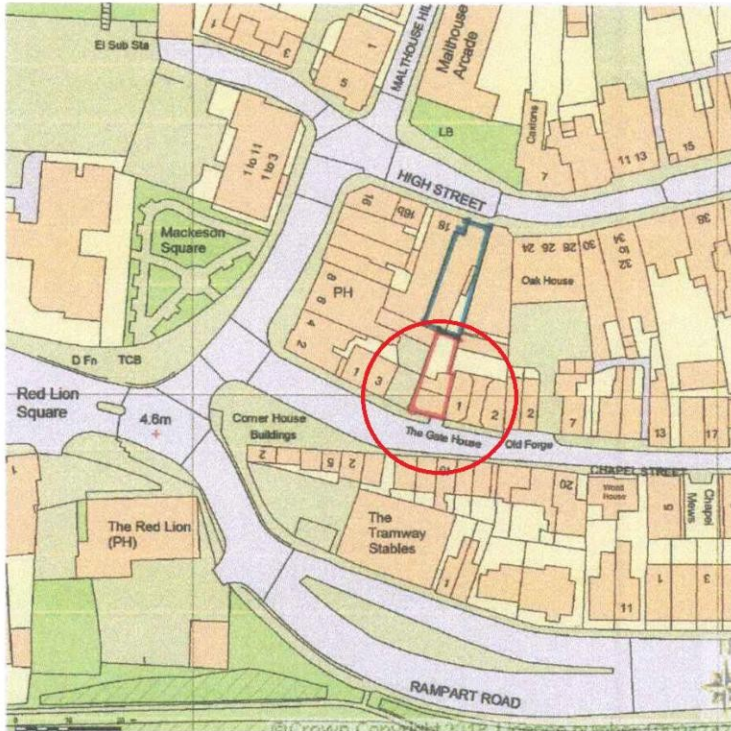


Chapel Street, Hythe - Rear of 20 High Street Flood Risk Assessment

Prepared for Deltafirst Properties Ltd

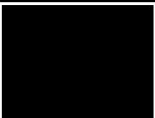


Brighton Consulting
Engineers Ltd

April 2018

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1. INTRODUCTION

In February 2018 Brighton Consulting Engineers Limited were commissioned by Deltafirst Properties Ltd to carry out a Flood Risk Assessment for the proposed development at the rear of 20 High Street, Hythe, Kent CT21 5AT. The development proposal is for the construction of a two bed room house.

This flood risk assessment was prepared complying to the requirements in National Planning Policy Framework, March, 2012 and the Technical Guidance to the National Planning Policy Framework (March, 2012).

In carrying out this Flood Risk Assessment, information was obtained from the Environment Agency and Shepway District Council. Development plans, topography survey and other information about the development were provided by the Project Architect, Mr Keith Barker.

For the avoidance of doubt and for clarity, some information is repeated in more than one section.

2. EXECUTIVE SUMMARY

1. **LOCATION:** The proposed residential development is situated at the Chapel Street to the rear of 20 High Street, Hythe, Kent CT21 5AT.
2. **DEVELOPMENT DESCRIPTION:** The proposed development is for the demolition of existing out buildings and construction of a 2 bedroom house at Chapel Street, Hythe.
3. **VULNERABILITY:** As the site is for a residential development it falls into “more vulnerable” land use category according to Table 2 - Flood Risk Vulnerability Classification in the Technical Guidance to NPPF (March, 2012).
4. **FLOOD ZONE:** The site is located in Flood Zone 2.
5. **PROBABILITY OF FLOODING:** Main source of flooding at the site is tidal. Environment Agency Flood Map indicates that the site is within “medium” probability flood outline (between 0.1% -0.5% AEP).

However, climate change can increase the risk of flooding at the site, if existing defences are not upgraded. Tidal flood water level for 0.5 % AEP event in 2115 with climate change is 5.57mAOD. The finished ground floor level of the development is 4.6mAOD.

Sea defences between Dymchurch redoubt and Fisherman’s Beach currently provide a 5% (1 in 20) standard of protection. As informed by the Environment Agency “planned improvements to these defences will provide a 0.5% (1 in 200) standard of protection”. Sea defences between Fisherman’s Beach and Folkestone harbour have been designed to provide a 0.5% (1 in 200) standard of protection. Therefore, it is highly likely that defences will be upgraded to 1 in 200 year standard with climate change.

Surface water flood risk is “moderate to high” and groundwater flood risk at the site is “moderate”.

6. **RESIDUAL FLOOD RISK AND FLOOR LEVEL:** There is a residual flood risk due to breach/overtopping of flood defences. Finished ground floor level is set at 4.6mAOD. Surrounding ground level is at 4.3mAOD on average. Therefore, there is reasonable freeboard to prevent surface water ingress in to the property.

The 0.5 % AEP flood level in 2115 with climate change is 5.57mAOD. The finished ground floor level of the development is 4.6mAOD. Therefore, ground floor level is lower than the future flood level. Therefore, it is recommended to incorporate flood resistant/resilient measures into the building design.

Bed rooms are located on the first and second floors. Finished floor level of the first floor is 7.2mAOD. 1 in 1000 year climate change flood level in 2115 is 5.72mAOD. Therefore, an adequate freeboard is available above the extreme flood level.

7. **SURFACE RUNOFF:** Based on storage volume calculation tool available at HR Wallingford (www.uksuds.com) it was estimated that a storage volume of 1m³ will be required to attenuate run-off volume on site to reduce outflow rate from the property to greenfield level of 5 l/s (see Appendix – D for calculations). This calculation is based on 1 in 100 year 6 hour rainfall event with 40% increase to account for climate change. Soakaways can be used to attenuate the flow from the site. In addition it is recommended to provide ponds/basins to store 2m³ of water to improve water quality.
8. **FLOOD STORAGE DISPLACEMENT:** The site is located outside the 1 in 200 year flood outline. The increase in footprint area is a marginal 48 sq.m. Therefore, flood storage will not be displaced. However, climate change can increase the flooding extent and depth displacing flood volume if defences are not upgraded.
9. **DRY ACCESS & EGRESS:** The site and access routes are located in Flood Zone 2. Therefore, dry access and egress is available.
10. **SEQUENTIAL TEST:** The site is located in Flood Zone 2. The following residential development proposals in Flood Zone 2 and 3 in the vicinity of the proposed development have been granted full planning permission in the past:
 - Ref. No. Y17/0620/SH, Erection of two semi-detached dwelling houses with associated landscaping at 11-13 High Street Hythe Kent CT21 5AE, Approved on 31 July 2017
 - Ref. No: Y17/0615/SH, Erection of a detached dwelling following demolition of existing outbuildings at 43 High Street Hythe Kent CT21 5AD, Approved on 05 Sep 2017
 - Ref. No. Y11/1177/SH, Change of use from first floor offices to a four bedroom self-contained flat at 44B High Street Hythe Kent CT21 5AT, Approved on 08 Feb 2012

Therefore, the Sequential Test is deemed to have been carried out for this area and the proposed development is consistent in location, type and scale with the residential developments for which planning permission have been given in the past.

11. **EXCEPTION TEST:** The proposal will meet sustainability requirements of the Shepway District Council in terms of energy, water, waste etc., and the development will not increase flood

risk elsewhere, safe for the design lifetime and hence, is consistent with the Exception Test related requirements.

12. **SUMMARY:** The site is in Flood Zone 2. It is recommended to attenuate surface run-off to greenfield level using SUDS. It is also recommended to incorporate flood resistant/resilient measures into the building design (see Appendix F).

3. SITE LOCATION

The site comprises the land to the rear of 20 High Street, Hythe, Kent CT21 5AT.

A Location Plan is shown in Appendix A as Figure A2.

4. EXISTING SITE CONDITION

Total area of the site is 227 sqm and the total hard paved/impermeable area is 150 sqm. The topography survey indicates that the ground levels at the entrance to the site is 4.3mAOD on average.

The site at present consists of a single garage that is disused and an empty outbuilding behind and old stone wall facing on to the Chapel Street and part of the rear garden to the Golden Bowl Chinese take away food outlet situated at no. 20 High Street.

Deltafirst Properties Ltd own the premises and intend to develop the unused part of the garden and the disused outbuildings whilst continuing the tenancy to the Golden Bowl proprietors.

5. DEVELOPMENT DESCRIPTION

The proposed development is for the demolition of existing out buildings and construction of a 2 bedroom house at the rear of 20 High Street, Hythe, CT21 5AT.

The ground floor will have the entrance hall with internal access to the refuse and cycle store, a disability access toilet and large kitchen, dining room with patio doors leading to the rear garden.

