No.88 Ancton Way in January 2023. The location of the trial pit where these tests were undertaken is shown on Drawing 006 and the results of the tests and calculation of the infiltration rates are included in **Appendix 5**. The locations of the tests were approximately 4m from the centre of the development site.

The method of calculating the soil infiltration rate is by taking a known volume of water and dividing it by the product of the surface area of the excavation exposed to water measured between two points and the time taken for that volume of water to fall between those two points. The method is the same for both BRE 365 and Building Regulations Part H and the size of the trial pit makes no difference to the methodology or to the result. For BRE 365 a trial pit should be between 1m and 3m long, and 0.3m and 1m wide; and for Part H a trial pit should be 300mm square and at least 300mm deep. The pit for the upper level test was 1.0m x 1.0m x 0.6m deep and the pit for the lower level test was 0.5m x 0.5m x 1.0m deep.

Infiltration tests were carried out at 0.6m below ground level and at 1.0m below ground level and the infiltration rate at the higher level was calculated to be 1.16×10^{-5} m/s ; and the infiltration rate at the lower level was calculated to be 8.8×10^{-6} m/s.

The method of calculating the soil infiltration rate *f* is correct and is compliant with both BRE 365 and Building Regulations Part H methods.

Inspections of the trial pits to assess the underlying geology, and witnessing of the soakage tests were carried out by Herbert Stumpp Ltd.

The results show that infiltration drainage is feasible and it is therefore the proposed method for the dispersal of surface water run-off.

All patios, paths and hardstandings around the development site will be permeably surfaced and will infiltrate directly into the ground. Surface water run-off from the roof of the proposed dwelling will discharge into rain gardens.

- Priority 3: discharged to an above ground surface water body
There is no above ground surface water body to discharge to, so this has been discounted. In any case, this option is lower down the hierarchy than the proposed infiltration drainage techniques.
- Priority 4: Discharged to a surface water sewer, or another piped surface water drainage system
There is no surface water sewer or piped drainage system to discharge to so this has been discounted. In any case, this option is lower down the hierarchy than the proposed

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infiltration drainage techniques.

- **Priority 5: discharged to a combined sewer**
There is no combined sewer to discharge to so this has been discounted. In any case, this option is lower down the hierarchy than the proposed infiltration drainage techniques.

3.5 Storm frequency, climate change & urban creep

Planning policies and current guidance require the surface water drainage system to be designed to receive flows from a 1 in 30 year +45% climate change event without flooding. The storage system and the below ground pipework leading to it have been designed to receive flows from a 1 in 100 year +45% climate change event without flooding. The measured impermeable areas used in the calculations include a 10% allowance to take into account urban creep.

3.6 Timetable for implementation

The proposed surface water drainage system will be constructed as part of the development of the site and will be operational prior to occupation.

3.7 Management and maintenance

Responsibility for maintenance will rest with the owner of the proposed dwelling, and regular inspection and maintenance of the drainage system, its components and its contributing areas will be required.

The construction details and the proposed drainage layout drawing show that the drainage system complies with the relevant requirements of Part H of the Building Regulations in respect of maintenance, access, pipe diameters and gradients; and they also show that the proposed materials are of a suitable nature for the intended use. Construction of the drainage system and installation of individual components will be tested where required in accordance with the Building Regulations, current codes of practice and manufacturer's recommendations.

The maintenance requirements for the drainage system are summarised as follows:

Gutters

Materials: Plastic/composite/steel gratings, plastic gutters and gullies, precast concrete channels

Maintenance requirements: Monthly inspections to assess condition and to ensure no accumulations of debris or silt. Remove any debris and carry out jetting/flushing and repairs as necessary to ensure continued operation.

FLOOD RISK ASSESSMENT & THE MANAGEMENT OF SURFACE WATER RUN-OFF

Permeable paving

Materials:

Clay/concrete pavers with stone media beneath

Maintenance requirements: Sweeping of the surface 2 – 4 times per year, removal of any surface debris as it appears, and the removal of any weed and plant growth. Sweeping can be carried out manually or mechanically. Mechanical sweeping should only be carried out with the suction feature turned off to prevent the accidental removal of any surface grit.

Water butts & diverters

Materials:

Plastic

Maintenance requirements: Twice yearly inspections to assess condition of water butts and to ensure no accumulations of debris or silt. Remove any debris as necessary. Regular inspection of diverter inlet and outlet pipes to ensure no blockages

Rain gardens

Materials:

Live plants

Maintenance requirements: Careful selection of plants to ensure they are appropriate for the conditions. Regular weeding, pruning and trimming to ensure the garden does not become overgrown. Regular inspection of plants to assess their health and replacement of dead and dying plants.

FLOOD RISK ASSESSMENT & THE MANAGEMENT OF SURFACE WATER RUN-OFF

4. DESIGN

The proposal is for surface water run-off from the proposed dwelling to drain into the ground via a drainage blanket located beneath the rear patio and via the permeable driveway/parking area to the front of the property. The design has been broken down into the following sub-headings and these are subsequently discussed in detail:

- Groundwater monitoring
- Structural performance
- Hydraulic performance
- Exceedence flows

4.1 Groundwater monitoring

A groundwater monitoring point was installed at the site in April 2023 and water levels were observed and recorded regularly. The monitoring point comprised a 1.5m length of perforated plastic pipe inserted into the ground to a depth of 1.45m and surrounded with shingle. A photographic record is included in **Appendix 6**. The results of the monitoring are tabulated in Table 4.1. Monitoring took place between April 2024 and April 2025. The location of the monitoring point is shown on Drawing 006. It is a requirement that there is not less than 1.0m distance between the highest recorded groundwater level and the underside of any planar drainage blanket or soakaway. The ground level at the monitoring point is 9.600m and the highest ground water level recorded was 220mm above the base of the monitoring point., i.e. 8.370m. No formation level is permitted to be lower than 9.370m. Formation levels are shown on Drawing 006.

Date	Depth of water above base
27.04.2024	95mm
16.05.2024	75mm
25.05.2024	Dry
07.06.2024	Dry
30.06.2024	Dry
20.07.2024	Dry
02.08.2024	Dry
08.08.2024	Dry
06.09.2024	Dry
11.10.2024	150mm
01.11.2024	Dry
15.11.2024	Dry
23.12.2024	Dry
18.01.2025	Dry
30.01.2025	220mm
14.02.2025	Dry
18.03.2025	Dry
20.04.2025	Dry

Table 4.1 – Groundwater levels

FLOOD RISK ASSESSMENT & THE MANAGEMENT OF SURFACE WATER RUN-OFF

4.2 Structural performance

The parking area and the patio will be permeably surfaced and will be constructed to meet the requirements of the anticipated traffic loads. The minimum depth of aggregate sub-base which will be used to form the drainage blanket beneath these areas will be either the depth required to provide the satisfactory storage volume or the depth required to provide satisfactory structural performance, whichever is the greater of the two.

The parking area will be subjected to light car use and will be surfaced using one of the following options:

- Permeable resin bound gravel designed in accordance with Marshall's Permeable Paving Design Guide; BS EN 13108 Bituminous mixtures (material specifications); and Asphalt Applications AA1 and AA2 published by the Mineral Products Association. This requires 150mm of open graded crushed rock sub base (drainage aggregate).
- Permeable tarmac designed in accordance with Marshall's Permeable Paving Design Guide; BS EN 13108 Bituminous mixtures (material specifications); and Asphalt Applications AA1 and AA2 published by the Mineral Products Association. This requires 150mm of open graded crushed rock sub base (drainage aggregate).
- Permeable block paving designed in accordance with BS 7533. This requires 150mm of open graded crushed rock sub base (drainage aggregate).
- Unbound stone contained in a cellular system such as Bodpave by Green-Tech or a Geoweb system. Examples are included in **Appendix 7**. This surface requires at least 200mm of aggregate beneath it for satisfactory structural performance.

The patio will be subjected to pedestrian traffic only and will be designed to meet the structural requirements of Traffic Category 1 of BS 7533. For satisfactory structural performance, the patio requires a minimum of 100mm depth of open graded crushed rock sub base (drainage aggregate).

4.3 Hydraulic performance

Calculations are included in **Appendix 8** to show the design for the planar infiltration. The calculations have been prepared using the tool provided by UKSuDS (HR Wallingford) and are based on FEH Rainfall data.

- **Planar infiltration**

This covers the design of the permeable surfaces, and the calculations show that:

No urban creep:

per 1.0 sq.m. of surface, and allowing for a 1 in 100 year event plus 45% allowance for climate change, a safety factor of 10, and a depth of aggregate of 125mm, the required base area (plan area of the planar infiltration) is 0.9 sq.m which is less than that provided (1.0 sq.m) and is therefore satisfactory.

FLOOD RISK ASSESSMENT & THE MANAGEMENT OF SURFACE WATER RUN-OFF

+10% for urban creep:

per 1.1 sq.m. of surface (1.0 sq.m. + 10% for urban creep), and allowing for a 1 in 100 year event plus 45% allowance for climate change, a safety factor of 10, and a depth of aggregate of 125mm, the required base area (plan area of the planar infiltration) is 1.0 sq.m. which is equal to that provided (1.0 sq.m) and is therefore satisfactory.

125mm depth of aggregate is therefore required for satisfactory hydraulic performance. This needs to be compared to the minimum depth of sub base (drainage aggregate) that is required for satisfactory structural performance, and this comparison is shown in **Table 4.2**.

Construction format	Minimum depth required for:		Minimum depth to be provided
	Structural design	Hydraulic design	
Resin bound on permeable tarmac	150mm	125mm	150mm
Permeable tarmac	150mm	125mm	150mm
Block paving	150mm	125mm	150mm
Patios/paving etc	100mm	125mm	125mm

Table 4.2: Depth of drainage aggregate required

In the case of the parking bay, the structural design (150mm) governs the depth of aggregate required, and in the case of the patio, the hydraulic design (125mm) governs the depth of aggregate required.

4.4 Exceedence flows

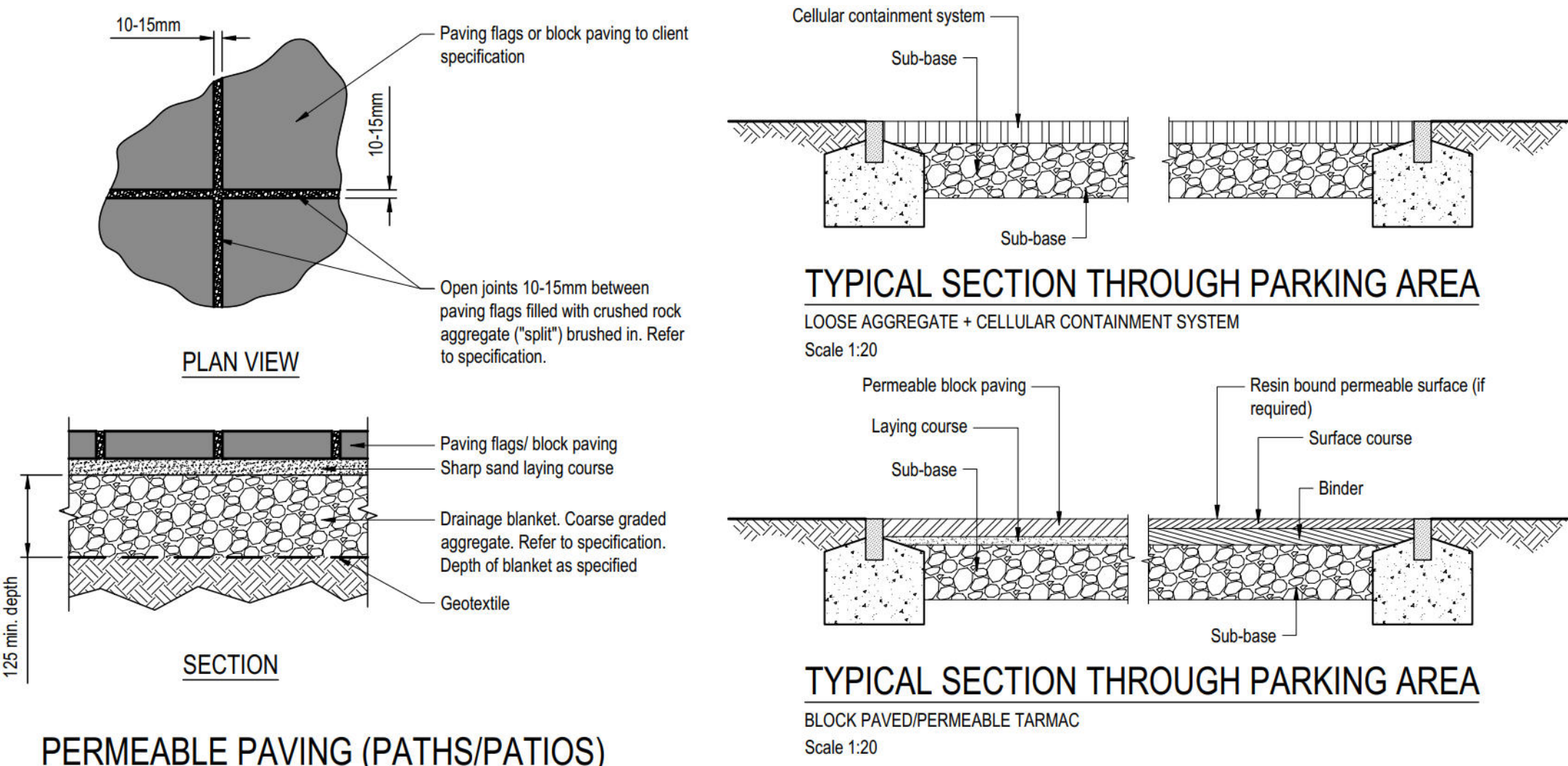
The proposed ground levels within the site will remain largely as they are at present. Overland flows resulting from flooding of the drainage system in the event that the 1 in 100 year + 45% climate change event is exceeded would flow as they do at present (i.e. prior to development). Flows generated in this way will be rare and will present a very low risk.

5. ADDITIONAL INFORMATION

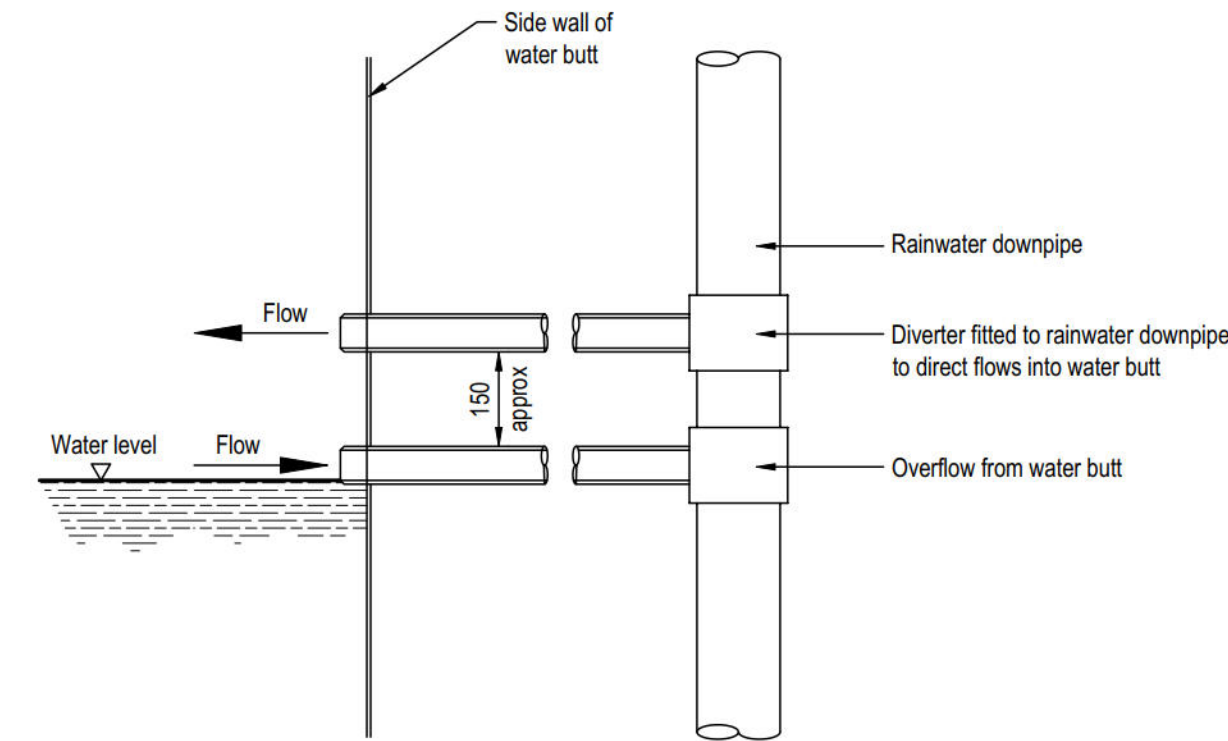
This document was originally prepared in February 2025. It was revised in June 2025 to address comments made by Arun DC drainage engineers in their consultation response dated 10/6/2025 and a summary of the response to those comments is included in letter form in **Appendix 9**.