The first floor will partly oversail the ground floor entrance providing shelter to the front door and accommodate a shower room to serve the two bedrooms. Both bedrooms will be double size and have built in wardrobes.

The second floor will accommodate a large open plan lounge and study area partly within the roof structure and will have a concealed balcony on the Chapel Street elevation.

The finished ground floor level is set at 4.6mAOD.

Access to the new property will be directly from the Chapel Street.

The total building footprint area of the proposed new construction is 150 sq.m The footprint area of the existing out buildings to be demolished is 102 sq.m. Therefore, the development will increase building footprint area by 48 sq.m.

A site Layout is shown in Appendix A as Figure A3.

6. HYDROLOGY/HYDRO-GEOLOGY

6.1 Hydrology

Royal Military Canal and its tributaries drain the area. The Canal is classified as a main river and drains a catchment of approximately 70km² to the sea at a number of tidal outlets.

6.2 Hydro-geology

Environment Agency Groundwater Maps show that the site is located over a secondary (minor) aquifer of high vulnerability.

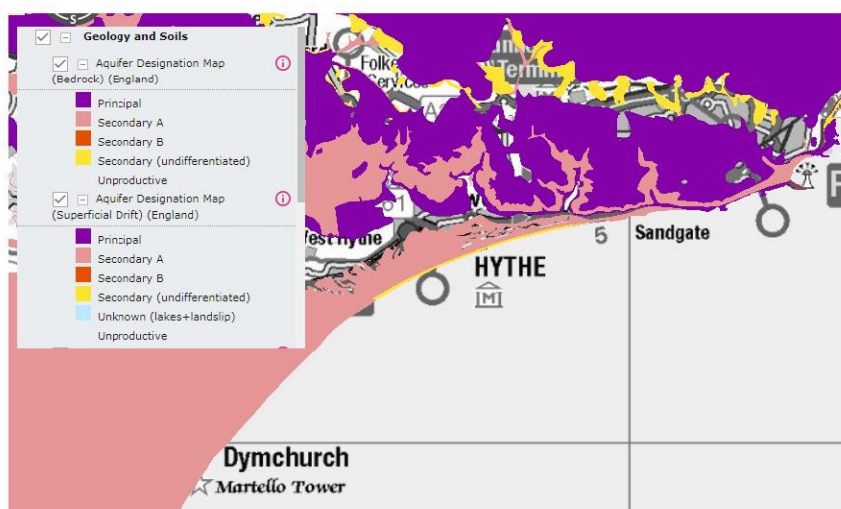


Figure 1. Groundwater Map (Copyright BGS/MAGIC/DEFRA)

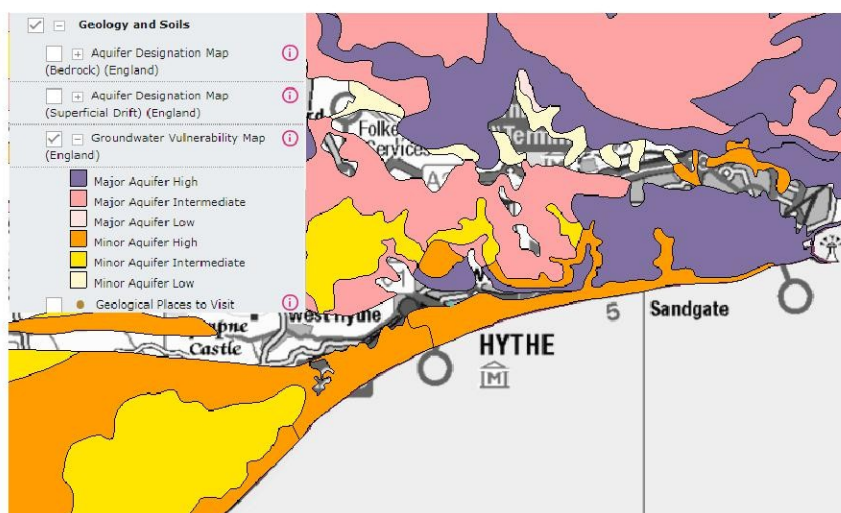


Figure 2. Groundwater Vulnerability Map (Copyright BGS/MAGIC/DEFRA)

7. SOURCES, MECHANISMS AND PATHWAYS OF FLOODING

The sources of flooding are tidal and fluvial from Royal Military Canal, groundwater, surface water, sewer surcharging and infrastructure failure.

Fluvial and tidal flooding is due to over bank flow or overtopping/breach of the embankment.

Flooding to low-lying land from the sea and tidal estuaries is caused by storm surges and high tides. Where tidal defences exist, they can be overtopped or breached during a severe storm, which may be more likely with climate change. Tidal flood would come from the south of the site due to direct flooding from the sea. Tidal flooding is due to the propagation of a surge up the Canal.

Intense rainfall, often of short duration, that is unable to soak into the ground or enter the sewer system due to insufficient capacity or blockages, can run quickly off land and result in local flooding. Surface water flooding can arrive from the Chapel Street.

Groundwater flooding occurs when water levels in the ground rise above surface elevations. Water levels below the ground rise during wet winter months, and fall again in the summer as water flows out into rivers. In very wet winters, rising water levels may lead to the flooding of normally dry land.

8. PROBABILITY OF FLOODING

8.1 Fluvial

The main risk of fluvial flooding to the site comes from Royal Military Canal. The Canal is classified as a main river and drains a catchment of approximately 70km² to the sea at a number of tidal outlets.

During the winter of 2002 heavy and prolonged rainfall resulted in high water levels in the Royal Military Canal. The ground within the catchment was also heavily saturated. On the 30th December 2002 an intense rainfall event coincided with high tide which meant that the canal's outfall at Seabrook was tide-locked and therefore, the canal could not discharge to the sea. This caused levels in the canal to exceed the crest of the canal's bank in areas where this was low. The flooding affected the low-lying areas south of the canal in the West Hythe (SFRA, Herrington Consulting, July 2015).

Following table gives extreme water levels in the canal as obtained from the Strategic Flood Risk Assessment of Shepway District Council.

Table 1. Predicted extreme water levels in the Royal Military Canal at Hythe.

<i>Return period (Yrs)</i>	<i>Water level (mAOD)</i>
2	2.57
5	2.71
10	2.74
100	3.01*
1000	3.25*

* Extrapolated values

The finished ground floor level is set at 4.6mAOD. Therefore, the risk of flooding from fluvial sources is "moderate" at the site.

8.2 Tidal

The site is located within the flood plain having greater than 0.1% AEP of flooding and less than 0.5% AEP of flooding. Therefore, probability of tidal flooding is "moderate" at the site at present.

However, climate change can increase the risk of flooding, if existing defences are not upgraded. Tidal flood water levels provided by the Environment Agency (Reference: KSL 79272 UE of 29 March 2018) included a climate change allowance. The 0.5 % AEP flood level in 2115 with climate change is 5.57mAOD. The finished ground floor level of the development is 4.6mAOD.

8.3 Surface water

Surface water flooding is typically generated by short duration, intense rainfall events exceeding the design event where precipitation is unable to infiltrate to the ground or enter the drainage system (i.e., saturated soil, paved surfaces, sewer blockages, lack of sewer capacity).

As shown in the Environment Agency surface water flood map, the flood depths on Chapel Street and the streets surrounding the property may exceed 300mm during extreme events. However, flood velocity is less than 0.25 m/s. Therefore, the hazard level may be low.

The area is built up with a high proportion of paved surfaces. Therefore, there is a “moderate to high risk” due to surface water and sewer surcharge flooding during extreme events.

8.4 Groundwater

Environment Agency Groundwater maps indicate that the area is a secondary (minor) aquifer of high vulnerability. Therefore, the risk of groundwater flooding is “moderate”.