Further revisions to this document were made in November 2025 to address further comments made by Arun DC drainage engineers in their consultation response dated 27/10/2025. These further revisions are summarised in the comments highlighted in red in the document included in **Appendix 10**.

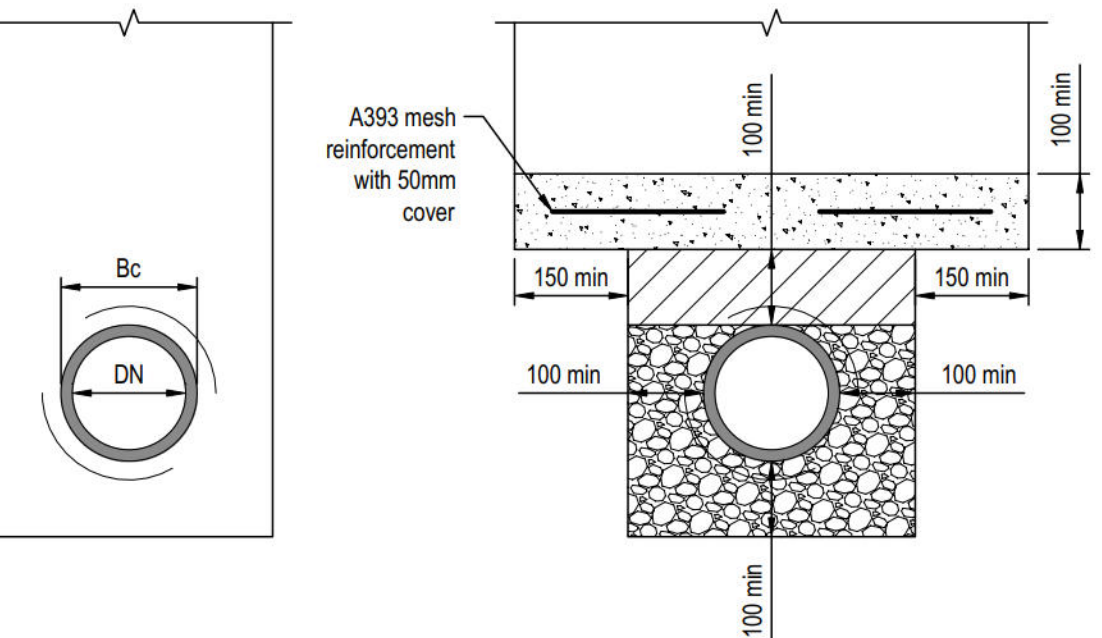
APPENDIX 1



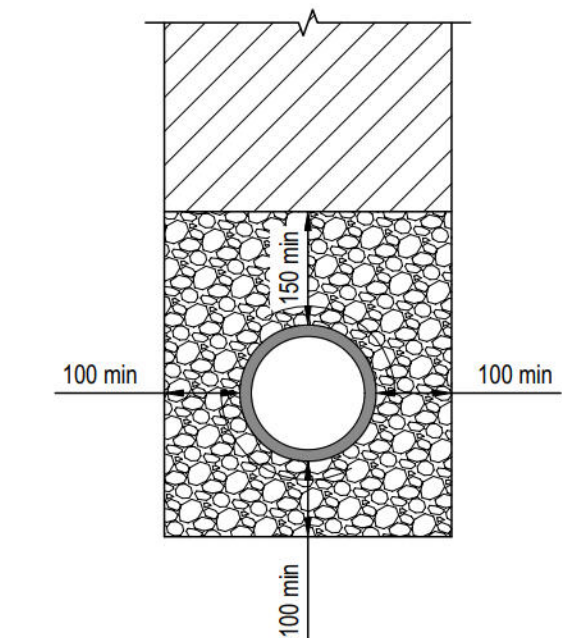
PERMEABLE PAVING (PATHS/PATIOS)
Scale 1:10



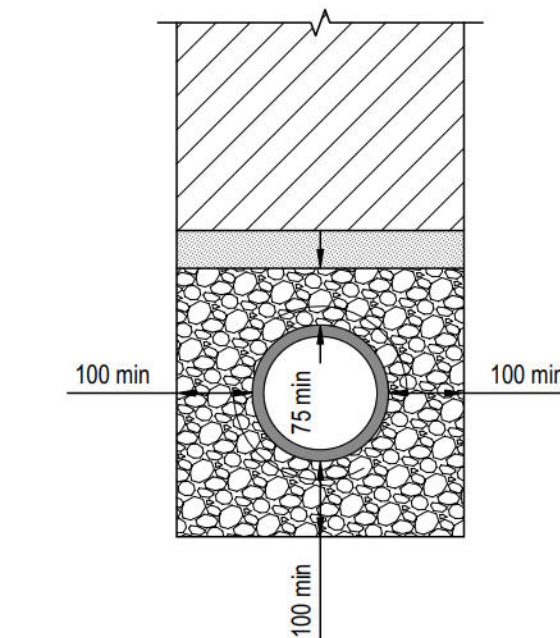
TYPICAL SECTION THROUGH RAINWATER DIVERTER
TO BE FITTED TO EACH RAINWATER BUTT
Scale 1:10



PIPE BEDDING FOR FLEXIBLE PIPES WITH LESS THAN 0.9m COVER BENEATH DRIVEWAYS AND VEHICULAR ACCESSSES
(Scale 1:10)



PIPE BEDDING FOR FLEXIBLE PIPES WITH MORE THAN 0.9m COVER BENEATH DRIVEWAYS AND VEHICULAR ACCESSSES
(Scale 1:10)



PIPE BEDDING FOR FLEXIBLE PIPES WITH LESS THAN 0.6m COVER BENEATH AREAS WITHOUT VEHICULAR ACCESS
(Scale 1:10)

GRANULAR BEDDING REQUIREMENTS - RIGID PIPES:

PIPE INTERNAL DIAMETER:
UP TO 100mm: 6 or 10 single size or 10 to 5 graded
100mm to 150mm: 10 or 14 nominal single size or 14 to 5 graded
225mm to 525mm: 10, 14 or 20 nominal single size or 14 to 5 graded or 20 to 5 graded
600mm and above: 10, 14, 20 or 40 nominal single sized crushed rock or 14 to 5 graded or 20 to 5 graded or 40 to 5 graded

GRANULAR BEDDING REQUIREMENTS - FLEXIBLE PIPES:
Either 6mm single size granular material or graded granular material 5mm minimum 10mm maximum size

PIPE STRENGTH AND BEDDING COMBINATIONS:
For concrete pipes with 0.9m to 1.2m cover to crown of pipe use Concrete Class M or Class H with Class A bedding
For concrete pipes with 1.2m to 2.5m cover to crown of pipe use Concrete Class M or Class H with Class B bedding
For clay pipes with 0.9m to 1.2m cover to crown of pipe use ESVC with Class A bedding
For clay pipes with 1.2m to 2.5m cover to crown of pipe use ESVC with Class B bedding

PIPE BEDDING NOTES:

Bc = Outside diameter of pipe
DN = Internal diameter of pipe

DIMENSION Y: EITHER: 1/6 of external pipe diameter OR 100mm under barrels and 50mm under sockets, whichever is greater. Maximum 400mm

Where a concrete surround is specified, Flexcell or equivalent compressible material is to be provided in the concrete surround at each pipe joint. Minimum thickness of compressible material 25mm

Selected as dug fill material or granular material free from stones larger than 40mm nominal size, lumps of clay over 100mm timber, frozen material and vegetable matter

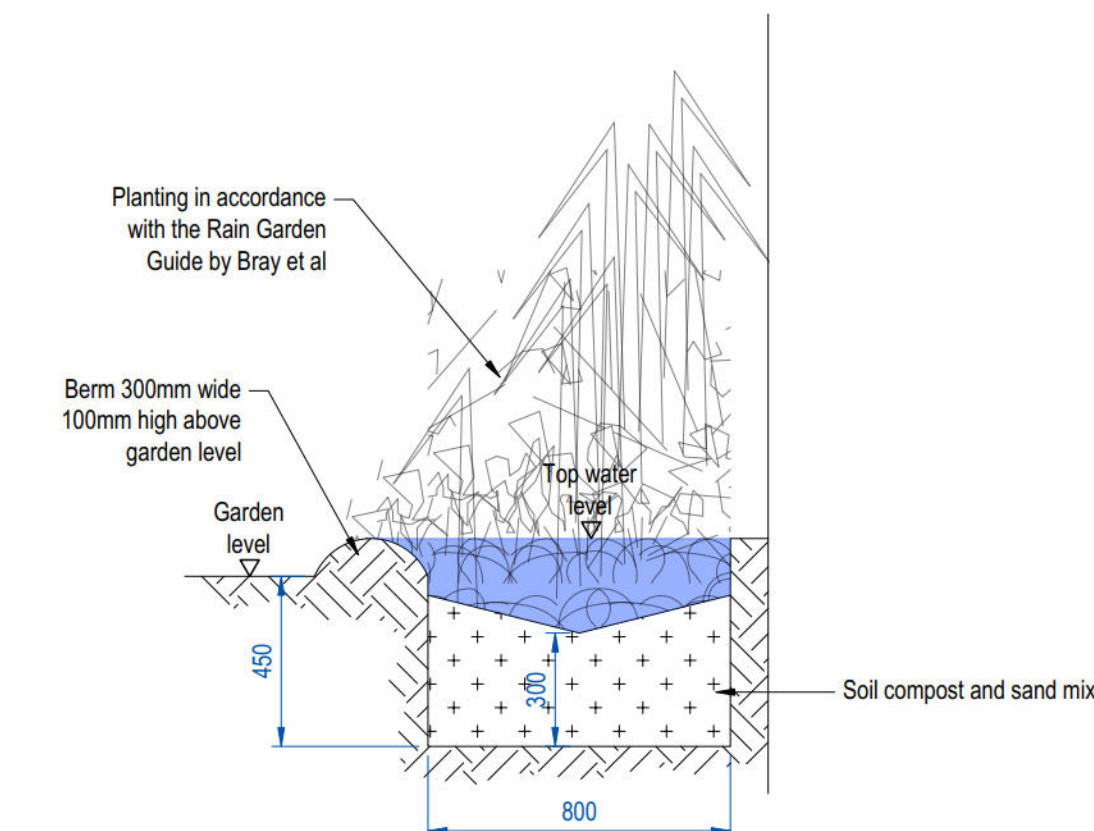
Granular bed (refer to granular bedding requirements)

Concrete Grade ST4

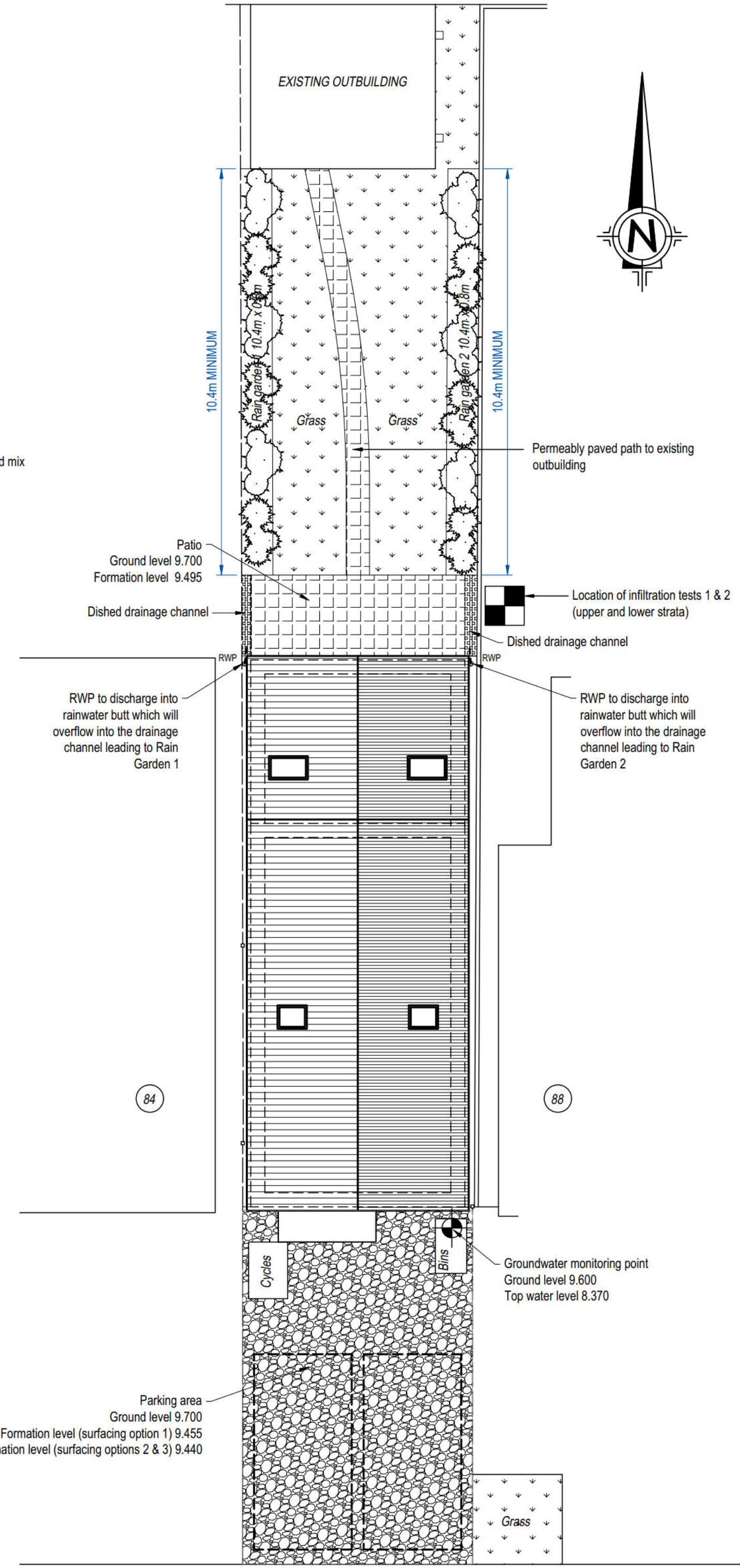
DRIVEWAY/PARKING BAY CONSTRUCTION	
OPTION 1 Permeable asphalt construction (245mm overall thickness)	
Surface course:	35mm nominal thickness PA 6 or 10 SURF 70/100 binder to BS EN 13108:1 2006 (with permeable resin bound surface finish if required)
Binder:	60mm nominal thickness AC20 open bin 160/220 binder to PD 6691 Annex B
Sub-base:	150mm minimum thickness of 20mm open graded crushed rock.
OPTION 2 - Permeable block paving (260mm overall thickness)	
Finishes:	60mm concrete block pavers
Laying course:	50mm open graded crushed rock
Sub-base:	150mm minimum thickness of 20mm open graded crushed rock.
OPTION 3 - Loose aggregate + cellular containment system (260mm overall thickness)	
Finishes:	Loose aggregate contained in proprietary cellular containment system such as Bodpave or GeoWeb
Sub-base:	200mm minimum thickness of 20mm open graded crushed rock

USE OF OPEN GRADED CRUSHED ROCK SUB BASE BY CONSTRUCTION TRAFFIC

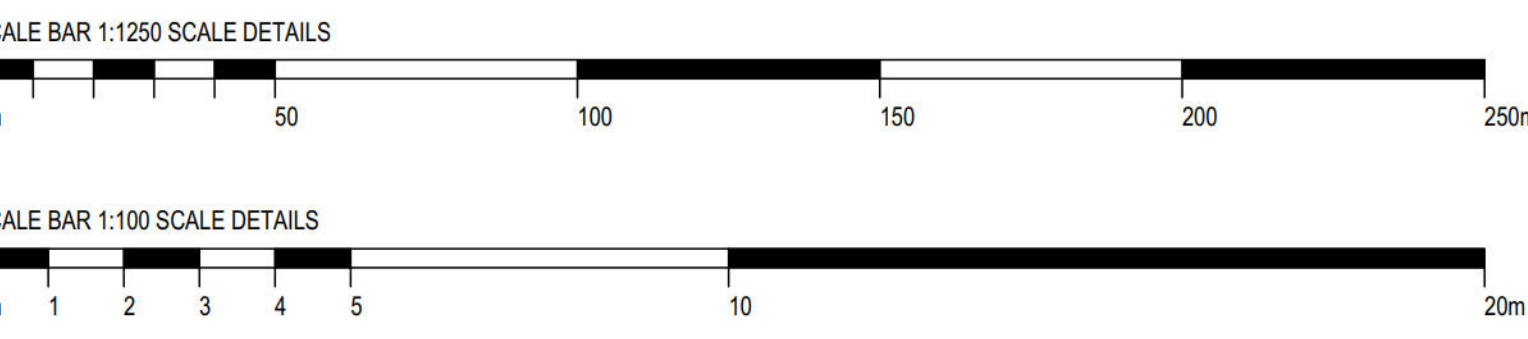
CONSTRUCTION TRAFFIC MUST NOT USE THE OPEN GRADED CRUSHED ROCK SUB-BASE AS A RUNNING SURFACE. IF THE SUB BASE IS REQUIRED TO BE USED AS A RUNNING SURFACE, IT IS TO BE LAID TO THE REQUIRED THICKNESS AND PROTECTED WITH 225mm MNIIMUM THICKNESS LAYER OF CRUSHED CONCRETE LAID ON TERRAM 1000 GEOTEXTILE.



TYPICAL CROSS SECTION THROUGH RAIN GARDEN
Scale 1:20



PROPOSED SURFACE WATER DRAINAGE
Scale 1:100



Revisions:
PL1:
PL2 19.02.2025:
PL3 23.06.2025:
PL4 18.11.2025:

Draft issue:
Issued for planning:
Revised to reflect Arun DC drainage engineer comments:
Revised to address Arun DC drainage engineer comments of 27.10.2025



HERBERT STUMPP
LIMITED
Civil & Structural Engineers
Party Wall Surveyors
07921 214399
Email: info@herbertstump.co.uk

Project
86 ANCTON WAY, BOGNOR REGIS, WEST SUSSEX PO22 6JP

PROPOSED SURFACE WATER DRAINAGE

- NOTES
1. TAKE TIME TO READ AND UNDERSTAND THIS DRAWING AND FAMILIARISE YOURSELF WITH ITS CONTENT. DO THIS IN GOOD TIME BEFORE COMMENCING ANY WORK, AND IN THE EVENT OF ANY QUERY, REFER TO HERBERT STUMPP LTD IN A TIMELY MANNER.

2. Do not scale from this drawing for construction or fabrication. Work to figured dimensions only

3. This drawing is to be read in conjunction with all other relevant Architects and Engineer's drawings

4. The contractor's attention is drawn to the drawing status and is to note the following:
PLANNING (PL): The drawing is for planning only
TENDER (T): The drawing is for pricing purposes only
PRELIMINARY (P): The drawing has not received technical approval from the relevant approving authority
CONSTRUCTION (C): The drawing is for construction

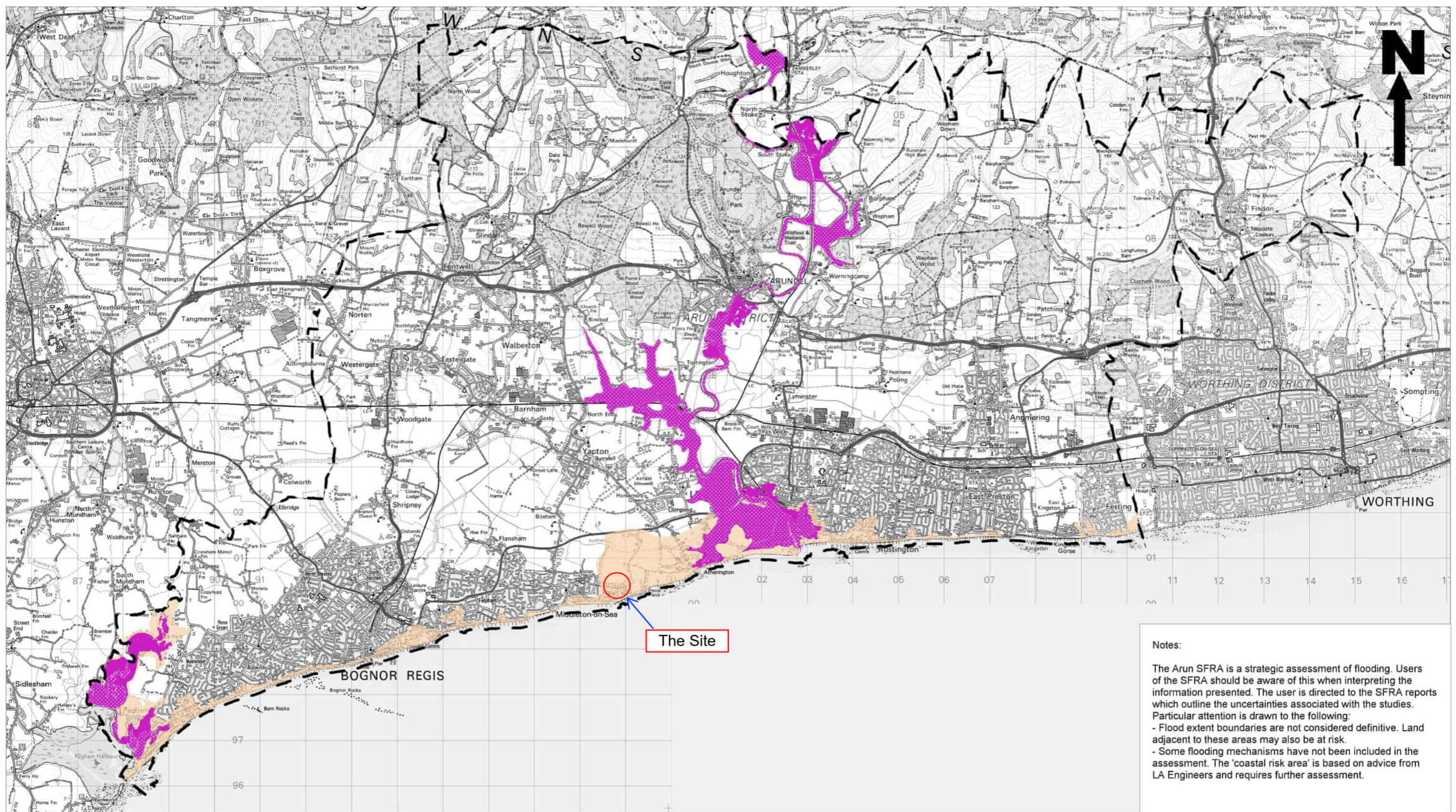
THE CONTRACTOR MUST BE AWARE THAT ANY WORKS CARRIED OUT BASED UPON DRAWINGS MARKED TENDER OR PRELIMINARY ARE CARRIED OUT AT THE CONTRACTOR'S OWN RISK.

5. The Construction (Design and Management) Regulations 2015 apply to this project. It is the client's responsibility to ensure that the requirements of the Regulations are satisfactorily addressed prior to commencement of any works.

Drawing status
PLANNING
Scale
PP
Drawing Number
006

Date
January 2025
Scale
As shown
Revision
PL 4

APPENDIX 2



Arun District Council SFRA

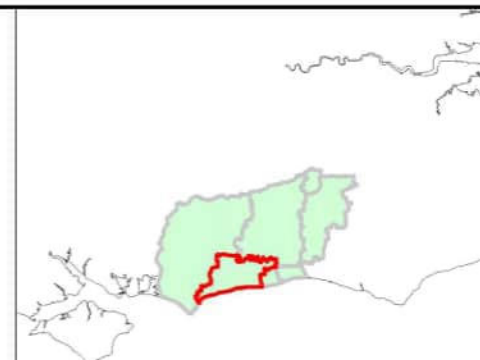
Map A1-T - Actual and Residual Flooding from the Sea



CAPITA SYMONDS

Legend

- Arun District Boundary
- Actual Defended Tidal Flood Risk (0.5% AEP, 2006)
- Residual Defended Tidal Flood Risk (0.1% AEP, 2006)
- Coastal Risk Area



0 2 4
Kilometres

Scale at A3: 1:80,000

Date: 31/01/2008

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Map_A1-T.wor



Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA

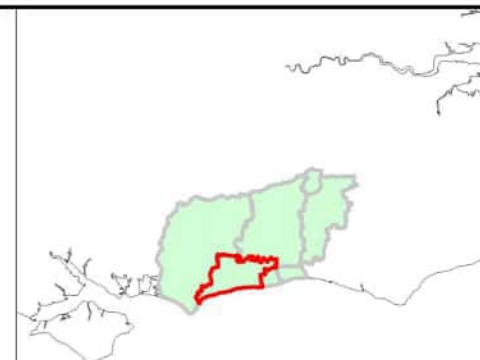
Map A1-F - Actual and Residual Risk of Flooding from Rivers



CAPITA SYMONDS

Legend

- Arun District Boundary
- Actual Defended Fluvial Flood Risk (1% AEP, 2006)
- Residual Defended Fluvial Flood Risk (0.1% AEP, 2006)



0 2 4
Kilometres

Scale at A3: 1:80,000

Date: 31/01/2008

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Map_A1-F.wor

APPENDIX 3

Our ref: SSD240165

Date: 12/11/2021

Enquiry Regarding Product 4 for a Flood Risk Assessment for 68 Ancton Way, Elmer, PO22 6JP.

Thank you for your enquiry which was received on 11th October 2021.

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 Zone 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 flood defences in the form of offshore breakwaters, sea wall, embankment and a sand and shingle beach. These assets are maintained by the Environment Agency.

Model Information

The model used was the River Arun to East Head Coastal Modelling which was completed by JBA Consulting in 2016.

Flood History

We hold no record of previous flooding events affecting this site.

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, **Arun District Council** for a more comprehensive flood history check.

[FRA advisory text](#)

Name	Product 4
Description	Detailed Flood Risk Assessment Map for 68 Ancton Way, Elmer, PO22 6JP.
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	<i>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.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2021 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

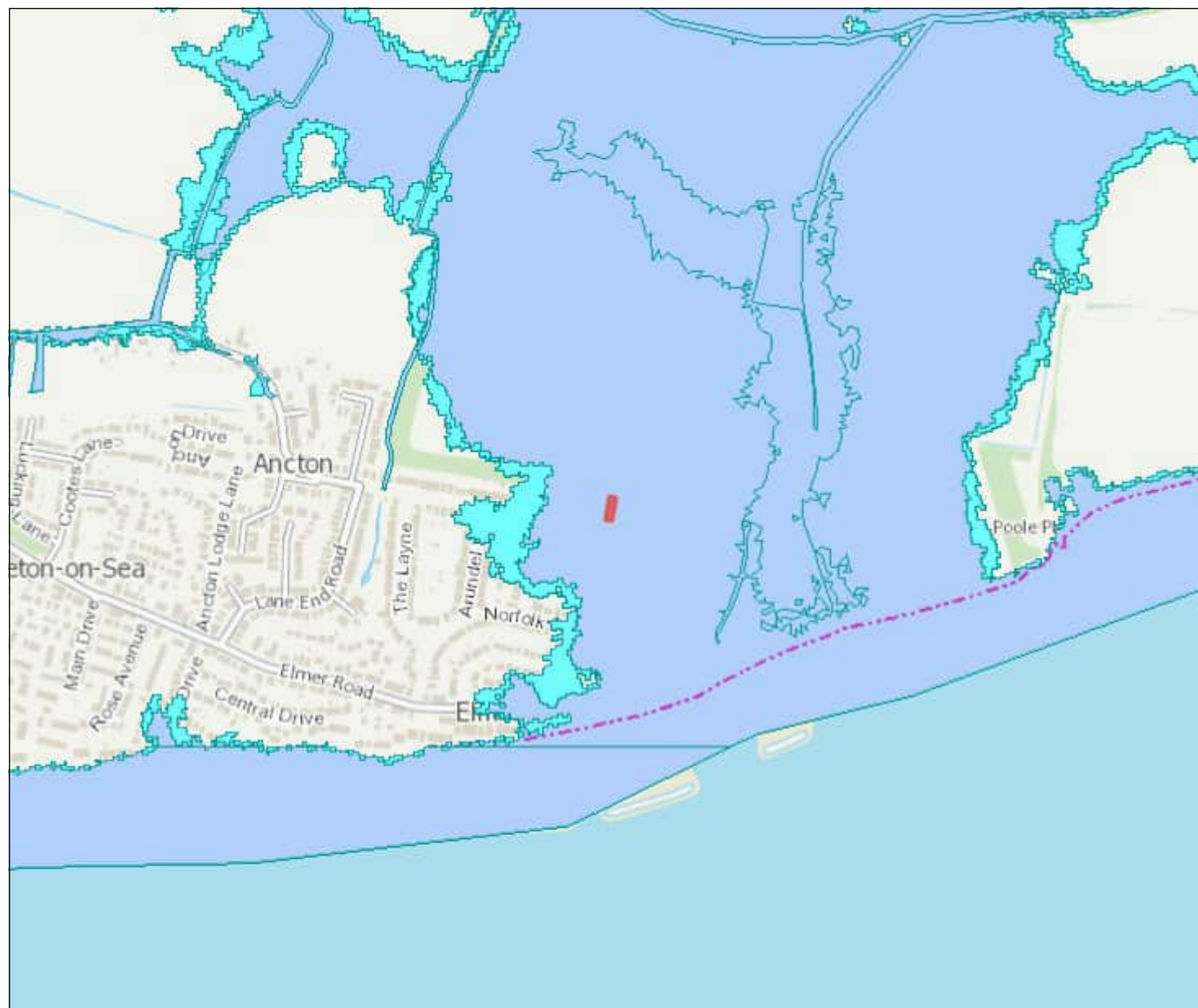
- Flood Map For Planning ([Flood Zone 2](#), [Flood Zone 3](#), [Flood Storage Areas](#), [Flood Defences](#), [Areas Benefiting from Defences](#))
- [Risk of Flooding from Rivers and Sea](#)
- [Historic Flood Map](#)
- [Current Flood Warnings](#)

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,

Edward Conway
Partnership & Strategic Overview - West Sussex
Environment Agency, Guildbourne House, Chatsworth Road, Worthing, BN11
1LD

Flood Map for Planning (Rivers and Sea). Centred PO22 6JP. Created 12/11/2021.



1: 10,000

0 Metres 250



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)

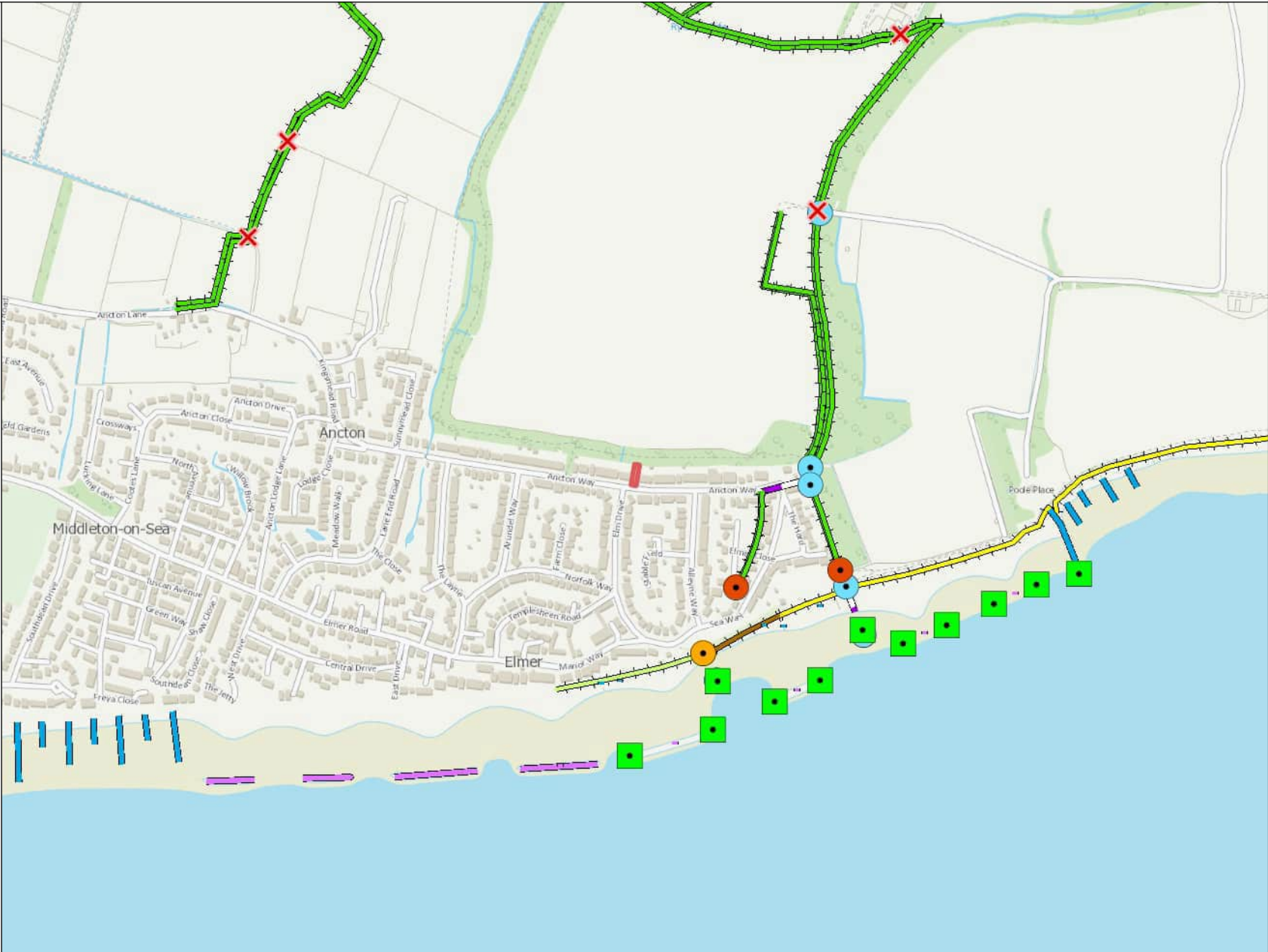
Flood Zone 3 shows the area that could be affected by flooding:

- 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 occurring each year.