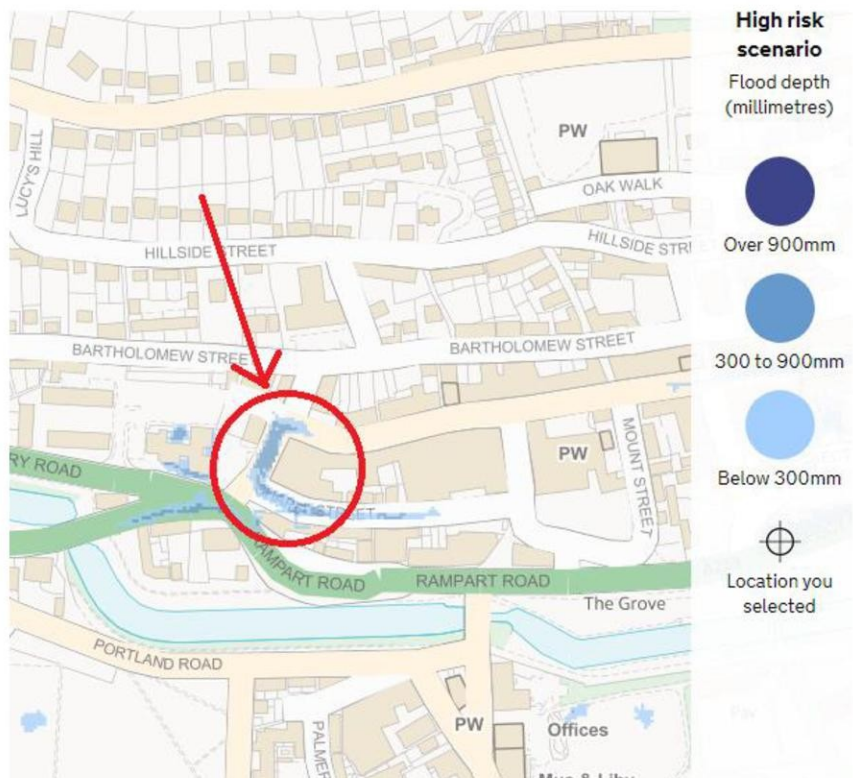


Figure 3. Surface water flood depth – high risk scenario (Copyright Environment Agency)

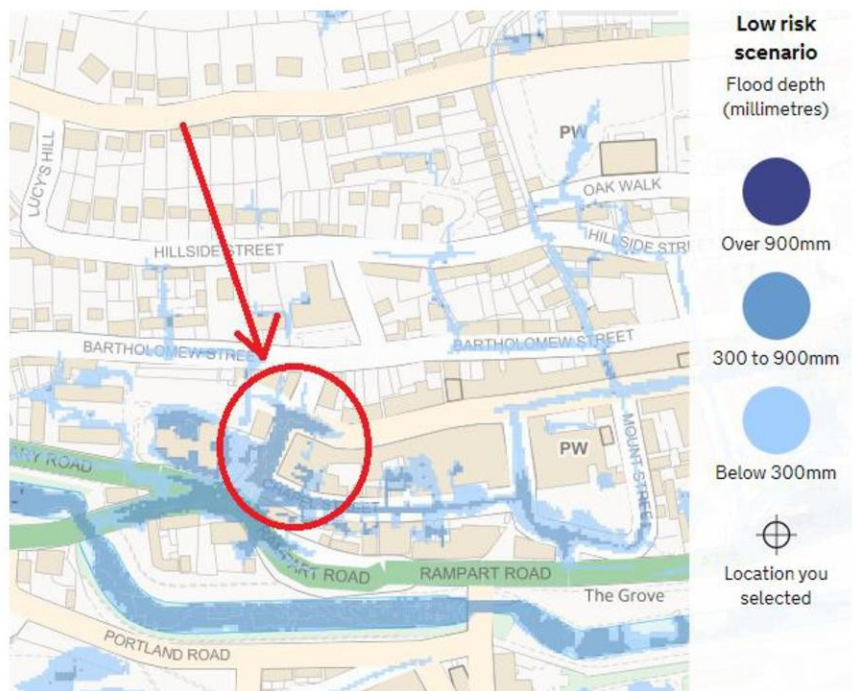


Figure 4. Surface water flood depth – low risk scenario (Copyright Environment Agency)

9. FLOOD ZONE

As shown in the Environment Agency Flood Map, the proposed site is located within the region having greater than 0.1% AEP of flooding and less than 0.5% AEP of flooding. Therefore, the site is located in fluvial/tidal Flood Zone 2.

10. FLOOD RISK VULNERABILITY

The proposed development is for “more vulnerable” land use according to Flood Risk Vulnerability Classification (Table 2) of the Technical Guidance to the NPPF (March, 2012).

11. SEQUENTIAL TEST

NPPF requires that a Sequential Test be carried out by the LPA to steer the developments first into low risk Flood Zone 1 and then to medium risk Flood Zone 2 following a sequential approach. PPS25 states “ Only where there are no ‘reasonably available’ sites in Flood Zone 1 and 2 should decision makers consider suitability of sites in high risk Flood Zone 3, applying Exception Test if required”.

The site is in Environment Agency Flood Zone 2.

Residential developments have been permitted in the past by the Shepway Council in the Flood Zones 2 and 3 in the close proximity to the proposed site as shown by the following examples:

- Ref. No. Y17/0620/SH, Erection of two semi-detached dwelling houses with associated landscaping at 11-13 High Street Hythe Kent CT21 5AE, Approved on 31 July 2017.
- Ref. No: Y17/0615/SH, Erection of a detached dwelling following demolition of existing outbuildings at 43 High Street Hythe Kent CT21 5AD, Approved on 05 Sep 2017.
- Ref. No. Y11/1177/SH, Change of use from first floor offices to a four bedroom self-contained flat at 44B High Street Hythe Kent CT21 5AT, Approved on 08 Feb 2012.
- Ref. No. Y11/0151/SH, Erection of first floor extension to rear above existing flat roof rear terrace to provide new dwelling (flat), and replacement of part of existing first floor rear balustrade at 24 - 28 High Street Hythe Kent CT21 5AT, Approved on 08 Aug 2011.
- Ref. No. Y07/1144/SH, Change of use from offices (Class B1) to residential (Class C3) at 42 High Street Hythe Kent CT21 5AT, Approved on 04 Dec 2007.

Therefore, the Sequential Test is deemed to have been carried out for this area and the proposed development is consistent in location, type and scale with the permitted residential developments.

12. EXCEPTION TEST

Para 102 of the NPPF (March, 2012) states that:

If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate.

For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. Both elements of the test will have to be passed for development to be allocated or permitted.

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	x	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	x	x	x

Key: ✓ Development is appropriate.
x Development should not be permitted.

Figure 5. Flood risk vulnerability and flood zone compatibility (Technical Guide, NPPF, March 2012).

For 'more vulnerable' developments in Flood Zone 2, an Exception Test, as shown in Figure 5, is not required. Following information is provided to support the requirements of the Exception Test:

Sustainability: The house will be designed and constructed to reduce the impact on surrounding areas complying to sustainability requirements of the Shepway District Council.

Flood Risk: The site and the escape routes are located in the flood zone 2. The development will not increase flood risk elsewhere as run-off volume will be attenuated to greenfield levels using

soakaways or similar SUDS methods. The development will not displace flood storage. Some defences have a 1 in 200 year standard. There are plans to improve the sea defences having lesser standard of protection to 1 in 200 year standard. Therefore, the development will be safe for its designed lifetime.

13. DURATION OF FLOODING

The time for the flood to peak could vary depending on parameters like catchment size, slope and land use. It could be 12 - 24 hours for a small catchment while it could be several days for large catchments like Severn and Thames. In large, relatively flat catchments flood levels will rise slowly and natural flood plain may remain flooded for several days. In small, steep catchments, local intense rainfall can result in the rapid onset of deep and fast-flowing flooding with little warning. Such “flash” flooding, which may only last a few hours, can cause considerable damage and possible threat to life.

In this lower catchment of the Royal Military Canal, slopes are relatively less steep and hence, floods could peak relatively slowly. Therefore, river floods may last 1-2 days.

Peak of the tidal flood could last around 3-4 hours.

Floods due to surface water and surcharging of sewers could last days and even weeks as high river levels or pipe blockages could cause backing up of water in the sewers.

Joint occurrence of several factors, such as high astronomical tide/tidal surges, blockage of sewers, culverts, flash flooding, fluvial floods could increase the severity of flooding and may even take weeks to subside.

14. SURFACE WATER RUN-OFF

NPPF requires that the developed rate of runoff and volume to a water course or receiving water body should not be greater than the existing run-off rate and volume. Out of the 227 sq.m site, and area of 150 sq.m could be considered impermeable.

14.1 SUDS storage requirement

Surface water storage to be provided on site to attenuate surface run-off discharge to greenfield 5 l/s was calculated using tools available at HR Wallingford site (<http://www.uksuds.com>). Based on this calculation it was determined that the attenuation storage required for the site is 1.0m³.

It is recommended to attenuate surface water using soakaways if infiltration rate is sufficiently high as proved from infiltration tests. If the soil conditions are not suitable to use soakaways, underground cell storage could be considered. Bottom of the soakaways should be located at least 1m above the highest known groundwater level.

It is also recommended to provide additional 2m³ of pond/basin storage to improve water quality.

Surface runoff storage calculation sheet is included as Appendix- D.

15. DRY ACCESS AND EGRESS

As the site and the access routes are in Flood Zone 2, safe dry access to and egress from the site can be provided.

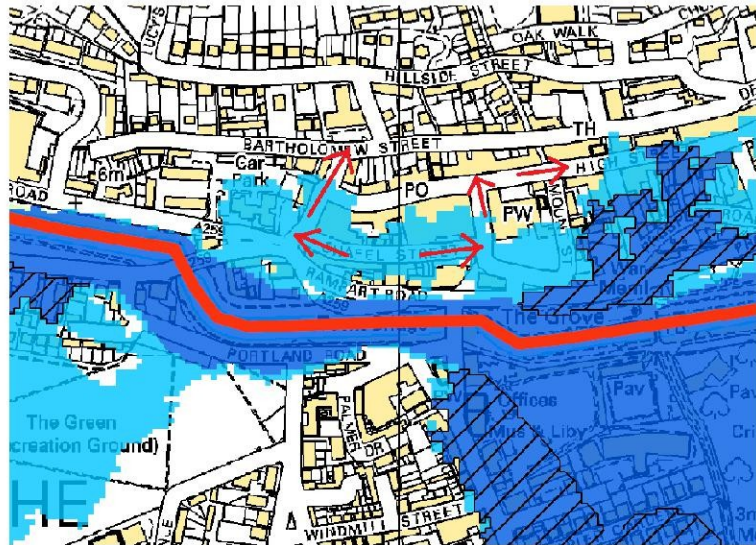


Figure 6. Escape route (EA Copyright)

The site is also located in Environment Agency's Flood Warning Area as shown in figure below.

Flood warning or alert area map

Coast from Folkestone to St Mary's Bay

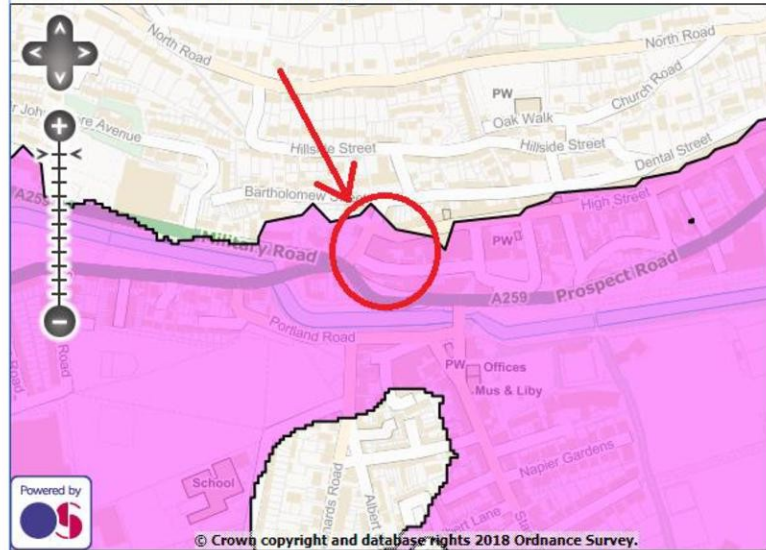


Figure 7. Environment Agency Flood Warning Area (EA Copyright)

16. CLIMATE CHANGE

Climate change allowance guidance changed since February, 2016 and the latest allowances are available at:

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

The new guidance requires that the rainfall intensity to be increased up to 40% for the epoch 2070-2115.

Tidal flood water levels provided by the Environment Agency (Reference: KSL 79272 UE of 29 March 2018) included a climate change allowance. The 0.5 % AEP flood level in 2115 with climate change is 5.57mAOD.

The risk of flash flooding could increase as storminess and frequency of storms increases in the future. Sewers are generally designed to 1 in 30 year standard according to 'Sewers for Adoption'. However, climate change could bring intense rainfall events exceeding current design standard overwhelming the existing sewers.

The information on flood defences provided by the Environment Agency is quoted below (Reference: KSL 79272 UE of 29 March 2018).

"Sea defences between Dymchurch redoubt and Fisherman's Beach comprise of a clay embankment with a rock revetment and shingle beach. Planned improvements to current defences with 1 in 20 defence standard comprise of strengthening the existing embankment, extensive shingle recharge and construction of a rock revetment around the Dymchurch redoubt. These improvements are designed to provide a 0.5% (1 in 200) standard of protection for flooding from the sea in any given year." These defences will include a climate change allowance in setting the crest level.

The site is classified as a minor aquifer of high vulnerability. Therefore, the risk of groundwater flooding is moderate at present. However, this risk could increase if climate change brings in more rainfall and higher river levels. This will be especially severe during winter as winter rainfall is predicted to increase as a result of climate change. There is a chance for groundwater to emerge in the winter when ground is saturated.

Therefore, the standard of flood defence could fall from current levels while the risk of fluvial, tidal, groundwater and surface water flooding could increase as a consequence of the climate change.

The adverse impact of the climate change could be mitigated to some extent by appropriate planning and design. Following steps could be taken to mitigate climate change impact.

- Design new pipes with a 40% allowance provided for rainfall intensity to account for climate change.
- Design soakaways, Permeable Pavements and other Sustainable Drainage Systems to store increased run-off volume due to climate change.
- Raise threshold floor level 600mm above 1 in 200 year climate change flood level and 300mm above surrounding average ground level if it is practicable.
- If it is not possible to raise ground floor level, incorporate flood resistant/resilient measures into the design.

17. FLOOD DEFENCES

The information on flood defences provided by the Environment Agency is quoted below (Reference: KSL 79272 UE of 29 March 2018).

“Sea defences between Dymchurch redoubt and Fisherman’s Beach comprise of a clay embankment with a rock revetment and shingle beach. Timber groynes act to retain shingle on the frontage. The defences currently provide a 5% (1 in 20) standard of protection for flooding from the sea in any given year. The defences are owned and maintained by the Ministry of Defence. Planned improvements to these defences comprise of strengthening the existing embankment, extensive shingle recharge and construction of a rock revetment around the Dymchurch redoubt. These improvements are designed to provide a 0.5% (1 in 200) standard of protection for flooding from the sea in any given year.”

“Sea defences between Fisherman’s Beach and Folkestone harbour arm comprise of a sea wall and shingle beach. Rock groynes act to retain shingle on the frontage. The defences, together with annual shingle recycling, are designed to provide a 0.5% (1 in 200) standard of protection for flooding from the sea in any given year. These defences are owned and maintained by Shepway District Council.”

18. OFF SITE IMPACTS AND THEIR MITIGATION

18.1 Loss of flood storage and level-to-level compensation

Flood storage will not be displaced as the site is outside the 1 in 200 year flood outline and located in Flood Zone 2.

However, climate change may increase the flood extent and depths causing displacement of flood storage if the defences are not upgraded.

18.2 Increase of run-off volume

Run-off rate and volume corresponding to 6 hour 1 in 100 year rainfall will be attenuated to greenfield level by using SUDS. It is recommended to provide 1 m³ of storage as soakaways or similar to reduce discharge from the site to 5 l/s. It is also recommended to provide 2 m³ of storage as ponds/basins to improve water quality.

18.3 Sustainable drainage systems (SUDS)

Table 2 shows a hierarchy of recommended sustainable drainage systems in order of sustainability. It is recommended to consider using one or more of the listed methods to attenuate surface run-off on site depending on site conditions. SUDS Hierarchy should be followed in choosing attenuation methods.

These SUDS methods include living roofs, detention basins (depressions which are normally dry except after storm events), ponds (ponds contain water in dry weather, and are designed to hold more when it rains), filter strips and swales, infiltration devices such as soakaways, permeable pavements, rain water harvesting etc.

18.4 Effect on coastal & river morphology

There is no effect on river and coastal morphology as the development will not cause scour or deposition of sediment in the main river channel or coastal zone.

Table 2. SUDS hierarchy

	SUDS Technique	Flood Reduction	Water Quality Improvement	Landscape & Wildlife benefit
Most sustainable  Least sustainable	Living roofs	✓	✓	✓
	Basins and ponds - constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips & swales	✓	✓	✓
	Infiltration devices - soakaways - infiltration trenches & basins	✓	✓	✓
	Permeable surfaces & filter drains - gravelled areas - solid paving blocks - porous paving	✓	✓	
	Tanked systems - over sized pipes / tanks - storms cells	✓		

19. RESIDUAL RISKS AND THRESHOLD FLOOR LEVEL

Residual risks may occur due to extreme events exceeding the design event and breach/overtopping of defences. Residual risks can be reduced by appropriate planning and design.