Legend

Please see page 2 for asset symbology



Structures

-  Control Gate
-  Draw Off Tower
-  Fish Pass
-  Hydrobrake
-  In Channel Stoplogs
-  Inspection Chamber
-  Jetty
-  Outfall
-  Screen
-  Spillway
-  Stilling Basin
-  Weir

Beach Structures

-  Breakwater
-  Ramp
-  Slipway
-  Steps
-  Groyne

Instruments

-  Active Monitoring
-  Passive Monitoring

Channel Crossings

-  Bridge
-  Utility Services

Aids to Navigation

-  Beacon
-  Buoy
-  Dolphin
-  Signage
-  Signal

Building Assets

-  Pump House

Major Civils

-  Abutment
-  Central Pier

Defences

-  Embankment
-  Wall
-  Flood Gate
-  Demountable defence
-  Bridge abutment
-  High Ground
-  Beach
-  Barrier Beach
-  Promenade
-  Quay
-  Cliff
-  Dunes

Channels

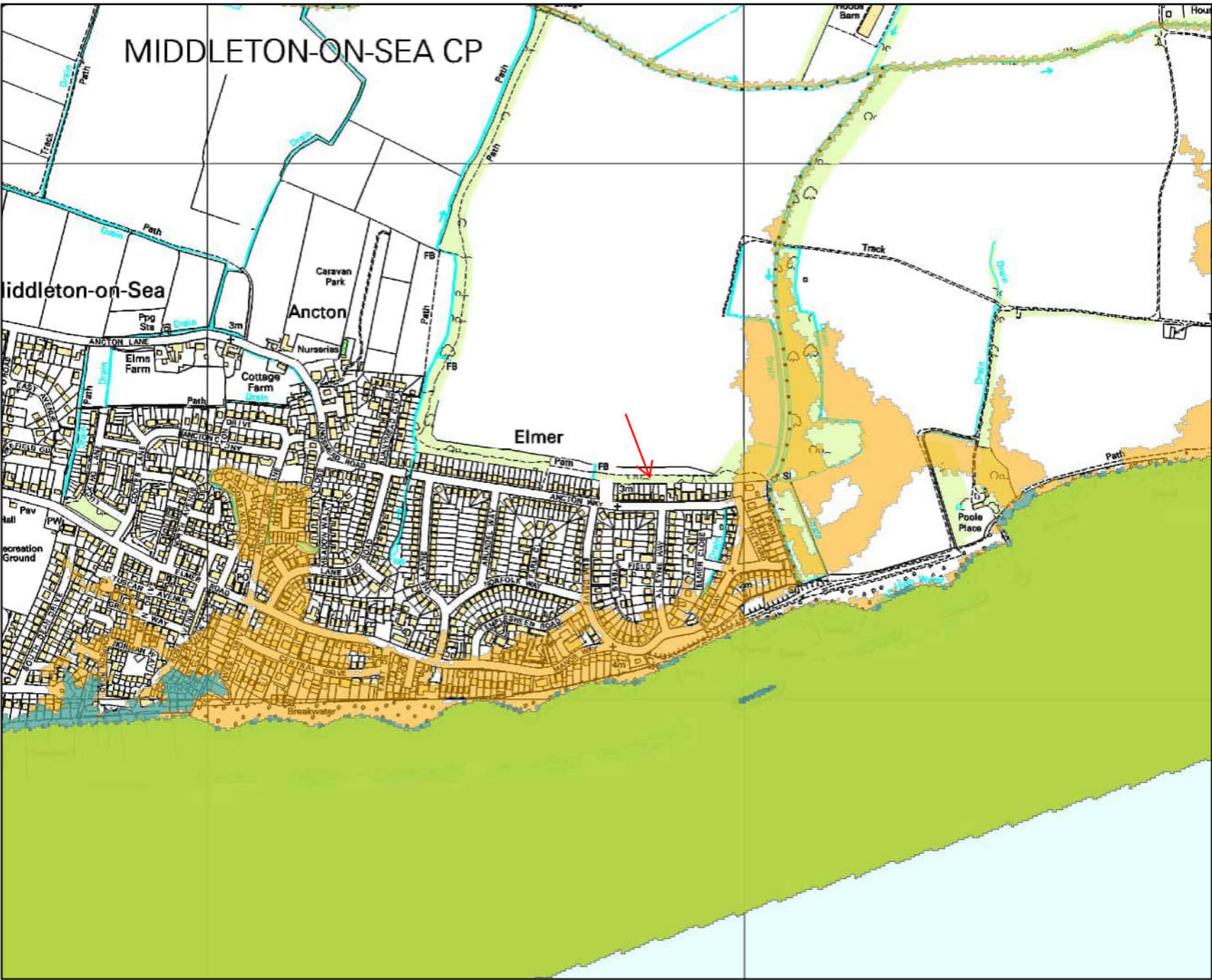
-  Open channel
-  Simple culvert
-  Complex culvert

Land

-  Mudflats
-  Saltmarsh
-  Washland

Sites

-  Amenity
-  Control Structure
-  Erosion Protection
-  General
-  Harbour
-  Monitoring
-  Navigation Lock
-  Pumping Station
-  Reservoir
-  Tidal Barrier

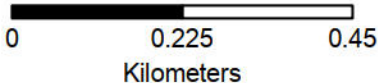


Legend

- Site_Boundary
- 0.5% AEP (Defended Tidal)
- 0.5% AEP (2070) NPPF (Defended Tidal)
- 0.5% AEP (2115) NPPF (Defended Tidal)
- 0.1% AEP (Defended Tidal)

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

Scale: 1:10,000





N


Legend

 Site Nodes



 Site Boundary

Scale: 1:1,000

00.02250.045

Kilometers





Environment
Agency

N



Legend

Site_Boundary

0.5% AEP (Undefended Tidal)

0.5% AEP (2070) NPPF (Undefended Tidal)

0.5% AEP (2115) NPPF (Undefended Tidal)

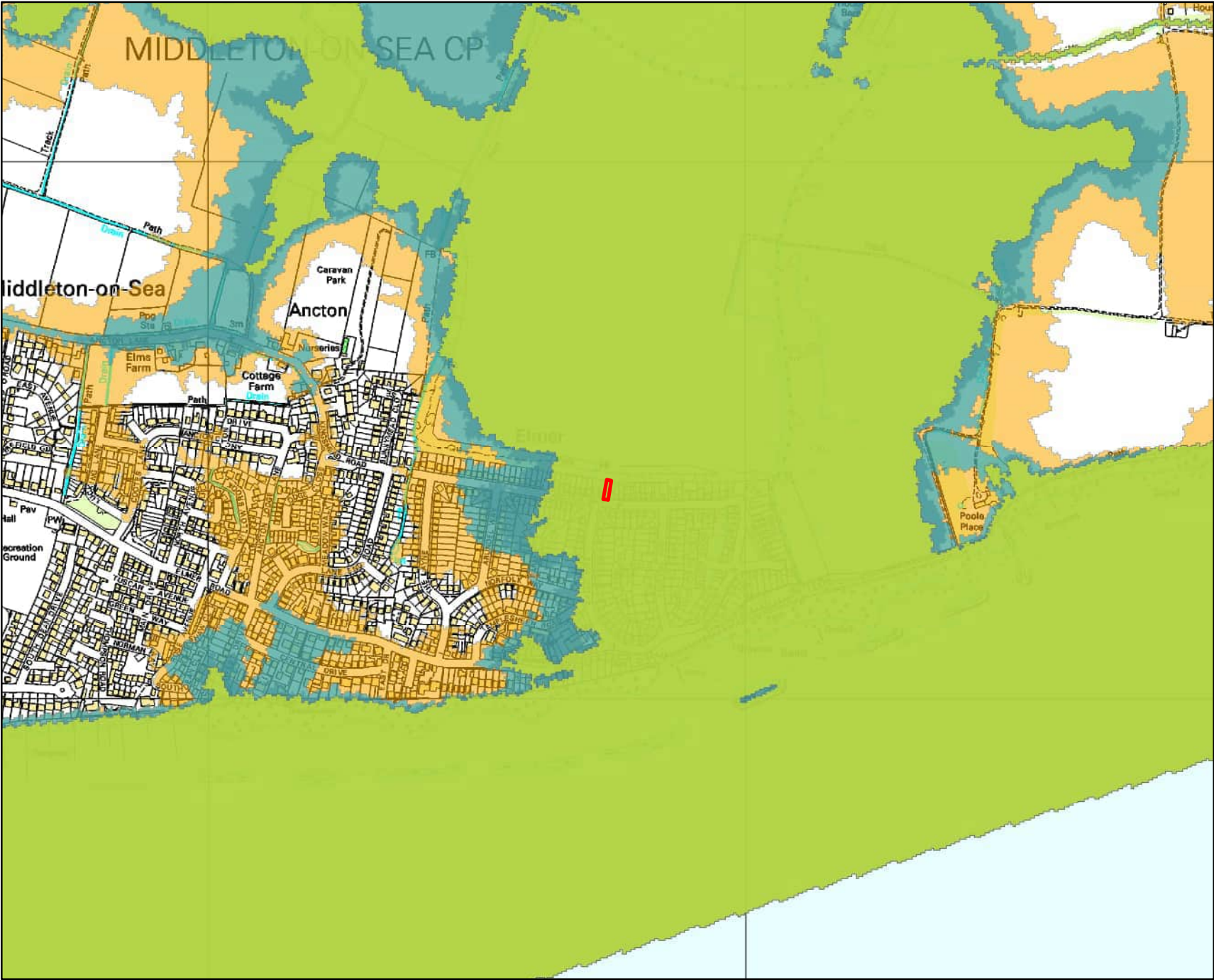
0.1% AEP (Undefended Tidal)

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

Scale: 1:10,000

00.2250.45

Kilometers



Product 4 Flood Risk Data Requested by: UK Flood Risk

Site: 68 Ancton Way, Elmer, PO22 6JP

Table 1: Water Levels: Tidal Undefended

	Eastings	Northings	0.5%	0.5% (2070)*	0.5% (2115)*	0.1%
1	498742	100379	3.86	4.38	4.97	4.08
2	498745	100398	3.86	4.38	4.97	4.08

Table 2: Water Levels: Tidal Defended

	Eastings	Northings	0.5%	0.5% (2070)*	0.5% (2115)*	0.1%
1	498742	100379	-	-	-	-
2	498745	100398	-	-	-	-

Table 3: Water Depths: Tidal Undefended

	Eastings	Northings	0.5%	0.5% (2070)*	0.5% (2115)*	0.1%
1	498742	100379	0.65	1.17	1.77	0.87
2	498745	100398	0.71	1.24	1.82	0.93

Table 4: Water Depths: Tidal Defended

	Eastings	Northings	0.5%	0.5% (2070)*	0.5% (2115)*	0.1%
1	498742	100379	-	-	-	-
2	498745	100398	-	-	-	-

Office Address: Guildbourne House, Chatsworth Road, Worthing BN11 1LD.

All levels taken from: River Arun to East Head Coastal Modelling (2016)

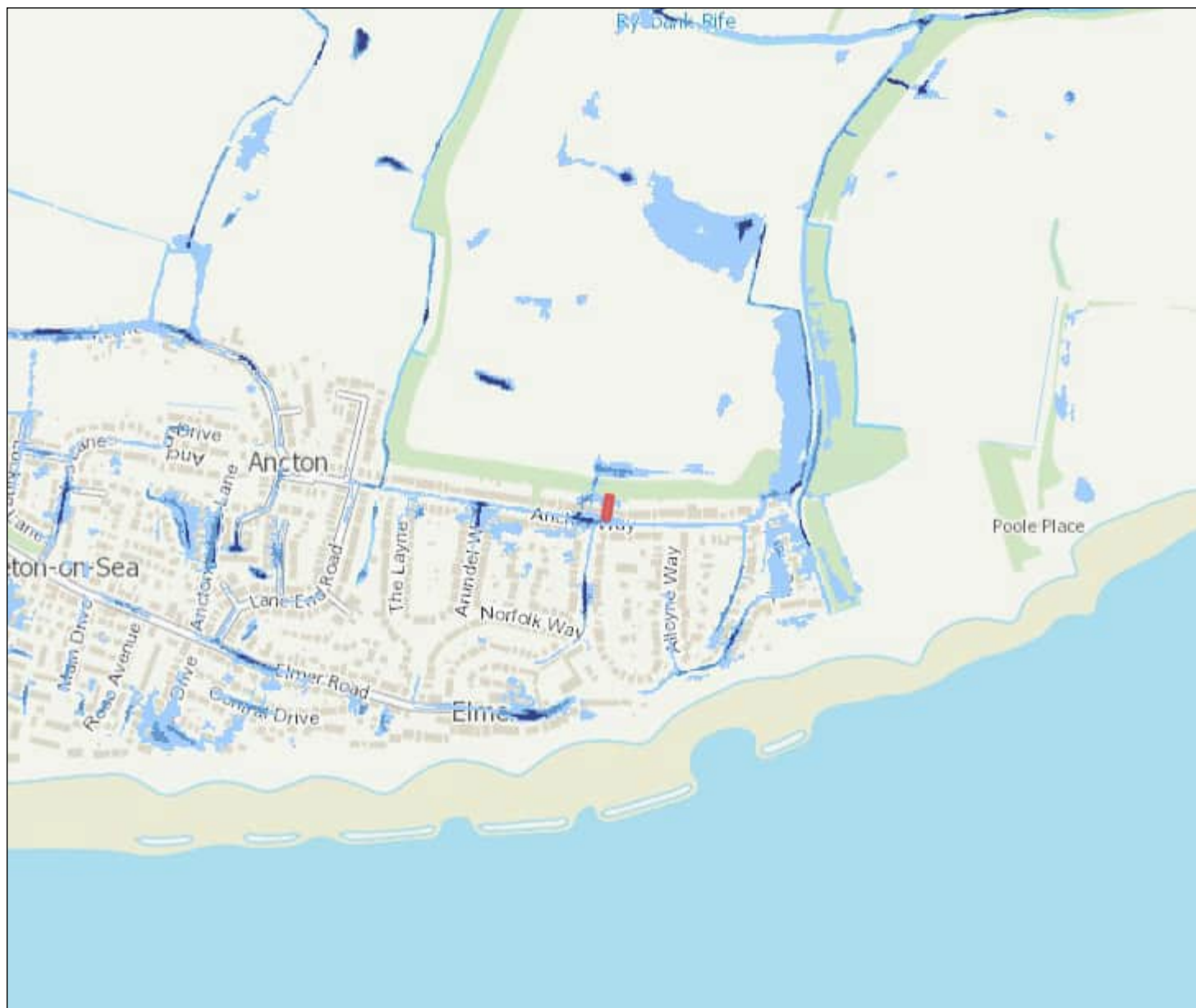
Produced on: 12/11/2021

***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 PO22 6JP. Created 12/11/2021.



1: 10,000

0 Metres 250



Likelihood of flooding from Surface Water

- High ($\geq 3.3\%$)
- Medium (3.3% - 1%)
- Low (1% - 0.1%)
- 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: 0800 048 048

Solent & South Downs Area

Pre-application Advice Note

September 2019

This document sets out the environmental issues we will consider when providing our planning application consultation advice to Local Councils. It can be used by applicants, developers and consultants at the pre-planning stage.

Fluvial Flood Risk

Development must be safe and should not increase the risk of flooding.