19.1 Increased sewer and SUDS capacity

It is recommended to design new pipes to absorb run-off from 1 in 100 year rainfall events with 40% increase in rainfall intensity for climate change. It is expected that the increased capacity of the sewers will be able to accommodate exceedance flows during the short and medium terms assuming climate change would occur gradually over the next 100 years.

It is also recommended to have additional SUDS storage volume than required such as ponds, basins, permeable pavements to reduce run-off volume from the site.

19.2 Finished ground floor level

Finished ground floor level is set at 4.6mAOD. Surrounding ground level is at 4.3mAOD on average. Therefore, there is reasonable freeboard to prevent surface water ingress in to the property.

However, climate change can increase the risk of flooding at the site, if existing defences are not upgraded. The 0.5 % AEP flood level in 2115 with climate change is 5.57mAOD. The finished ground floor level of the development is 4.6mAOD.

Therefore, it is recommended to incorporate flood resistant/resilient measures into the building design.

19.3 Sleeping accommodation

Bed rooms are located on the first and second floors. Finished floor level of the first floor is 7.2mAOD. 1 in 1000 year climate change flood level in 2115 is 5.72mAOD. Therefore, an adequate freeboard is available above the extreme flood level.

19.4 Regular inspection and sewer maintenance

It is recommended to install a regular maintenance regime to ensure the efficient functioning of the sewers and sustainable drainage systems (if installed).

19.5 Management of risks during life time of the development

The designers should take measures to reduce flood risk by incorporating mitigation measures into the design taking into

account the design life of the building. The owners will be vested with the responsibility of maintaining the mitigation measures periodically, including sewers, sustainable drainage systems and manage the risks (floods, health & safety risks to occupants and public) during the life time of the development. This includes obtaining of insurance cover as appropriate.

19.6 Flood insurance

It is recommended that the owners obtain adequate flood insurance cover to minimise the economic losses and manage the risks during the lifetime of the development.

20. FLOOD RESILIENT/RESISTANT BUILDINGS

The document "[Improving the flood performance of new buildings – flood resilient construction, May 2007](#)" defines *avoidance* as measures that can be taken to prevent floodwater from reaching a property. For example, these can take the form of low defence mounds or barriers surrounding a development or individual property, or landscaping the ground surrounding a building to divert floodwaters away or into temporary storage.

Flood Resistance is defined as measures taken at building level to prevent floodwater entering the building and damaging its fabric.

Flood Resilience is defined as sustainable measures that can be incorporated into the building fabric, fixtures and fittings to reduce the impact of floodwater on the property. This allows easier drying and cleaning, ensures that the structural integrity of the building is not compromised and reduces the amount of time until the building can be re-occupied.

Building Designers are also requested to refer to the publication "[Home owners Guide to Flood Resilience – A Living Document](#)" to decide on measures to increase the flood resilience in buildings.

Flood Resistance (Dry Proofing)

This requires choosing flood proof materials and construction methods to exclude water (increase *flood resistance*). Finished threshold floor level should be placed 300mm above the flood level and surrounding ground level. Seepage/ingress of water through floors, walls, foundation, doors, windows should be prevented. The risk of groundwater emergence and surface water ingress can be reduced by using concrete floors, damp proof course, damp proof membranes etc., which will cut-off moisture pathways.

Ground supported floors are the preferred option and concrete slabs of at least 150mm thickness should be specified for non-reinforced construction to prevent cracking due to uplift water pressure. Hollow slabs are not suitable if the elements are not effectively sealed.

Damp Proof Membranes (d.p.m.) should be included in any design to minimise the passage of water through ground floors. Impermeable polythene membranes should be at least 1200 gauge to minimise ripping.

Flood Resilience (Wet Proofing)

Wet proofing allows for some flooding and aims to increase *flood resilience* by using suitable construction methods and materials. A variety of water-resistant paints and coatings are available to help

prevent floodwater soaking into the external face of the wall, thus allowing the wall to dry out more quickly. For new properties the choice of materials including bricks, mortars and renders should be carefully considered to limit water penetration. Generally denser materials will provide greater flood resistance.

Undermining of foundations due to scour, hydrostatic and hydrodynamic loads on the structure, load impacts of floating debris, pressure on the floor slab, foundation, due to groundwater should be considered during engineering design.

Floodwater can backflow through sewers into properties. Therefore it is recommended to install non-return valves.

Following Table extracted from the publication - *Improving flood resilience of buildings through improved materials, methods and details, June 2005 published by CIRIA* - lists suitable building materials for flood proofing.

Table 3. Summary of material suitability for building components (source: Scottish Executive, 2004b)

Component	Most suitable	Suitable	Unsuitable
Flooring	Concrete, pre-cast or in situ	Timber floor, fully sealed, use of marine plywood	Untreated timber Chipboard
Floor covering	Clay tiles Rubber sheet floors Vinyl sheet floors	Vinyl tiles Ceramic tiles	
External walls – to Max flood level	Engineering brick Reinforced concrete	Low water absorption brick	Large window openings
Doors	Solid panels with waterproof adhesives Aluminium, plastic or steel	Epoxy sealed doors	Hollow core plywood doors
Internal partitions	Brick with waterproof mortar Lime based plasters	Common bricks	Chipboard Fibreboard panels Plasterboard Gypsum plaster
Insulation	Foam or closed cell types	Reflective insulation	Open cell fibres
Windows	Plastic, metal	Epoxy sealed timber with waterproof	Timber with PVA glues and mild steel

		glues and steel or brass fittings	fittings
--	--	---	----------

Guidance on flood resilient building design can be obtained from the following web sites.

The publication "Improving the Flood Performance of New Buildings- Flood Resilient Construction, Defra, May, 2007".

http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

Repair and restoration of buildings following floods, CIRIA.

<http://www.ciria.org.uk/flooding>

21. HEALTH AND SAFETY

Health & safety issues arising due to floods before, during and after the construction should be addressed according to CDM (2007) regulations.

Exit routes should be provided within the building and within the site to be used in a flooding situation.

There is a risk of people falling into pits, manholes during floods and hence, manhole covers should be designed to resist uplifting.

There is a risk of electrocution and failure of services during floods. Therefore, all electrics - power outlets, service meters and boilers - should be located well above the finished ground floor level and well above the climate change flood level of 5.57mAOD with cables dropping from distribution located above the flood level.

Chemicals and fuel storage tanks should be stored securely well above the flood level.

Floods may cause buoyancy of stored container units, boxes, and materials. This can cause health and safety hazards. Therefore, they should be stored above the flood level.

Prepare an emergency Flood Plan (see Appendix-C). The Flood Plan should be given to the first occupants of the house.

22. EMERGENCY FLOOD PLAN

It is important that every house and business develop an Emergency Flood Plan to minimise the damage from floods. An emergency flood plan would include a list of useful contact numbers of the Environment Agency FloodLine, Emergency Services, an awareness of the escape routes and instructions how to respond to a flooding situation.

- Register with Environment Agency Floodline. Contact number 0845 988 1188 to receive flood warnings, by telephone, mobile, fax.
- Know emergency services contact 999 and 112.
- Know your escape routes to the outside of the flood plain. Identify exit routes within the building and within the site.
- Prepare an emergency Flood Response Plan. A form to design a flood response plan is attached as Appendix D.
- More information on the preparation of an emergency flood plan is available on the following web site.
<http://www.environment-agency.gov.uk/homeandleisure/floods/38329.aspx>

22.1 Flood warning service

The Environment Agency operates a flood warning service in all areas at risk of flooding which is available on their web site www.environment-agency.gov.uk.

The proposed site is located in an Environment Agency's Flood Warning Area.

There are four flood warning codes that indicate the level of severity of flooding expected in the area.

Table 4. Flood warning codes

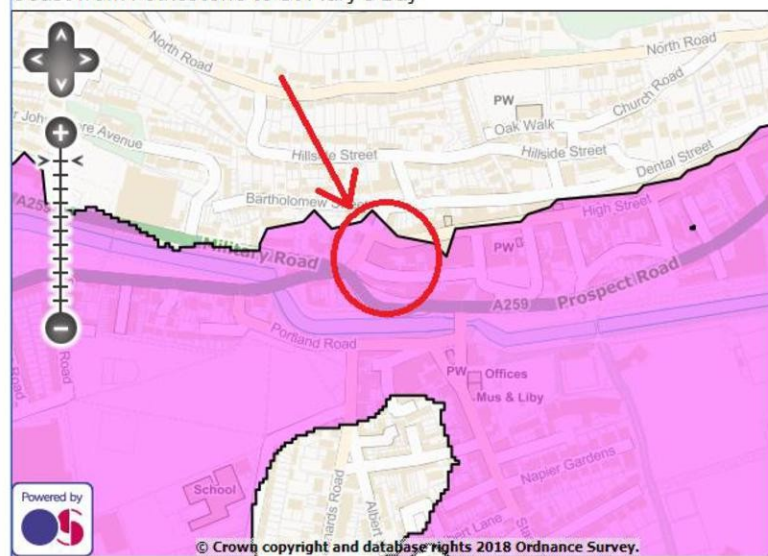
Flood Warning Code	Description
Flood Alert	Flooding of low-lying land and roads is expected. Make the necessary actions to prepare for a flood event.
Flood Warning	Flooding of homes and businesses is expected. Take immediate action.
Severe Flood Warning	Severe flooding is expected. Extreme danger to life and property is expected. Take immediate action.
All clear	Flood watches or warnings are no longer in force for this area

The flood warnings are disseminated through a variety of mediums that include TV, radio, Flood Warnings Direct which is a service direct to phone/fax/pager/internet. Loudhailers are also used in certain circumstances. There is also an emergency Floodline number (0845 988 1188) and a quick dial number for individual rivers.

As stated on their web site the Environment Agency aim to give a minimum of two hours warning prior to the onset of a flood event. However, the rapid onset of some flood events, particularly with a high intensity rainfall event within an urban catchment means that sometimes a sufficient warning cannot always be raised.

Flood warning or alert area map

Coast from Folkestone to St Mary's Bay



23. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Constraint	Impact	Mitigation
Flood Zone 3	Flood risk is high	The site is in Flood Zone 2.
Run-off	Flood risk in adjacent areas will increase if runoff volume increases.	Runoff will be attenuated to greenfield level by using SUDS – Living roofs, basins, ponds, permeable pavements are recommended
Flood storage	Flood risk in adjacent areas will increase if flood storage is displaced.	The site is located outside the 1 in 200 year flood outline. Footprint area will increase only marginally as existing outbuildings will be demolished. Therefore, flood storage will not be displaced. However, climate change may widen the flood extent and increase food depths causing displacement if defences are not upgraded.
Dry access and egress	Emergency services will not have access, people cannot escape to safer areas if safe access and egress is not available.	The site and access routes are in Flood Zone 2. Therefore, dry access and egress can be provided in a flood of 1 in 200 year magnitude.
Residual risks	Flooding the ground floor	Finished ground floor level will be set at 4.6mAOD. Surrounding ground level is at 4.3mAOD on average. Therefore, the risk of surface water ingress in to the property is reduced. Climate change flood level in 2115 is 5.57mAOD. Flood level is higher than the floor level. Therefore, it is recommended to incorporate flood resilient/resistant measures into the building design.
Exceedance of design flood water level		
Surface water, flash floods		
Defence breach or overtopping		
Flood resilience	Increased flood resilience/resistance reduces property damage and economic losses	It is recommended to use flood proof materials, concrete floors, damp proof courses/membranes to cut off groundwater emergence, surface water ingress, water absorption. It is also recommended to consider undermining of foundations due to scour, hydraulic loads and impact forces from floating debris during the engineering design.
Health and safety	Injury, fatalities	Electrics, boilers, chemical & fuel storage, should be kept well above the finished ground floor level and well above the flood level of 5.57mAOD.

24. REFERENCES

Association of British Insurers (ABI), undated, Flood Resilient Homes – What homeowners can do to reduce flood damage

CIRIA, Designing for Exceedance in Urban Drainage-Good Practice, C635, 2006

CIRIA, The SUDS Manual, C697, 2007

CIRIA Sustainable Urban Drainage Systems Initiative
<http://www.ciria.org/suds/index.html>

Defra/Environment Agency, Flood Risk Assessment Guidance for New Developments, Phase 2, R&D Technical Report, FD2320/TR2, October 2005

Department for Communities and Local Government, March, 2010, Planning Policy Statement 25: Development and Flood Risk

Department for Communities and Local Government, February 2007, Development and Flood Risk: A Practice Guide Companion to PPS25, 'Living Draft', A Consultation Paper

Department for Communities and Local Government, National Planning Policy Framework (NPPF), March, 2012.

Department for Communities and Local Government, Technical Guidance to the National Planning Policy Framework (NPPF), March, 2012.

Environment Agency, 2000, Fluvial Freeboard Guidance Note, R&D Technical Report W187

Environment Agency Flood Map – <http://www.environment-agency.gov.uk/>

Institute of Hydrology, 1999, Flood Estimation Handbook, Institute of Hydrology, Wallingford, UK

Marshall D C W & Bayliss, A C, 1994, Flood Estimation for Small Catchments, Report 124, Institute for Hydrology Wallingford, UK

FEH Handbook, Centre for Ecology & Hydrology, Version 2.0

APPENDIX – A : PLANS & FIGURES

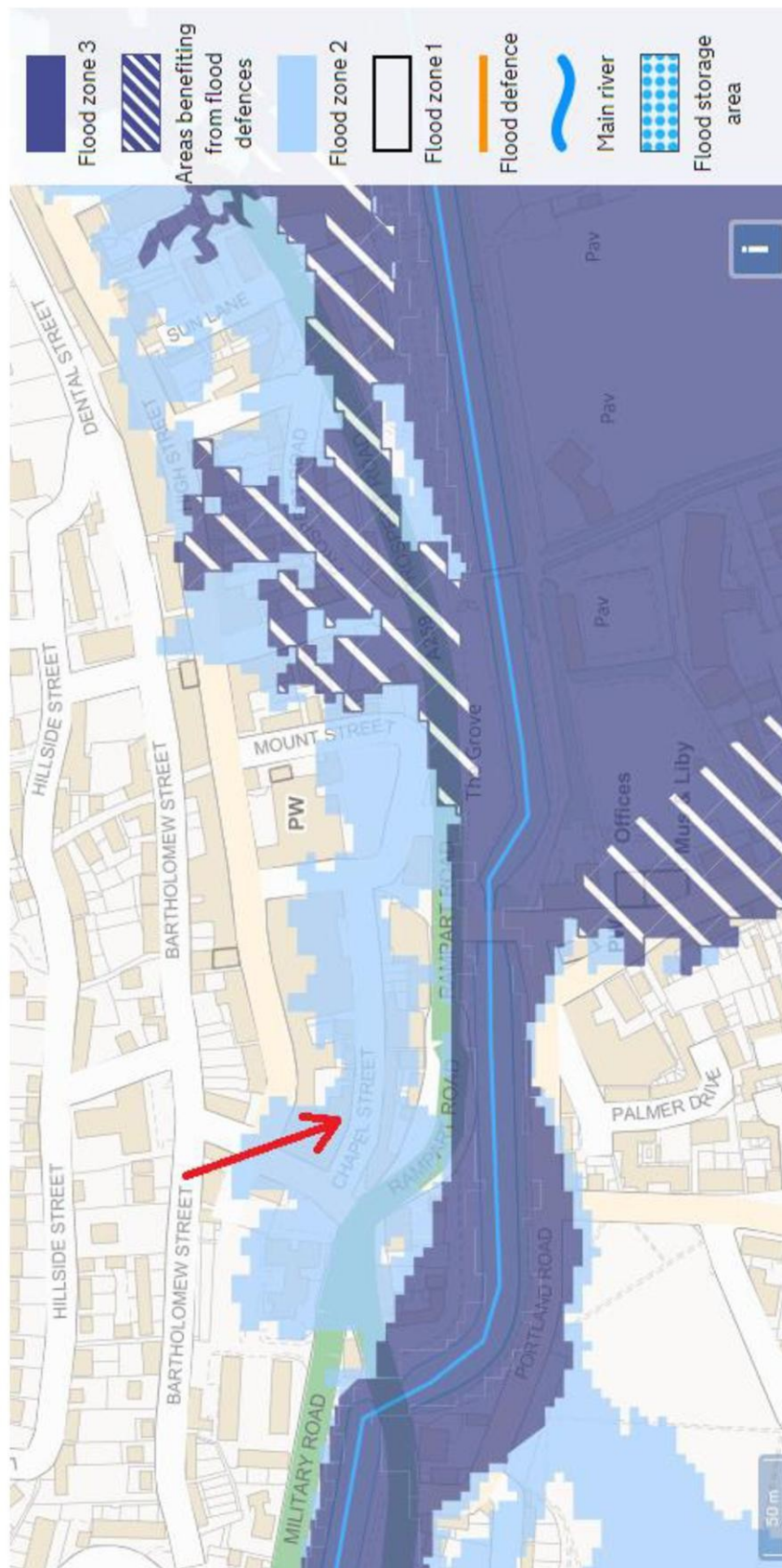
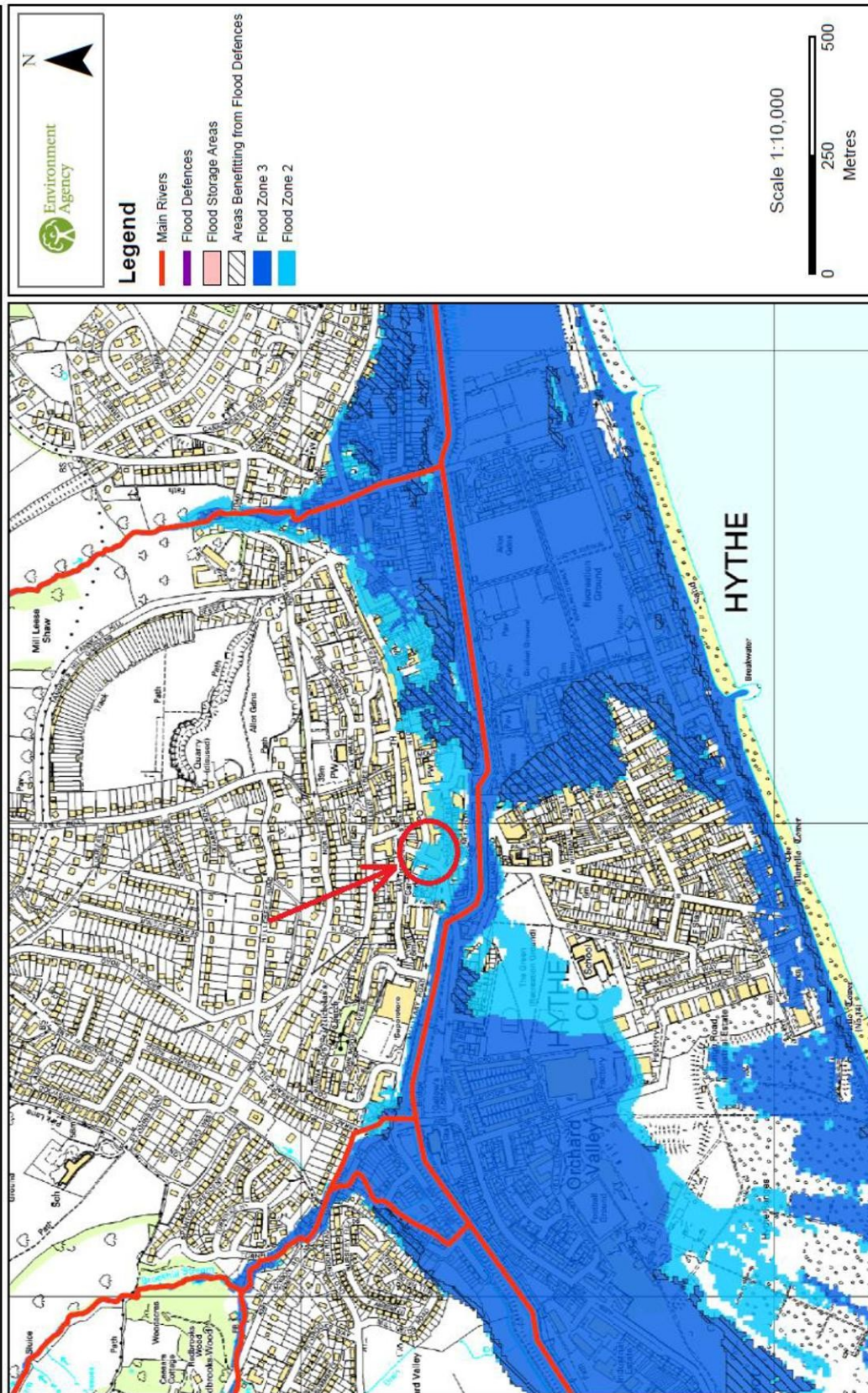