You can view a site's flood zone on the Flood Map for Planning on our website: <https://flood-map-for-planning.service.gov.uk>

If your proposed development is located within flood zone 2 or 3 you should consult the Flood Risk and Coastal Change pages of the National Planning Policy Guidance (NPPG)

<http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/>

Here you can determine whether the flood risk vulnerability of your proposed development and the flood zone are compatible. You can also establish if there are flood risk sequential test and exception test requirements for your proposed development. In the first instance we recommend the developer/applicant liaises with the Local Planning Authority (LPA) to undertake the Sequential Test in accordance with the National Planning Policy Framework (NPPF).

If your proposed development is located within flood zone 2 or 3 and its vulnerability and flood zone are considered acceptable under the NPPG then a site specific Flood Risk Assessment (FRA) is required to support any subsequent planning application. This is required by paragraph 163 of the NPPF: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

Guidance on the content of a site specific FRA can be found in the NPPG and online: <https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications>

More detailed flood risk modelling data is available to help you produce a FRA please contact our Customers and Engagement team at [REDACTED]

Climate Change Allowances

On 19 February 2016, we published new guidance for planners and developers on how to use climate change allowances in a site-specific FRA: <https://www.gov.uk/guidance/flood-risk-assessments-climatechange-allowances>

Groundwater Quality

Development must not cause pollution to the water environment.

Source Protection Zones

We have defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used across the country for public drinking water supply. These zones are more sensitive to contamination from activities that might cause pollution in the area. The closer the activity, the greater the risk.



SPZ1s are the areas designated as most at risk from contamination and development activities and in these areas we may consider it inappropriate for development to discharge foul or surface water into the ground.

To see if your proposed development is located within a Source Protection Zone, please use our online map: <https://magic.defra.gov.uk/>

Contaminated Land

The NPPF takes a precautionary approach to land contamination. Before the principle of development can be determined, land contamination should be investigated to see whether it could preclude certain development due to environmental risk or cost of remediation. Where contamination is known or suspected, a desk study, site investigation, remediation and other works may be required to enable safe development.

Pollution

If the proposed development use has the potential to pollute ground or surface water receptors then an assessment to establish whether the risk of pollution is acceptable or can be mitigated will be required within any planning application.

Foul Drainage

When drawing up wastewater treatment proposals for any development, the first presumption is to provide a system of foul drainage discharging into a public sewer to be treated at a public sewage treatment works (those provided and operated by the water and sewerage companies). This should be done in consultation with the sewerage company of the area prior to the submission of a formal planning application.

If connection to a public sewage treatment plant is not feasible, a package sewage treatment plant may be considered. If you would like further advice please call 03708 506 506.

Cemeteries

The development of new cemeteries in areas where groundwater vulnerability is high should be avoided, except where the thickness and nature of the unsaturated zone, or the impermeable formations beneath the site, protect groundwater; or where the long-term risk is mitigated by appropriate engineering methods.

Main Rivers

Ecology

In accordance with the National Planning Policy Framework (NPPF), any development proposal should avoid significant harm to biodiversity and seek to protect and enhance it. Opportunities to incorporate biodiversity in and around the development will be encouraged.

Your scheme should be designed with a naturalised buffer zone of at least 8 metres from the main river to protect and enhance the conservation value of the watercourse and ensure access for flood defence maintenance.

This buffer zone should be managed for the benefit of biodiversity for example by the planting of locally appropriate, UK native species. The buffer zone should be undisturbed by development with no fencing, footpaths or other structures. This buffer zone will help provide more space for flood waters, provide improved habitat for local biodiversity and allows access for any maintenance requirements.

To identify any Main Rivers in proximity to your proposed development please see our Main Rivers Consultation Map: <http://apps.environment-agency.gov.uk/wiyby/151293.aspx>

customer service line

incident hotline

floodline

www.gov.uk/environment-agency

Culverting

The Environment Agency is likely to oppose culverting as it is damaging to the ecological integrity of the river channel and its corridor and acts as a barrier to the movement of wildlife, including fish and may also increase flood risk. If the proposal will impact an existing culvert the Environment Agency may oppose planning consent for development either over, or within 8 metres of an existing culvert. Wherever possible, existing culverts should be removed and the river channel and bankside habitat reinstated to restore the ecological continuity of the river channel and its corridor.

Water Framework Directive (WFD)

Any marine works below MHWS require an assessment of possible impacts on Water Framework Directive (WFD) . The assessment should include all elements of the works that fall within, or have the potential to affect, a WFD water body and any of the protected areas therein (including Bathing Waters and Shellfish Waters).

The WFD assessment should follow the 'Clearing the Waters for All' guidance available at <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>

Where appropriate, a WFD Assessment should assess any potential impacts and demonstrate that the required enhancements will be delivered. In some cases the requirements of a WFD assessment can be incorporated into an Environmental Impact Assessment (EIA). Any development that has the potential to cause deterioration in classification under WFD or that precludes the recommended actions from being delivered in the future is likely to be considered unacceptable to us.

Permits & Consents

Environmental Permitting Regulations

To see if your proposed development requires an Environmental Permit under the Environment Permitting Regulations please refer to our website: <https://www.gov.uk/guidance/check-if-you-need-an-environmental-permit>

From 6 April 2016 an Environmental Permit is required for any proposed works or structures, in, under, over or within 8 metres of the top of the bank of designated Main River, and within 16 metres of a tidal defence.

Ordinary Watercourse Consent

The prior written consent of the relevant Lead Local Flood Authority is required for the erection of any flow control structures, culverting or diversion of ordinary watercourses, including streams, land drains and ditches.

Marine Licence

A marine licence may be required for any activities at the mean high water spring tide up to the territorial limit. This also includes the waters of every estuary, river or channel where the tide flows at mean high water spring tide.

Any development must demonstrate how adverse impacts on migratory fish, bathing waters, shellfish waters, designated sites, protected and priority species and habitats will be avoided, minimised, mitigated and if necessary compensated for. Works within or affecting a Water Framework Directive (WFD) waterbody will need to demonstrate that compliance with WFD objectives will be achieved. 'Clearing the Waters for All' provides guidance on how the impacts on WFD should be addressed, and should be used when preparing an assessment, including the screening and scoping of activities. <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>

Further pre-application options

The information provided above details generic information which may or may not be applicable to your development. We are able to provide more detailed and bespoke advice and answer technical questions for a charged fee of £100 per person per hour +VAT.

If you are interested in finding out more about this service, please email:

[REDACTED]

We can explain this service and provide you with a bespoke quote for further pre-application advice that you may require please see .gov - <https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Please note

Please note that the view expressed in this letter by the Environment Agency is in response to the enquiry only and does not represent our final view in relation to any future planning application made in relation to this site.

We reserve the right to change our position in relation to any such application.

As part of this preliminary response we have not technically reviewed any documents. This opinion is based on the information submitted and current planning policy and guidance.

If you have any questions please contact the Solent & South Downs Sustainable Places team:

[REDACTED]

To make a request for data

Please submit your request for data to ssdenquiries@environment-agency.gov.uk. You should get the information within 20 working days. We will tell you when to expect the information if we need more time.

There are many datasets available online at www.data.gov.uk including flood maps, historic landfill, waste exemptions, consented discharges to controlled waters, and much more.

customer service line

incident hotline

floodline

www.gov.uk/environment-agency

Use of Environment Agency Information for Flood Risk Assessments

Important

The Environment Agency are keen to work with partners to enable development which is resilient to flooding for its lifetime and provides wider benefits to communities. If you have requested this information to help inform a development proposal, then we recommend engaging with us as early as possible by using the pre-application form available from our website:

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

We recognise the value of early engagement in development planning decisions. This allows complex issues to be discussed, innovative solutions to be developed that both enables new development and protects existing communities. Such engagement can often avoid delays in the planning process following planning application submission, by reaching agreements up-front. We offer a charged pre-application advice service for applicants who wish to discuss a development proposal.

We can also provide a preliminary opinion for free which will identify environmental constraints related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In preparing your planning application submission, you should refer to the Environment Agency's Flood Risk Standing Advice and the Planning Practice Guidance for information about what flood risk assessment is needed for new development in the different Flood Zones. This information can be accessed via:

<https://www.gov.uk/flood-risk-assessment-standing-advice>
<http://planningguidance.planningportal.gov.uk/>

You should also consult the Strategic Flood Risk Assessment or other relevant materials produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or surface water runoff. Information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires an FRA and this is not submitted or is deficient, the Environment Agency may raise an objection.

APPENDIX 4



APPENDIX 5

Calculations to determine Soil Infiltration Rate (f)

Site address

88 Ancton Way
Bognor Regis
PO22 6JP

Date

January 2023

Soil Infiltration Rate (f) is given by $f = Vp75-25 / (As50 \times Tp75-25 \times 60)$

DETAILS OF TRIAL PIT (UPPER STRATA TESTS)

Trial pit dimensions			Outflow O = L x W x (Vp75-Vp25)		As50 = (L x 0.5 x D x 2) + (W x 0.5 x D x 2)			
Length (L)	1.000	m	O=	0.3	cu.m	As50=	1.200	sq.m
Width (W)	1.000	m						
Depth (D)	0.600	m						
Vp75	0.450	m						
Vp25	0.150	m						

DETAILS OF TESTS

Test 1				Test 2				Test 3			
Time		Elapsed time		Time		Elapsed time		Time		Elapsed time	
		hh:mm	Minutes			hh:mm	Minutes			hh:mm	Minutes
Start	07:04			Start	07:10			Start	08:02		
75% full	10:30	03:25	206	75% full	11:05	03:55	235	75% full	13:30	05:28	328
25% full	15:59	08:54	535	25% full	17:02	09:52	592	25% full	18:05	10:03	603
Empty	20:05	13:00	781	Empty	20:45	13:35	815	Empty	22:00	13:58	838

	Time		
Depth	Test 1	Test 2	Test 3
0	0	0	0
150	206	235	328
450	535	592	603
600	781	815	838

RESULTS OF TESTS (CALCULATED SOIL INFILTRATION RATE)

Test 1			Test 2			Test 3		
Tp75-25	329	min	Tp75-25	357	min	Tp75-25	275	min
f=	1.26646E-05	m/second	f=	1.16713E-05	m/second	f=	1.51515E-05	m/second

SOIL INFILTRATION RATE TO USE (THE MINIMUM VALUE FROM THE THREE TESTS):

1.16713E-05

m/sec

INFILTRATION RATES

Top Water Level Below Ground Level (mm)	Test 1 Elapsed Time (min)	Test 2 Elapsed Time (min)	Test 3 Elapsed Time (min)
0	0	0	0
150	206	235	328
450	535	592	603
600	781	815	838

Calculations to determine Soil Infiltration Rate (f)	Site address
	88 Ancton Way Bognor Regis PO22 6JP
	Date January 2023

Soil Infiltration Rate (f) is given by $f = Vp75-25 / (As50 \times Tp75-25 \times 60)$

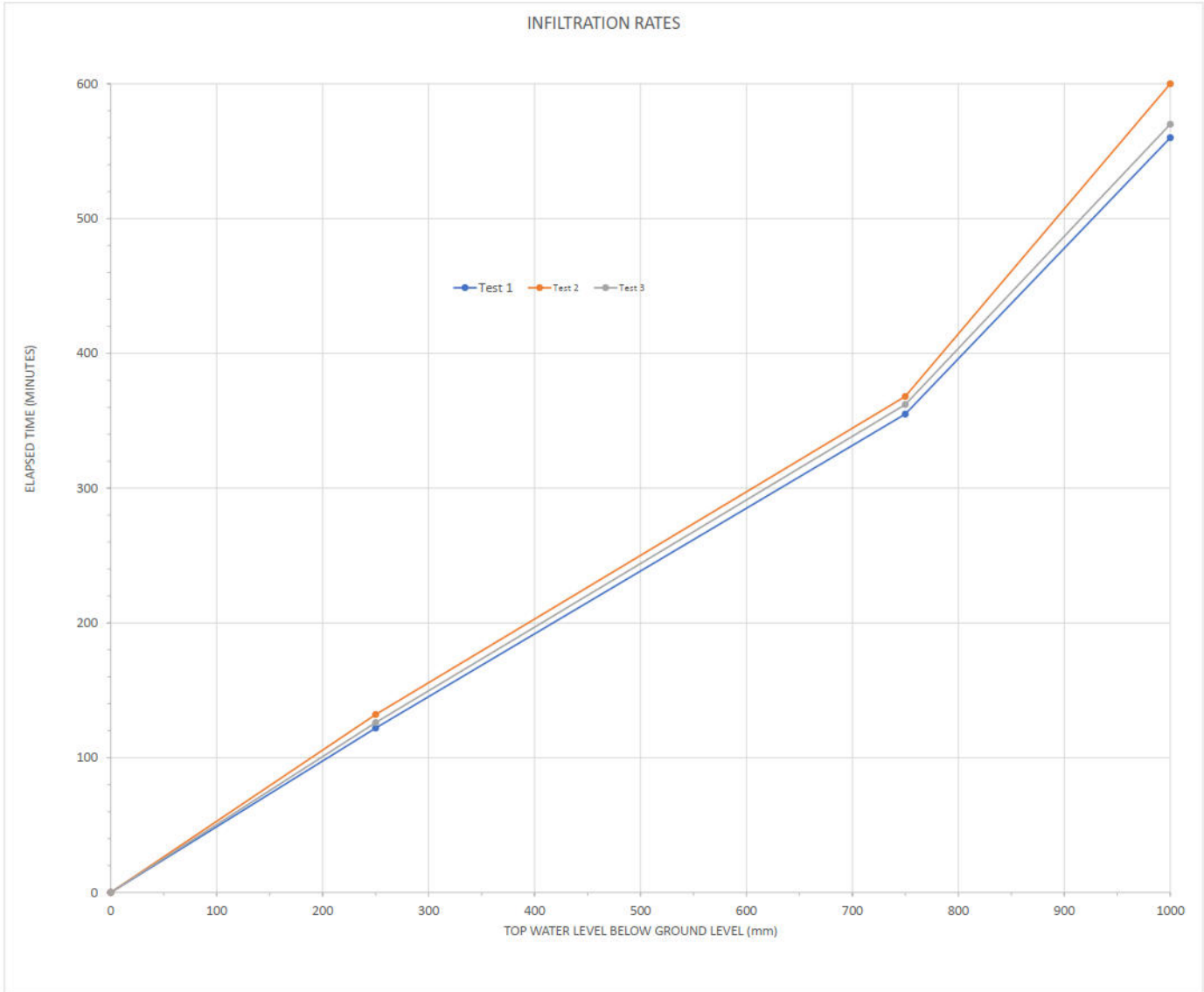
DETAILS OF TRIAL PIT					
Trial pit dimensions			Outflow O = L x W x (Vp75-Vp25)		As50 = (L x 0.5 x D x 2) + (W x 0.5 x D x 2)
Length (L)	0.500	m	O= 0.125		As50= 1.000
Width (W)	0.500	m			sq.m
Depth (D)	1.000	m			
Vp75	0.750	m			
Vp25	0.250	m			

DETAILS OF TESTS									
Test 1				Test 2				Test 3	
Time		Elapsed time		Time		Elapsed time		Time	
		hh:mm	Minutes			hh:mm	Minutes		
Start	08:00			Start	08:00			Start	08:00
75% full	10:02	02:02	122	75% full	10:12	02:12	132	75% full	10:06
25% full	13:55	05:55	355	25% full	14:08	06:08	368	25% full	14:02
Empty	17:20	09:20	560	Empty	18:00	10:00	600	Empty	17:30

Depth	Time		
	Test 1	Test 2	Test 3
0	0	0	0
250	122	132	126
750	355	368	362
1000	560	600	570

RESULTS OF TESTS (CALCULATED SOIL INFILTRATION RATE)									
Test 1				Test 2				Test 3	
Tp75-25	233	min		Tp75-25	236	min		Tp75-25	236
f=	8.941E-06	m/second		f=	8.828E-06	m/second		f=	8.828E-06

SOIL INFILTRATION RATE TO USE (THE MINIMUM VALUE FROM THE THREE TESTS): 8.828E-06 m/sec



APPENDIX 6







APPENDIX 7

Technical Data Sheet

BODPAVE™ 85

GRASS SURFACES



Ground, Wind, Weed
and Erosion Control

Bodpave™ is an interlocking cellular porous plastic paving grid system for ground surface stabilisation.