Figure A1.1 Flood Map (Environment Agency Copyright)

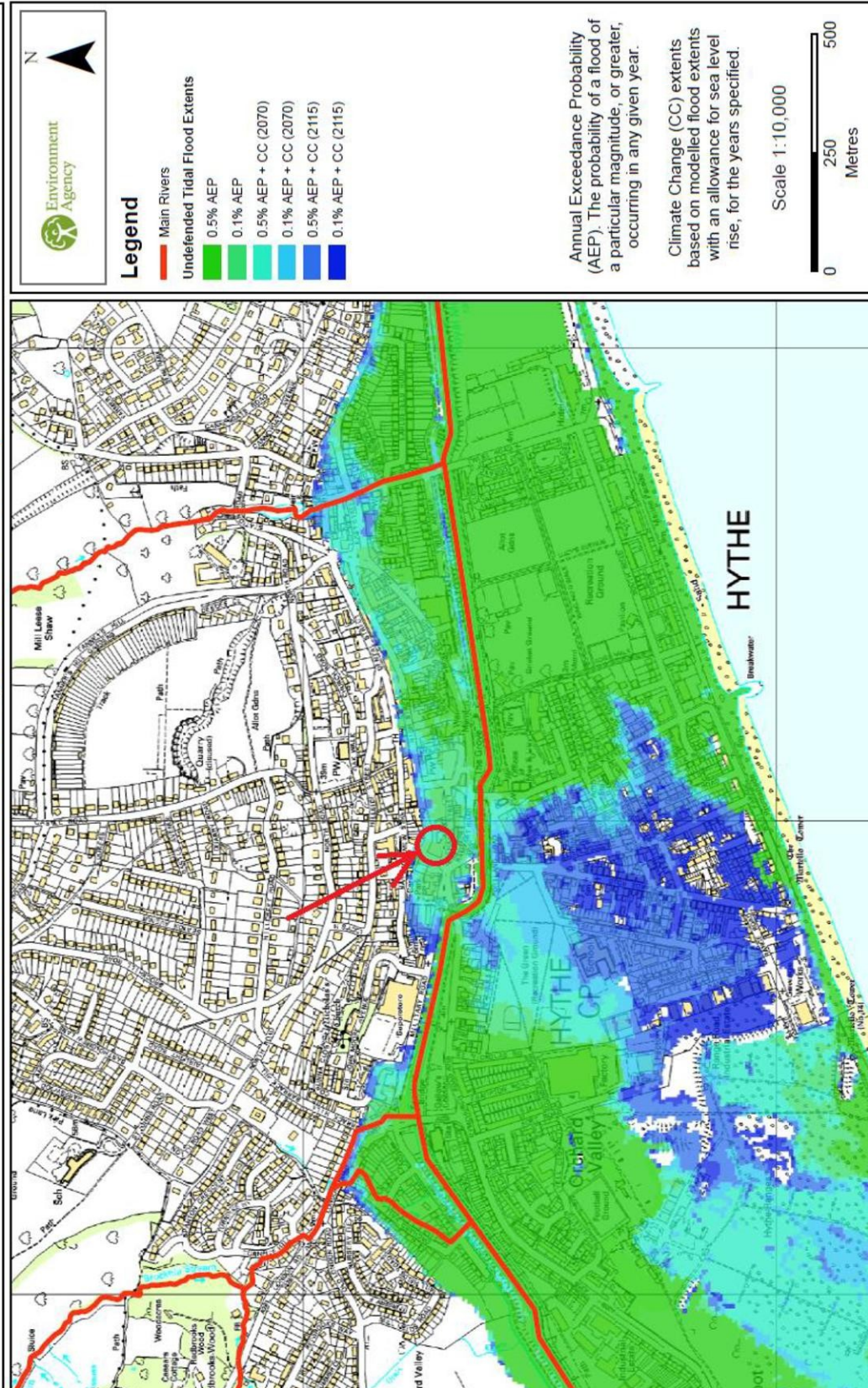
Flood Map centred on land at Chapel Street, Hythe, CT21 5AT.
Created 29 March 2018 [Ref: KSL 79272 UE]



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

Figure A1.2 Flood Zone Map (Environment Agency Copyright)

Undefended tidal flood extents map centred on land at Chapel Street, Hythe, CT21 5AT.
Created 29 March 2018 [Ref: KSL 79272 UE]



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

Figure A1.4 Flood Extent Map with climate change (Environment Agency Copyright)



Figure A1.5 Flood model nodes (Environment Agency Copyright)

Table 1: Modelled tidal flood levels for Annual Exceedance Probability (AEP) events shown (mAOD)