Applications

- Car and light vehicle parking
- Pedestrian walkways
- Golf buggy paths
- Cycle paths
- Driveways
- Residential parking
- Sustainable Drainage Systems (SuDS)

Design

Most Bodpave™ installations will require a new sub-base (pavement foundation layer) to be constructed. The thickness and type of granular material used to form the sub-base will generally depend on the following factors;

- Strength of the underlying ground (sub-grade) measured in CBR* %
- Water permeability of the underlying ground (sub-grade) k measured in m/s
- Type of underlying ground (sub-grade) e.g. clay/silt/sand/gravel/rock
- Type of vehicle traffic (HGV/LGV/car/cycles/pedestrian)
- Frequency of traffic (occasional/regular)

*California Bearing Ratio Test

A comprehensive ground investigation survey with suitable testing is highly recommended to ensure the sub-base for a Bodpave™ surface is suitably strong and sufficiently durable for the anticipated use. **This design guide can be used for estimating ground conditions and producing preliminary pavement designs but it is not a substitute for site specific ground investigation works and a detailed pavement design by a suitably qualified civil engineer.**

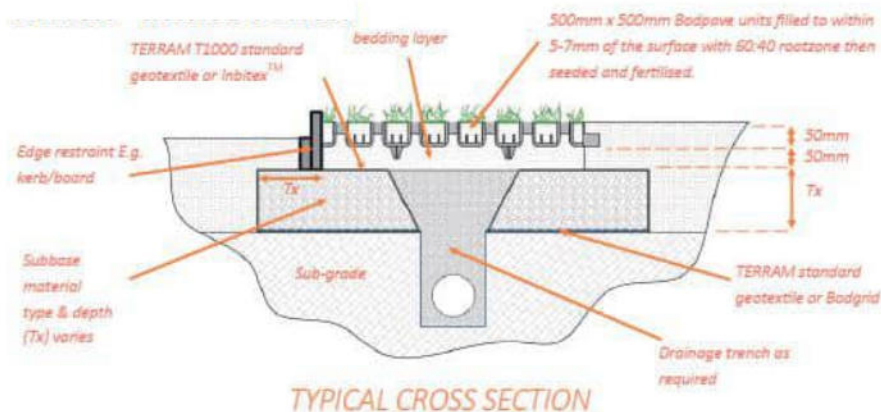
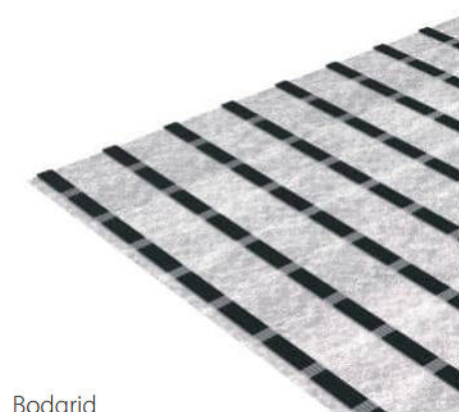


Table 1 - Minimum Sub-base Thickness (Tx) with Bodgrid

Sub Grade CBR* %	Cars/Light Vehicles (#)		Coaches/Heavy Goods/ Emergency Vehicles		Overlap (mm)
	Thickness (mm)	Bodgrid	Thickness (mm)	Bodgrid	
1	300	GC30	400	GC30	600
2	150	GC30	250	GC30	500
3	125	GC30	175	GC30	450
4	125	GC30	150	GC30	400
5+	100	GC30	125	GC30	300



Bodgrid

Table 2 - Minimum Sub-base Thickness (Tx) without Bodgrid

Sub Grade CBR* %	Cars/Light Vehicles (#)		Coaches/Heavy Goods/ Emergency Vehicles		Overlap (mm)
	Thickness (mm)	Standard Geotextile	Thickness (mm)	Standard Geotextile	
1	450	T2000	600	T2000	600
2	225	T1500	375	T1500	500
3	200	T1000	300	T1000	450
4	200	T1000	225	T1000	400
5+	150	T1000	200	T1000	300



Standard geotextile

*California Bearing Ratio Test

Regular tight turning of vehicles and "dry" steering may cause damage to the Bodpave™ units and/or displace gravel infill; vehicle manoeuvring should be carefully considered at specification/design stage. Gravel filled units may require some maintenance when subjected to regular channelised and turning traffic loadings. Terram Bodpave™ 85 and Truckpave™ pavours are generally recommended for occasional overrun or regular HGV traffic respectively. If construction traffic axle load exceeds 60kN (6 tonnes), minimum sub-base thickness over Terram Bodgrid should be 200mm.

Table 3 - Field Guidance for Estimating Sub-grade Strength

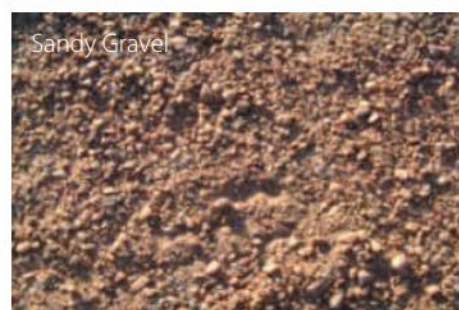
Consistency	Indicator		Mechanical (test) SPT	Strength	
	Tactile	Observation		CBR %	Cu Kv/SQM
Very Soft	Sample squeezes through fingers	Person standing will sink >75mm	<2	<1	<25
Soft	Easily moulded by finger pressure	Person walking sinks 50-70mm	2-4	~1	~25
Medium	Moulded moderate finger pressure	Person walking sinks 25mm	4-8	1-2	25-40
Firm	Moulded by strong finger pressure	Utility truck ruts 10-25mm	8-15	2-4	40-75
Stiff	Can be indented by thumb	Loaded construction vehicle ruts by 25mm	15-30	4-6	75-150



Green-tech endeavour to ensure that the information given on this technical data sheet is accurate but accept no liability for its use or suitability for particular application.

Table 4 - Typical Soil Types and Properties

Soil Type	Plasticity	CBR% Depth of Water Table Below Formation Level		Typical Range for Coefficient of Permeability K (m/s)	Infiltration
Heavy Clay	70	2	1	10^{-10} to 10^{-8}	No
	60	2	1.5		
	50	2.5	2		
	40	3	2		
Silty Clay	30	5	3	10^{-9} to 10^{-8}	No
Sandy Clay	20	6	4	10^{-9} to 10^{-6}	Partial
	10	7	5		
Silt	Non-plastic	2	1	10^{-8} to 10^{-6}	Partial
Poorly Graded Sand	Non-plastic	20	10	10^{-7} to 10^{-6}	Partial
Well Graded Sand	Non-plastic	40	15	10^{-6} to 10^{-4}	Total
Well Graded Sandy Gravel	Non-plastic	60	20	10^{-5} to 10^{-3}	Total



This field guide is provided as an aid to assessing the mechanical stabilisation requirements in commonly encountered site conditions.

1. Minimum sub-base thickness (Tx) can be selected from table 1 or 2 with ground strength and permeability estimated from tables 3 or 4 in the absence of any site specific ground investigation report.
2. If the Bodgrid layer is omitted, then the total sub-base layer thickness (Tx) must be increased by 50%. A standard geotextile separation layer should be specified with lower sub-grade strength (CBR value) requiring a more robust grade in accordance with BS8661:2019 (see table 2).
3. Bodpave™ units are an ideal surface for source control porous pavings SuDS with a permeable sub-base; DoT Type 3 (Type 1x) porous/open graded granular material as described in Specification for Highways Works clause 805. If a higher water storage (attenuation) capacity (void ratio) is required a hard crushed angular "clean stone" such as a coarse graded aggregate (CGA) type 4/20 (4mm minimum and 20mm maximum particle size) can be used. The type of SuDS design (attenuation, total or partial infiltration) will depend upon the underlying ground conditions and not all sites are suitable for infiltration. Weak and low-permeability cohesive sub-grades are generally unsuitable for infiltration (permeability coefficient $k < 10^{-6}$ m/s). Clays with a low plasticity index (<20%) will reduce in strength when saturated; a full attenuation system with an impermeable membrane directly on top of the sub-grade is recommended (see table 4). Specific advice on suitable drainage and construction over very weak ground (CBR <1%) is available.
4. Alternatively traditional 'DoT Type 1' well graded granular material may be used for the sub-base provided that an adequate drainage system is installed. Typical drainage details; 100mm diameter perforated pipe drain laid at minimum gradient 1:100, bedded on gravel in trench backfilled with SHW Clause 505 'Type A' drainage aggregate (or CGA type 4/20), covered or wrapped with Terram T1000 standard non-woven geotextile and leading to a suitable outfall or soakaway. Drains placed down the centre

Green-tech endeavour to ensure that the information given on this technical data sheet is accurate but accept no liability for its use or suitability for particular application.

or along the edge of access routes up to 5m wide. Wider areas may require additional drainings at 5m - 10m centres.

5. The sub-base must be covered with a layer of Terram T1000 standard or Inbitex™ non-woven geotextile to prevent settlement due to mixing of the bedding and sub-base layers and to provide filtration and pollution control.
6. Bedding layer material should be either free-draining clean angular hard aggregate gravel chippings or coarse grit sand. Bodpave units should be filled with free-draining clean angular hard aggregate gravel chippings. **Rounded pea shingle is not suitable.** See table 6 for more details.
7. The final pavement and drainage design should be undertaken by a suitably qualified civil engineer and based on specific site conditions.
8. Maximum advised gradient for traffic applications is 12% (1:8) 7°, Bodpave units have specific fixing points for **steel u-pins** if required for steep slope applications.

Table 5 - Products

Bodpave™ 85	
Dimensions	500mm x 500mm x 50mm + 35mm ground spike
Compressive Strength	<400 tonnes (400kN)/SQM (gravel filled)
Connection Strength	7kN/Lm
Material	100% recycled plastic
Coverage	4 units/SQM
White Markers	215mm x 70mm

Inbitex™ Non-woven Geotextile	
Standard Roll Dimensions	4.5m wide x 100m long
Tensile Strength kN/m	8.5
Elongation	30%
CBR Puncture Resistance kN	1.6
Oil Absorption and Removal	<400g/SQM year

Non-woven Standard Geotextile	
Standard Roll Dimensions	4.5m x 100m long
Grades	T1000/T1500/T2000
BS8661 Classification	1/2/3
Tensile Strength kN/m	8.0/12.5/14.5
Elongation	60%
CBR Puncture Resistance kN	1.5/2.25/2.75

Bodgrid GC30	
Standard Roll Dimensions	4.8m wide x 50m long
Tensile Strength kN	30
Tensile Elongation	7%
Functions	Separation, filtration, stabilisation



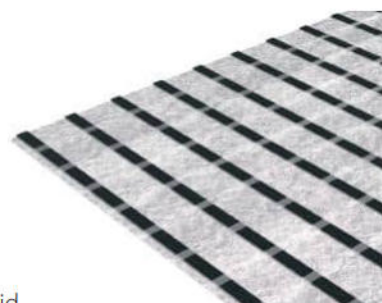
Bodpave™ 85 & White Markers



Inbitex



Standard geotextile



Bodgrid

Green-tech endeavour to ensure that the information given on this technical data sheet is accurate but accept no liability for its use or suitability for particular application.

Table 6 - Fill Materials

Rootzone (Bodpave surface fill and bedding layer material)

Description	Propriety mix of high quality, free draining sand and compost
Blend Ratio	60:40 or 70:30 sand:compost
Particle Size Range	0 to 2mm
Example	Green-tree Rootzone
Comments	Site won topsoil is not suitable



Rootzone

Grass Seed

Description	Low maintenance hard wearing amenity mix
Varieties and Suggested Blend	50% amenity perennial rye grass (Turf PRG) 25% creeping red fescue 25% smooth stalked meadow grass
Application Rate	35-50g/sqm (new grass) 25g/sqm (overseeding)
Example	John Chambers Grass Seed Parks



Site won topsoil



Fertiliser



Grass Seed Mix

Fertilisers

Description	Pre-seeder fertiliser to encourage early grass growth to enhance seed establishment and improving root development
Example	Pre-seeder fertiliser 8-12-8+3MGO+ZN
Description	Spring Summer Fertiliser
Example	ICL Sportsmaster Spring Summer 9-7-7 Fertiliser



Type 1

Sub-base (3 options)

Description	Option 1 - well graded granular DoT Type 1 (with filter drains)
Aggregate Size	0 < 63mm
Grading to BS EN 13242 or 12620	GC 75/32 1/31.5 (SHW Clause 803)
Description	Opt 2 - permeable open graded granular DoT Type 3 (Type 1x)
Aggregate Size	0 to 40mm
Grading to BS EN 13242 or 12620	GC 80/25 1/40 (SHW Clause 805)
Description	Opt 3 - clean stone, coarse graded aggregate type 4/20
Aggregate Size	4 to 20mm
Grading to BS EN 13242 or 12620	GC 90/15 4/20



Type 3 (1x) - permeable



CGA Type 4/20 (clean stone) - permeable

UNCOMPACTED

COMPACTED

Green-tech endeavour to ensure that the information given on this technical data sheet is accurate but accept no liability for its use or suitability for particular application.

Installation

1. Excavate ground to the required formation level.
2. Unroll Terram all-in-one Bodgrid geocomposite (white geotextile below, black geogrid above) or Terram standard geotextile onto the prepared sub-grade with a minimum of 300mm overlap at the joints.
3. Place and compact type 3 (*) open graded granular material on top of the Terram layer to the required compacted thickness determined by the designer (minimum 100mm) to form a strong permeable sub-base layer.

* Type 3 is an open graded granular material as described in Specification for Highways Works clause 805. If a higher water storage (attenuation) capacity (void ratio) is required, a hard crushed angular "clean stone" such as a coarse graded aggregate (CGA) type 4/20 (4mm minimum and 20mm maximum particle size) can be used. Traditional well graded type 1 aggregate (with suitable drainage) may be used to form the sub-base layer as determined by the designer.

4. Install edge restraints as specified; traditional precast concrete kerbs, steel, plastic or treated timber boards/sleepers.
5. Install a second layer of Terram standard geotextile on top of the sub-base with a minimum of 300mm overlap at the joints.
6. Place, compact and screed rootzone to a minimum uniform thickness of 50mm. See material specification section for more guidance on suitable bedding materials.
7. Start in the corner of the longest straight edge (kerb) leaving a 25mm expansion gap around the perimeter.
8. Place pre-connected set of four Bodpave units (1m x 1m) with the loop connectors facing outwards as a "leading edge" towards the remainder of the prepared bedding layer. Apply firm pressure so that the ground spikes are pressed fully into the bedding and the base of the units sit flat on the bedding layer surface.
9. Connect adjacent Bodpave units together by slotting the edge half cells down into the edge loops. Progress in rows (LOOPS ALWAYS LEAD) locking units in place with firm pressure over the snap-fit clips. If separation is required, clips can be dislocated using careful, firm hand or screwdriver pressure or by gently twisting the pavers.
10. Cut pavers to fit around obstructions and at the end of rows using a fine toothed hand or circular power saw. Partial units should be fixed using snap-fit clips and additional UV resistant nylon cable ties.
11. Install snap-fit markers as required before filling Bodpave units.
12. Once all Bodpave units have been installed, fill pavers with rootzone brushing away any surplus off the surface so that the tops of all the Bodpave units are visible. A single pass of a light vibrating plate compactor may be used to consolidate the pavers and settle the rootzone. Fill so the finished level is 5mm below the top of the units. Do not overfill or over compact.



Green-tech endeavour to ensure that the information given on this technical data sheet is accurate but accept no liability for its use or suitability for particular application.

13. The rootzone infill should be seeded with a lawn mixture containing plenty of hard-wearing amenity perennial rye grass (Turf PRG) and some fescues to bind the sward and Bodpave units together, a pre-seeder fertiliser followed by frequent watering. A light top dressing may be applied to just cover the seed and to provide adequate germination conditions. Do not overfill the paver cells.

14. Once seeded, the area should be cordoned off to protect the young grass from traffic damage and allow the root sward to fully develop which may take 8+ weeks or 3-4 cuts during the growing season.

Maintenance

A grass filled Bodpave 85 porous surface should last for many years with very little maintenance. Maintaining a healthy grass filled Bodpave surface is dependent upon many factors including a successful initial installation, the frequency and intensity of traffic loading, sufficient irrigation, sunshine and regular growth recovery periods. The following maintenance should be considered:-

- 1.** Regular mowing of the grass during the growing season (Spring/Summer/Autumn) and removal of clippings.
- 2.** Application of suitable fertiliser and Spring and Autumn.
- 3.** Irrigation during hot and dry conditions.
- 4.** Removal of fallen leaves, sticks and other debris from the surface as needed.
- 5.** Weeds - ideally removed by hand or using a biodegradable weed killer once or twice a year.
- 6.** Rotation of areas subject to seasonal traffic with frequent growth recovery periods. A minimum of 3 days per week without any traffic is recommended during the growing season, a longer recovery period may be required if the grass is in poor condition.
- 7.** If Bodpave units are damaged consult us for advice on repair.



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GEOWEB® 3D Solution Out-Performs Planar Geogrid System for Unpaved Roads and Platforms

1 Use Local Infill



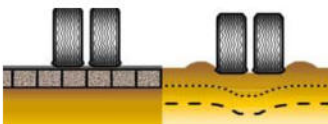
2 Confines Infill, Stabilizes Soils



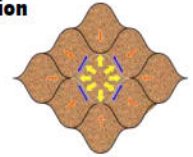
3 Reduces Rutting, Lowers Maintenance



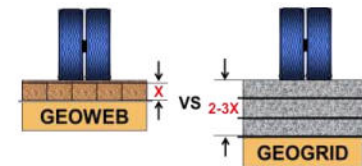
4 Decreases Rolling Resistance & Faster Cycle Times



5 Delivers Instantaneous Protection



6 Bridges Soft Subgrades with Single Layer



7 Deploys Directly Over Poor Soils



8 Increases Speed of Construction



1. Use Local Infill.

The Geoweb system can use locally-available, or onsite fill. Geogrids require clean aggregate, increasing material cost plus added hauling costs.

2. Confines Infill, Stabilizes Soils.

Infill is confined in the Geoweb 3D structure, preventing it from movement under loading.

3. Reduces Rutting, Lowers Maintenance.

The Geoweb system is a full depth solution. Geogrids do nothing to protect surface translation. As a result, Geogrids require more maintenance to maintain road surfaces.

4. Decrease Rolling Resistance & Faster Cycle Times.

Geogrids only control lateral movement in thin layers. The Geoweb 3D system gives full depth protection, creating a firm, stable surface that increases cycle times and reduces tire wear, tire replacement and fuel consumption.

5. Delivers Instantaneous Protection.

Geogrids require tension to activate, initiated by partial deformation. The Geoweb system's affect is immediate and works on a principal of hoop strength.

6 Bridges Soft Subgrades with Single Layer.

A single layer of Geoweb performs well over soft subgrades. Geogrids require 2-3 layers for same benefit, adding cost and time to construction.

7. Deploys Directly Over Poor Soils.

On multi-layer Geogrid solutions, low pressure equipment must be used. The Geoweb system allows heavy equipment to deliver structural fill right to the edge of construction.

8. Increases Speed of Construction.

Installation of the Geoweb system is up to 3 times faster to deploy than multi-grid systems.

APPENDIX 8

This is an estimation of the infiltration volumes and drain-down time to half empty the infiltration system in line with the on CIRIA infiltration drainage R156 guidance (1996) and CIRIA SuDS manual (C753, 2015). This information may be used as the basis for designing an infiltration system for the drainage of surface water runoff from sites.

Project details

Date	18/11/2025
Calculated by	P Pitman
Reference	Per sq.m, no urban creep
Model version	2.2.2

Site details

Site name	86 Ancton Way
Site location	Bognor Regis

Infiltration system

Infiltration system	Planar infiltration
Type	Infiltration from base only

Geometry, porosity and infiltration

Infiltration coefficient (m/s)	0.000088	m/s
Porosity of fill material	30% - e.g. High-porosity sand/gravel	
Soakaway height (m)	0.125	m

Area to be drained

Total area (m ²)	1.0	m ²
Factor of safety	10	

Rainfall

Rainfall input type	FEH22 CSV file	
	FEH 86 Ancton Way.csv	
Return period (years)	100	
Climate change allowance factor	145%	

Results

Minimum base area (m ²)	0.9	m ²
Time for half-emptying (hours)	0.6	hours
Critical duration (hours)	0.5	hours

Please note storage volume estimation are subject to uncertainty. Infiltration system height and base area are reported to the nearest 1m or 1m² value when the height or base area are greater than 10m or 10m²; and reported to the nearest to 0.1m or 0.1m² value when the height or base area are less than 10m or 10m².

Disclaimer

This report was produced using the infiltration volume design tool (2.2.2) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate infiltration volumes and drain-down times. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

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Appendix A – Rainfall Depths

Rainfall depths (mm) with climate change

Duration (minutes)	Duration (hours)	1 years	2 years	5 years	10 years	20 years	30 years	50 years	75 years	100 years	150 years	200 years	500 years	1000 years	10000 years
15	0.25	8.86	11.77	18.49	22.97	27.39	29.86	33.02	35.61	37.48	40.09	41.96	48.37	53.72	76.34
30	0.5	11.46	15.28	24.10	30.12	36.12	39.63	43.94	47.44	50.01	53.84	56.56	65.63	73.38	106.01
60	1	14.54	19.31	30.33	38.03	45.66	50.18	56.01	60.73	64.13	69.01	72.56	84.68	94.99	139.13
120	2	21.26	26.65	39.09	47.68	56.12	61.13	67.60	72.86	76.70	82.29	86.42	100.88	113.46	166.27
180	3	25.29	31.03	44.28	53.36	62.31	67.66	74.59	80.27	84.43	90.61	95.22	111.61	126.02	183.86
240	4	28.13	34.10	47.89	57.30	66.64	72.24	79.52	85.56	90.03	96.70	101.72	119.71	135.59	196.63
360	6	31.94	38.21	52.66	62.55	72.46	78.40	86.27	92.92	97.90	105.40	111.08	131.63	149.54	214.08
540	9	35.61	42.12	57.16	67.58	78.01	84.33	92.77	100.02	105.55	113.94	120.39	143.51	163.04	230.41
720	12	38.20	44.91	60.38	71.14	81.91	88.51	97.35	105.05	110.95	119.99	126.95	151.73	172.16	241.21
900	15	40.24	47.13	63.00	73.95	84.97	91.76	100.96	109.00	115.17	124.69	132.01	157.86	178.83	249.04
1080	18	41.99	49.02	65.25	76.36	87.55	94.50	104.01	112.30	118.70	128.59	136.17	162.82	184.16	255.24
1440	24	45.20	52.40	69.02	80.50	92.03	99.30	109.16	117.84	124.58	134.94	142.91	170.64	192.53	264.93
1800	30	48.05	55.42	72.41	84.16	95.98	103.41	113.56	122.54	129.48	140.19	148.41	176.81	199.07	272.27
2160	36	50.72	58.23	75.56	87.51	99.57	107.16	117.54	126.73	133.83	144.83	153.24	182.13	204.68	278.49
2880	48	55.65	63.44	81.40	93.70	106.17	113.93	124.71	134.20	141.53	152.92	161.59	191.20	214.21	288.99

Rainfall depths (mm) without climate change

Duration (minutes)	Duration (hours)	1 years	2 years	5 years	10 years	20 years	30 years	50 years	75 years	100 years	150 years	200 years	500 years	1000 years	10000 years
15	0.25	6.11	8.12	12.75	15.84	18.89	20.59	22.77	24.56	25.85	27.65	28.94	33.36	37.05	52.65
30	0.5	7.91	10.54	16.62	20.77	24.91	27.33	30.30	32.72	34.49	37.13	39.01	45.26	50.61	73.11
60	1	10.03	13.32	20.92	26.23	31.49	34.61	38.63	41.88	44.23	47.59	50.04	58.40	65.51	95.95
120	2	14.66	18.38	26.96	32.88	38.70	42.16	46.62	50.25	52.90	56.75	59.60	69.57	78.25	114.67
180	3	17.44	21.40	30.54	36.80	42.97	46.66	51.44	55.36	58.23	62.49	65.67	76.97	86.91	126.80
240	4	19.40	23.52	33.03	39.52	45.96	49.82	54.84	59.01	62.09	66.69	70.15	82.56	93.51	135.61
360	6	22.03	26.35	36.32	43.14	49.97	54.07	59.50	64.08	67.52	72.69	76.61	90.78	103.13	147.64
540	9	24.56	29.05	39.42	46.61	53.80	58.16	63.98	68.98	72.79	78.58	83.03	98.97	112.44	158.90
720	12	26.35	30.97	41.64	49.06	56.49	61.04	67.14	72.45	76.52	82.75	87.55	104.64	118.73	166.35
900	15	27.75	32.50	43.45	51.00	58.60	63.28	69.63	75.17	79.43	85.99	91.04	108.87	123.33	171.75
1080	18	28.96	33.81	45.00	52.66	60.38	65.17	71.73	77.45	81.86	88.68	93.91	112.29	127.01	176.03
1440	24	31.17	36.14	47.60	55.52	63.47	68.48	75.28	81.27	85.92	93.06	98.56	117.68	132.78	182.71
1800	30	33.14	38.22	49.94	58.04	66.19	71.32	78.32	84.51	89.30	96.68	102.35	121.94	137.29	187.77
2160	36	34.98	40.16	52.11	60.35	68.67	73.90	81.06	87.40	92.30	99.88	105.68	125.61	141.16	192.06
2880	48	38.38	43.75	56.14	64.62	73.22	78.57	86.01	92.55	97.61	105.46	111.44	131.86	147.73	199.30

This is an estimation of the infiltration volumes and drain-down time to half empty the infiltration system in line with the on CIRIA infiltration drainage R156 guidance (1996) and CIRIA SuDS manual (C753, 2015). This information may be used as the basis for designing an infiltration system for the drainage of surface water runoff from sites.

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Site location	Bognor Regis

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Infiltration system	Planar infiltration
Type	Infiltration from base only

Geometry, porosity and infiltration

Infiltration coefficient (m/s)	0.000088	m/s
Porosity of fill material	30% - e.g. High-porosity sand/gravel	
Soakaway height (m)	0.125	m

Area to be drained

Total area (m ²)	1.1	m ²
Factor of safety	10	

Rainfall

Rainfall input type	FEH22 CSV file	
	FEH 86 Ancton Way.csv	
Return period (years)	100	
Climate change allowance factor	145%	

Results

Minimum base area (m²)	1.0	m²
Time for half-emptying (hours)	0.6	hours
Critical duration (hours)	0.5	hours

Please note storage volume estimation are subject to uncertainty. Infiltration system height and base area are reported to the nearest 1m or 1m² value when the height or base area are greater than 10m or 10m²; and reported to the nearest to 0.1m or 0.1m² value when the height or base area are less than 10m or 10m².

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30	0.5	7.91	10.54	16.62	20.77	24.91	27.33	30.30	32.72	34.49	37.13	39.01	45.26	50.61	73.11
60	1	10.03	13.32	20.92	26.23	31.49	34.61	38.63	41.88	44.23	47.59	50.04	58.40	65.51	95.95
120	2	14.66	18.38	26.96	32.88	38.70	42.16	46.62	50.25	52.90	56.75	59.60	69.57	78.25	114.67
180	3	17.44	21.40	30.54	36.80	42.97	46.66	51.44	55.36	58.23	62.49	65.67	76.97	86.91	126.80
240	4	19.40	23.52	33.03	39.52	45.96	49.82	54.84	59.01	62.09	66.69	70.15	82.56	93.51	135.61
360	6	22.03	26.35	36.32	43.14	49.97	54.07	59.50	64.08	67.52	72.69	76.61	90.78	103.13	147.64
540	9	24.56	29.05	39.42	46.61	53.80	58.16	63.98	68.98	72.79	78.58	83.03	98.97	112.44	158.90
720	12	26.35	30.97	41.64	49.06	56.49	61.04	67.14	72.45	76.52	82.75	87.55	104.64	118.73	166.35
900	15	27.75	32.50	43.45	51.00	58.60	63.28	69.63	75.17	79.43	85.99	91.04	108.87	123.33	171.75
1080	18	28.96	33.81	45.00	52.66	60.38	65.17	71.73	77.45	81.86	88.68	93.91	112.29	127.01	176.03
1440	24	31.17	36.14	47.60	55.52	63.47	68.48	75.28	81.27	85.92	93.06	98.56	117.68	132.78	182.71
1800	30	33.14	38.22	49.94	58.04	66.19	71.32	78.32	84.51	89.30	96.68	102.35	121.94	137.29	187.77
2160	36	34.98	40.16	52.11	60.35	68.67	73.90	81.06	87.40	92.30	99.88	105.68	125.61	141.16	192.06
2880	48	38.38	43.75	56.14	64.62	73.22	78.57	86.01	92.55	97.61	105.46	111.44	131.86	147.73	199.30

APPENDIX 9

To:
Aun District Council
Civic Centre
Maltravers Road
Littlehampton
West Sussex BN17 5LF



HERBERT STUMPP
LIMITED

Civil & Structural Engineers
Construction Health & Safety
Party Wall Surveyors



By email only to harry.chalk@arun.gov.uk

Date: 20th June 2025

Dear Harry

Re: M/22/25/PL. Proposed replacement dwelling at 86 Ancton Way Middleton on Sea PO22 6JP

Thank you for your email with the response from the council's drainage engineers. It is frustrating that they have taken an unacceptable length of time to respond and that there has been no opportunity to engage with them on this. I am aware that you are keen to issue a decision on the application, but before you do, I would be grateful if you could first consider my response to the comments they have made in the section of their pro-forma letter 'Additional comments to the planning officer' and await the revised drawing and calculations which I intend to issue on Monday 23rd June.

Arun DC comment: *An infiltration design has been proposed. Groundwater levels have been monitored which revealed a peak groundwater level of 1.23m below ground level on the 30th January 2025. The design has tried to ensure that 1m of unsaturated ground is provided between the base of the infiltration structures and the peak groundwater level. However, it is unclear as to whether 1m is truly being achieved based upon the construction depths, particularly for the rear infiltration structure. The construction details for the proposed drainage blanket beneath the patio also does not replicate the proposed aggregate construction depths indicated on the layout plan view. Clarity should be provided by providing peak groundwater levels and formation levels for infiltration devices, to a common datum. AOD would be the preference. The construction details should be adjusted as necessary.*

Response: The rear infiltration structure is a drainage blanket beneath the patio area and the thickness of the blanket is 270mm. This 270mm is the depth required to achieve satisfactory hydraulic performance and is greater than the 100mm minimum required to achieve satisfactory structural performance. I have noticed there is a typo on the section detail provided. It states a depth of 370mm. The calculations and the plan both state 270mm. The 270mm is correct. I will correct the section detail. The revised drawing will be issued on 23rd June.

Arun DC comment: *A plan showing the location of the groundwater monitoring point should also be provided.*

Response: The location will be shown on the revised drawing to be issued on 23rd June

Arun DC comment: *In order to achieve such a design, a very shallow drainage system is being proposed, which has its challenges in terms of pipework configuration, etc. The layout plan should indicate all pipe invert levels, diameters, diffuser unit invert levels, manhole cover/invert levels, infiltration blanket formation levels, permeable paving/patio finished surface levels and infiltration structure plan areas/dimensions. Diffuser units should be 5m distance from buildings and this needs to be clearly indicated on the plans.*

Response: Updated drawing to follow on 23rd June. Diffuser units are not required to be 5m away from buildings. This 5m rule applies where shallow foundations are present. The foundations will be at least 1.2m deep and quite below the drainage blanket. Further, there will not be any concentrations of run-off because the flows will be dissipated through the drainage blanket and in any case, we are not dealing with large volumes of rainwater. Please refer to the publications by DETR; Stephen Wilson; Freeman et al; Susdrain which support this.

Arun DC comment: *Infiltration testing has not been carried out on site. Instead, infiltration test results have been taken from a neighbouring site (no.88). This test was undertaken at 1m depth and into the underlying chalk. This does not replicate the proposed design in terms of depth. Specific testing is required on the application site itself, and at the location/depth of the proposed infiltration structures. Testing must be undertaken at an agreed time in the winter period and in accordance with BRE365. The applicant should also be aware that the existing ground geology at the depth of the proposed infiltration structures is also important in terms of infiltration viability ie. made ground would not be suitable for infiltration due to its variability. Thus further information is required in this respect.*

Response: Arun DC should already be aware that surface water run-off from the properties in the area drains into the ground via infiltration and that infiltration drainage has been adequately demonstrated for a number of local sites. Winter infiltration testing was carried out in January 2023 less than 1m away from the boundary between No.86/88 Ancton Way. The locations of the tests were approximately 4m from the centre of the development site and less than 1m from the nearest proposed infiltration structure at No.86. Infiltration tests were also carried out to assess the potential for infiltration into the material overlying the chalk but below any made ground as well as into the chalk. In respect of the infiltration rate into this higher-level material, the infiltration rate was calculated as $1.16 \times 10^{-5} \text{m/s}$ (which is better than the lower rate that was calculated for the chalk and used in the previously supplied drainage design document). Details of how this figure for the upper strata was arrived at are attached. I will show on the drawing to be issued on 23rd June the locations of the test pits.

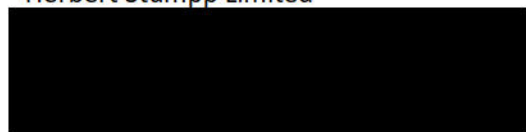
Arun DC comment: *The calculations provided are from software that it is unfamiliar to us and we would require further information in this respect. Surface water run off from the patio area is not included in the calculations so it is assumed that it will drain onto garden/grass areas – clarification required. Surface water runoff from the driveway appears not to be accounted for? Urban creep at 10% of the roof area also needs to be included. FEH rainfall data is to be used, however, the calculations are unclear in this respect. Infiltration for calculation purposes is to be through the base only – it is unclear if the sides have been utilised too? The calculations should be supported by an impermeable area plan, clearly indicating the drained areas and corresponding areas (m^2).*

Response: Arun DC should need no introduction to and should already be familiar with UKSuDS which is a website run by HR Wallingford, as well as its software/tools. In the time it has taken Arun DC to respond however, the software has evolved to use FEH data as well as FSR data. Urban creep was not included in the previously submitted calculations. Revised calculations and clarification of the above will be provided on 23rd June.

Yours sincerely,



Philip Pitman
C Build E MCABE MCIHT MFPWS
for
Herbert Stumpp Limited



APPENDIX 10

Engineers Comments Regarding Surface Water Drainage

Application Reference:	M/58/25/PL	Reviewer Reference:	ADC/SB
Planning Officer:	Harry Chalk	Date of Review:	27/10/2025
Site Name:	86 Ancton Way Elmer PO22 6JP		
Application Description:	Demolition and erection of 1 No dwelling (resubmission following M/22/25/PL). This application is in CIL Zone 4 and is CIL Liable as a new dwelling.		
Assessment Number:	1 of 1		

Policy and Guidance Information
Arun District Council Surface Water Drainage Guidance (including design checklists) - https://www.arun.gov.uk/surfacewater Land Drainage Consent – https://www.westsussex.gov.uk/fire-emergencies-and-crime/dealing-with-extreme-weather/flooding/flood-risk-management/ordinary-watercourse-land-drainage-consent/ Arun District Council Land Drainage Byelaws - https://www.arun.gov.uk/byelaws/ Arun District Council surface water pre-commencement conditions https://www.arun.gov.uk/planning-pre-commencement-conditions The National Standards for SuDS - https://www.gov.uk/government/publications/national-standards-for-sustainable-drainage-systems/national-standards-for-sustainable-drainage-systems-suds The SuDs Manual [C753] by CIRIA

Response	Objection
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References
The NPPF states that when determining any planning application, local planning authorities should ensure that flood risk is not increased elsewhere (paragraph 181, 182 and 187e). The PPG guides local planning authorities to refer to 'Sustainable drainage systems: non-statutory technical standards' [NsTS] and detailed industry guidance like The SuDS Manual [C753] by CIRIA to guide decisions about the design, maintenance, and operation of sustainable drainage systems for non-major development. The NsTS have been superseded by the National Standards for Sustainable Drainage Systems [NSfS] from 19 June 2025 This consultation has been primarily informed by the NSfS and The SuDS Manual.

Summary

This summary highlights if critical items aligning with each of the standards have been met. Critical items are highlighted in bold on our surface water drainage design checklist (linked above). A failure to address these will likely result in an objection to a full or reserved matters planning application.

If any of these items are inadequately addressed by the submission, then their correction may result in a redesign of the surface water drainage scheme. A redesign is likely to have site wide implications such as the potential for storage structures to increase in volume or plan area, or the provision of other important infrastructure to satisfy the NSfS set out below.

A full written explanation of the assessment and response is given in the consultation comments to the planning officer.

Standard	Assessment	Response
1. Runoff destination	Insufficient	Objection
2. Interception drainage	Insufficient	No objection subject to conditions
3. Extreme Rainfall and Flooding	Insufficient	Objection
4. Water Quality	Insufficient	No objection subject to conditions
5. Amenity	Insufficient	No objection subject to conditions
6. Biodiversity	Insufficient	No objection subject to conditions
7. Construction, operation, maintenance, decommissioning and structural integrity	Insufficient	No objection subject to conditions

Reviewed Plans

The following documents have been submitted and reviewed to inform this consultation with reference to surface water drainage:

Proposed Surface Water Drainage 006 PL3

Flood Risk Assessment & Management of Surface Water Run-off - February 2025

RESPONSE: The February 2025 version of the above FRA and Management of Surface Water Run-off document was superseded by Revision A dated 23.06.2025. Revision A has been superseded by Revision B dated 18.11.2025 which has been prepared to address the comments made in this document by Arun DC drainage engineers

Consultation comments to the planning officer

0. General

- 0.1. Insufficient information regarding surface water drainage has been submitted to evidence that flood risk will not be increased as due to the proposed development.

RESPONSE: The comments made by the Arun DC drainage engineers have been reviewed here and have been responded to and the responses have been summarised here in bold red. The scheme design drawings, the Flood Risk Assessment and Management of Surface Water Run-off document have been amended to address each of the comments and to overcome any objections.

1. Runoff destination

- 1.1. The designer proposes to drain the new dwelling and associated patio and driveway to 2 infiltration blankets at the front and rear of the house. We are supportive of the use of infiltration as the second highest priority disposal option (after water reuse); however, the designer has not adequately demonstrated that infiltration is viable. Nor have they presented any evidence of an alternative disposal location should that be the case. Therefore, it has not been demonstrated that the site can be sustainably drained, and an **objection** must be lodged.

RESPONSE: Soakage tests at two depths have confirmed that infiltration is viable and it is therefore not necessary to offer an alternative disposal location. The method of calculating the soil infiltration rate f is correct and is compliant with both BRE 365 and Building Regulations Part H methods.

- 1.2. Groundwater monitoring has been submitted that demonstrates that peak groundwater levels are 1.23m below ground level (0.22m above the base of a slotted pipe to a depth of 1.45m below ground level). Ground level at the monitoring point was 9.6mAOD, and the base would be 8.15mAOD. This means that the groundwater peaked at 8.37mAOD.

RESPONSE: Agreed.

- 1.3. To comply with the national standards for SuDS and The SuDS Manual the design must allow for 1m of unsaturated ground between the base of the infiltration blankets and the peak groundwater level. This would mean that the base of the blankets would need to be set 9.37mAOD. Both infiltration blankets are set lower than this and would need to be raised to be compliant.

RESPONSE: Agreed. No formation level will be lower than 9.37m. Formation levels are shown on the revised drawing.

- 1.4. It is assumed that this could be achieved within the confines of the site. However, the applicant has not submitted adequate infiltration testing to demonstrate that infiltration at

this depth is viable. Furthermore, the applicant would have to demonstrate that infiltrating at these depths would not be into made ground. No evidence of the geological strata has been submitted.

RESPONSE: Adequate infiltration tests have been carried out and the results of the tests do demonstrate that infiltration is viable. The geology is obvious from the photos of the trial pits. The soakage tests and the excavation of the trial pits were witnessed independently and made ground was not encountered in the locations where the investigations took place.

- 1.5. Two rounds of infiltration testing have been submitted. These are both claimed to be from the neighbouring property 88 Ancton Way. The trial pit dimensions are not compliant with BRE DG 365, and the depths do not replicate the depths of the proposed infiltration features.

RESPONSE: The location of the infiltration tests was on the boundary between the two properties, Nos. 86 & 88 Ancton Way. The method of calculating the soil infiltration rate is by taking a known volume of water and dividing it by the product of the surface area of the excavation exposed to water measured between two points and the time taken for that volume of water to fall between those two points. The method is the same for both BRE 365 and Building Regulations Part H and the size of the trial pit makes no difference to the methodology or to the result. For BRE 365 a trial pit should be between 1m and 3m long, and 0.3m and 1m wide; and for Part H a trial pit should be 300mm square and at least 300mm deep.

- 1.6. Furthermore, the shallower tests, completed at 0.6m below ground level, were not submitted to support the application at the neighbouring site. Indeed, only one photograph of the trial pit has been submitted, that at 1m depth. It is unclear who completed these tests, or why they were not submitted previously. It is suggested that an accompanying report by the ground investigator may assist in clarifying the uncertainty regarding the testing. Until further clarity is provided the infiltration testing completed at 0.6m depth is considered unreliable and unsuitable for the purposes of the design.

RESPONSE: The infiltration tests that were carried out for the neighbouring property (No.88) were deemed acceptable at the time and it was not necessary to include the results of the tests which were carried out at the higher level, which is why they weren't submitted for that property. The tests were carried out in accordance with accepted practice and the soil infiltration rate duly calculated, again using the correct method. The excavations for the trial pits and also for the foundations for No.88 adjacent were inspected at the time to verify the ground conditions. There was little variation in the geology encountered and it was broadly as anticipated. The foundations were taken down into the chalk

and this material was encountered from 0.8m below ground level. The final foundation depth was approximately 1.0m. The inspections and witnessing of the infiltration tests were carried out and recorded by Herbert Stumpp Ltd. There is no valid reason to consider that the testing is unreliable.

2. Interception drainage

2.1. Infiltration to the ground is proposed, which would provide an appropriate means of intercepting surface water. However, should infiltration prove unviable, alternative methods of interception would be required. In recognition of the National Planning Policy Framework's guidance that SuDS should be proportionate to the nature and scale of the proposal, we are willing to accept that, for a project of this size, the following interception features can demonstrate compliance without the need for further detailed assessment.

- Infiltration features designed to meet extreme rainfall standards.
- Water butts or other means of reuse that are not designed for regular daily demand attached to all new downpipes.
- Raingardens and bioretention features attached to all new downpipes.
- Permeable surfacing.

RESPONSE: The rainwater downpipes at the front of the property will be removed and all rainwater will discharge to the rear. 2nr rainwater downpipes will be provided on the rear to pick up surface water run-off from the roof. Each downpipe will flow into a rainwater butt and then into a rain garden instead of into a drainage blanket located beneath a permeable surface. Two rain gardens will be provided - one alongside each side boundary in the rear garden. The roof area is 75 sq.m (82.5 sq.m. with 10% allowance for urban creep) and a total area of 16.5 sq.m. of rain garden is required (20% of the roof area). Each rain garden will be 10.4m long and will be 0.8m wide, providing a total area of 16.6 sq.m. 8.3 sq.m. will be provided on each side. All paved surfaces will be laid so as to be permeable.

2.2. These features will not affect the scale or layout of development and as such can be secured by condition.

RESPONSE: Noted. It is intended the updated information provided will avoid the need for this as a stand-alone condition.

3. Extreme rainfall and flooding

3.1 The site is entirely within Flood Zone 3. The FRA appears to attempt to show that the site is in an area of low flood risk, despite the Flood Zone classification. It is not supported by product 4 data for the site which can be requested from the Environment Agency. It is important that this information is submitted as it will demonstrate accurately the flood risk on the site and its source. SuDS features should not be located in fluvial flood zones, whereas they are acceptable in tidal ones. (Please see our guidance relating to this at

www.arun.gov.uk/surfacewater). Without an accurate understanding of the flood risk on the site, we cannot assess if the proposed drainage strategy is compliant. Therefore, I **object** to the application.

RESPONSE: Agreed regarding the placing of SuDS features in areas of fluvial flooding. On this site, there is nowhere to place SuDS except at ground level. The site is at low risk of flooding from surface water and this is shown in Figures 2.6 & 2.7 of the FRA/surface water design document and is also confirmed by inspection of Arun DC's own SFRA. Flooding is from tidal sources. Undefended/defended tidal flood extents are shown in Product 4 data.

- 3.2. Preliminary calculations have been submitted to demonstrate that the volumes of the proposed infiltration blankets are adequate for the site. These do not clearly show that urban creep has been applied, or that a CV value of 1 has been used, we rely on the written confirmation of this within the FRA. This would require further detail and clarification for the final design, but are not a reason for objection at this stage.

RESPONSE: With regards the calculations that were included to show that the volumes provided within the drainage blankets are sufficient, urban creep has been considered and this is clearly stated in section 3.4 of the FRA/surface water design document submitted with the application. The Cv value is irrelevant to the calculation because the whole area is deemed to contribute, so by default the value of Cv would be 1.

4. Water quality

- 4.1. Insufficient evidence of water quality benefits has been provided, and as such, Standard 4 of the NSfS has not been met. However, the submission of this evidence is unlikely to affect the scale or layout of the development. Therefore, we do not object to the proposal on these grounds, subject to a condition securing the provision of details demonstrating water quality benefits.

RESPONSE: Water quality has been considered and groundwater pollution is covered briefly in section 4.2 of the FRA/surface water design document. The principal source of surface water run-off is from the roof of the proposed dwelling (75 sq.m excluding urban creep). Surface water run-off from roofs is generally considered 'safe' in terms of pollutant types and levels of pollutants, although airborne particles which settle on these areas can contain elevated levels of pollutants and these particles are generally washed off with the first flush of rainfall and conveyed into the drainage system. The roof will discharge into rain gardens where the planting, retention of the surface water run-off, and subsequent microbial and natural action will break down the pollutants into their less harmful components. This is well-documented. Any new hard landscaping around the site

will be permeable, and again any pollutants will be treated by microbial and natural action in the drainage media beneath them.

It is intended the updated information provided will avoid the need for this as a stand-alone condition.

5. Amenity

5.1. Insufficient amenity benefits arising from the proposed SuDS have been identified, and therefore Standard 5 of the Systems NSfS has not been met. However, the submission of such evidence is unlikely to affect the scale or layout of the development. Accordingly, we do not object to the proposal on these grounds, subject to a condition securing details of amenity benefits.

RESPONSE: The rain gardens will slow surface water run-off and will provide a garden feature for the use and enjoyment by the occupants of the dwelling. A project of this size has little potential to offer amenity on a wider scale, e.g. beyond the confines of the site.

It is intended the updated information provided will avoid the need for this as a stand-alone condition.

6. Biodiversity

6.1. Insufficient biodiversity benefits arising from the proposed SuDS have been identified, and therefore Standard 6 of the Systems NSfS has not been met. However, the submission of such evidence is unlikely to affect the scale or layout of the development. Accordingly, we do not object to the proposal on these grounds, subject to a condition securing details of biodiversity benefits.

RESPONSE: The rain gardens will be planted with native, nectar-rich plants, which will provide food for pollinators such as butterflies and bumblebees, and will attract birds. It will also enhance the natural habitat.

It is intended the updated information provided will avoid the need for this as a stand-alone condition.

7. Construction, operation, maintenance, decommissioning and structural integrity

7.1. Insufficient information regarding the construction, operation and maintenance of the SuDS system, and therefore Standard 8 of the Systems NSfS. However, in the absence of significant existing trees which could impact the scale and layout and location of SuDS features, most elements of this standard can normally be secured via condition. The submission of a Management and Maintenance Plan is unlikely to affect the scale or layout of the development. Accordingly, we do not object to the proposal on these grounds, subject to a condition securing the detailed surface water drainage design.

RESPONSE: Construction details and maintenance requirements are considered in the FRA/surface water design document previously submitted, although rain gardens, which did not previously feature, are now included.

It is intended the updated information provided will avoid the need for this as a stand-alone condition.

8. Suggested conditions / Overcoming the objection

- 8.1. As this is not a holding objection or a request for further information, requested conditions are not listed. If you are minded to approve this application, please reconsult engineers for a list of suggested conditions to ensure that the development is adequately drained and does not increase flood risk elsewhere.

RESPONSE: It is intended the updated information provided will avoid the need for conditions.

- 8.2 The imposition of conditions at this stage rather than overcoming the objection could result in a circumstance where the condition cannot be discharged. In the event of attaching a condition that cannot be discharged, permission may be invalid or that condition could be deemed to be unreasonable.

RESPONSE: Noted. It is intended the updated information provided will address the objections and avoid the need for conditions.

- 8.3. If you are minded to allow the applicant additional time to submit further documents to support this application, then further evidence may overcome our objection. Please do not allow the applicant to submit further documents without prior discussion as to whether it will be possible for these to be assessed or influence your determination.

Drainage impact on other planning matters

This application has been assessed with regards to surface water drainage design only, together with land drainage aspects if deemed necessary.

Other planning matters occasionally effect the surface water drainage design. If plans relating to other matters have been assessed for their impact on the proposed drainage, then it must not be assumed that they have been assessed for any other purpose. The planning officer is advised to check for conflicts with any existing approved plans and to consult any relevant consultees as appropriate.

It has been identified that the following consultees may have comments about the plans that have been submitted and reviewed for this application:

- ☐ Landscaping officer (proposed trees and landscaping)
- ☐ Tree officer (existing trees)
- ☒ **Environment Agency (main rivers and fluvial/tidal flood risk, River Arun internal drainage board, groundwater source protection zones)**
- ☐ Southern Water (foul drainage and surface water disposal to public sewer network/groundwater source protection zones)
- ☐ Portsmouth Water (groundwater source protection zones)
- ☐ Lead local flood authority (all other sources of flooding and ordinary watercourses)
- ☐ Other: Specify
- ☐ None