Point ID	National Grid Reference		Modelled Tidal Flood Levels for Annual Exceedance Probability (AEP) events shown [metres AOD]										
			Undefended					Defended					
	Easting	Northing	0.5%	0.1%	0.5% + CC (2070)	0.1% + CC (2070)	0.5% + CC (2115)	0.1% + CC (2115)	20%	5%	1.33%	0.5%	0.1%
1	615942	134698	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
2	615945	134697	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
3	615947	134697	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
4	615943	134702	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
5	615946	134701	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
6	615948	134700	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
7	615948	134703	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
8	615945	134704	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
9	615949	134707	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
10	615946	134708	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
11	615950	134710	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00
12	615947	134711	0.00	4.75	5.11	5.31	5.57	5.72	0.00	0.00	0.00	0.00	0.00

Figure A1.6 Flood Water Levels (Environment Agency Copyright)

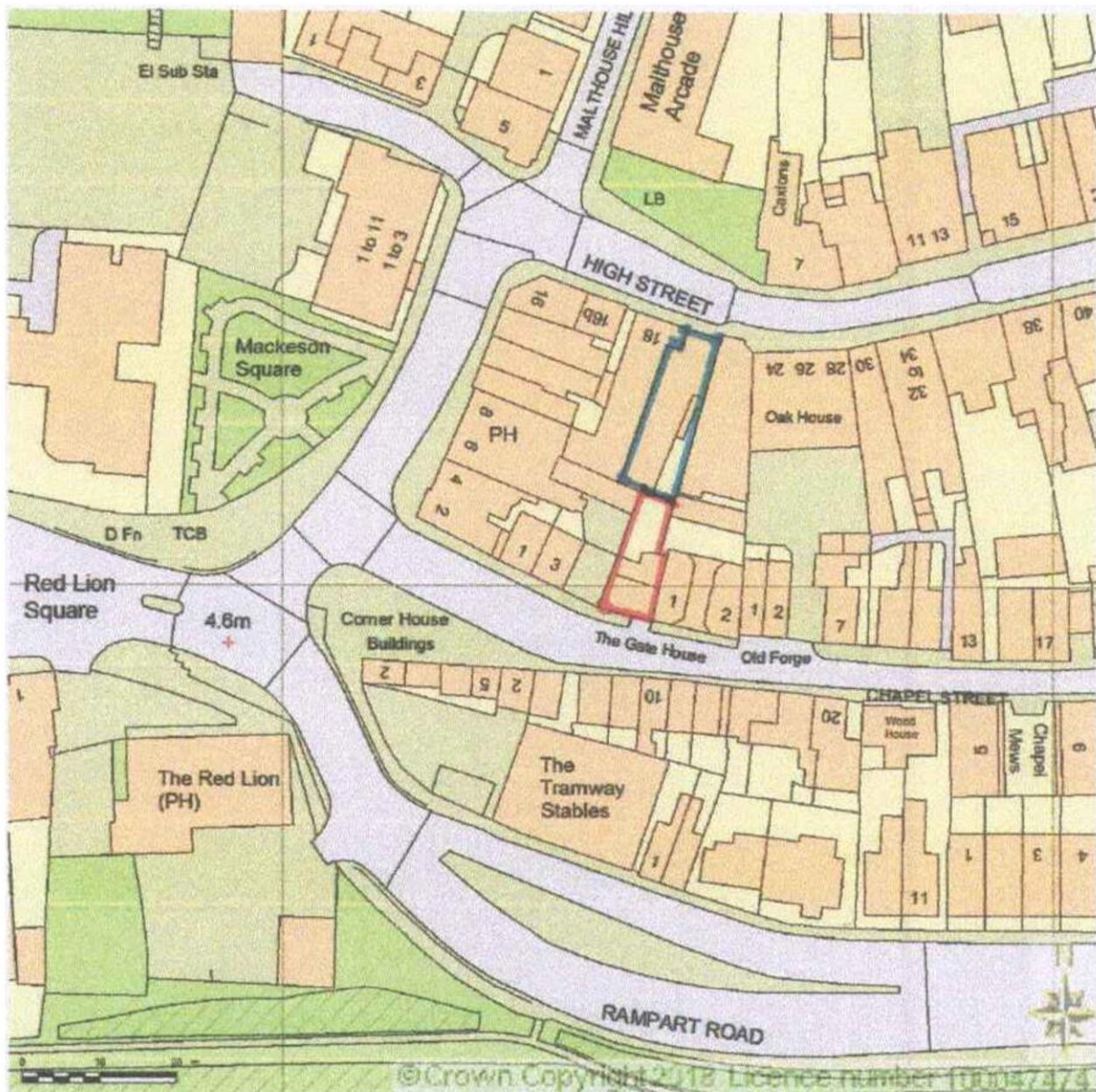


Figure A2. Location Plan

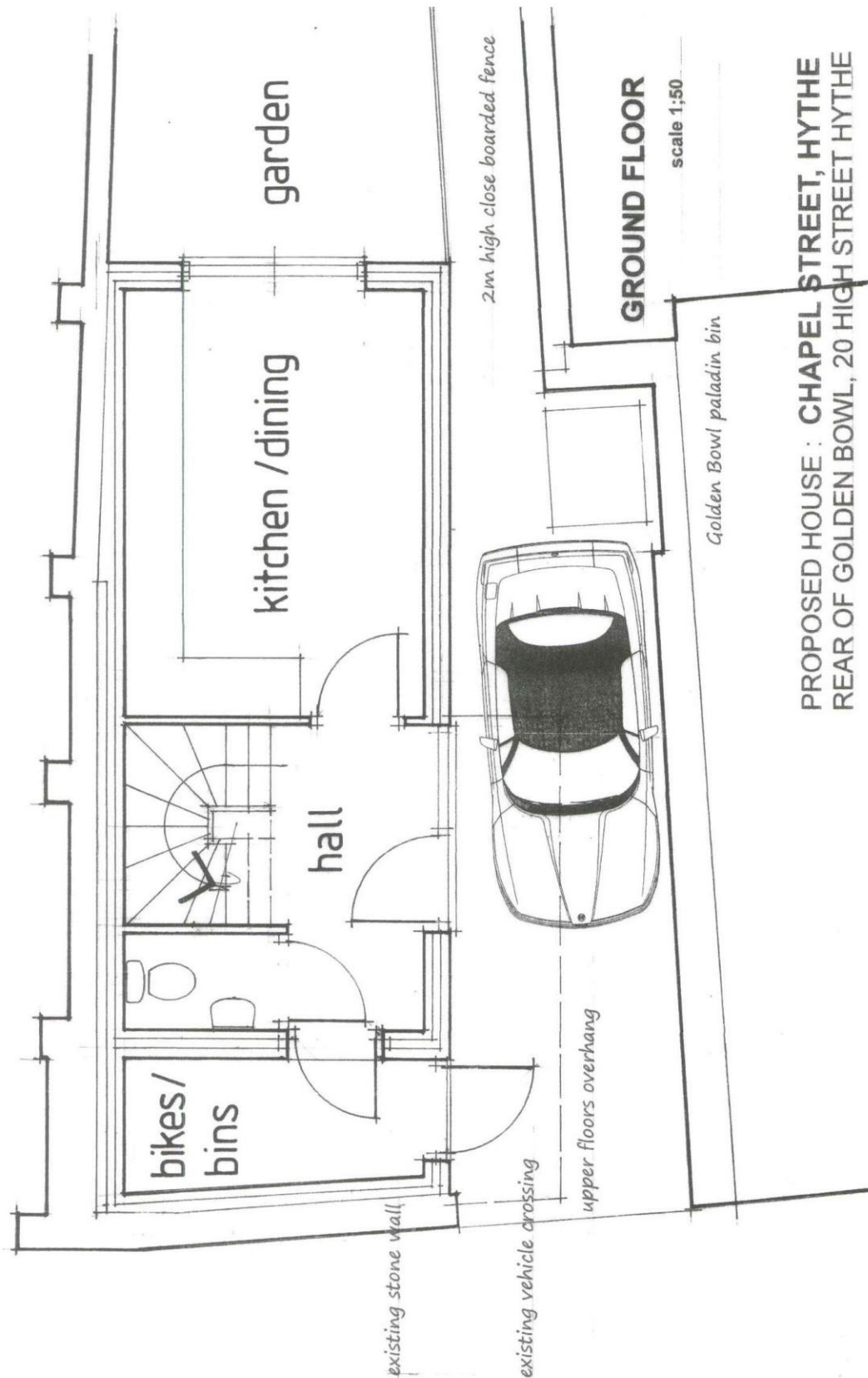


Figure A3.1 Site Layout – Ground Floor



PROPOSED HOUSE : CHAPEL STREET, HYTHE
 REAR OF GOLDEN BOWL, 20 HIGH STREET HYTHE

1038/01

Figure A3.2 Street Elevation

1038/09

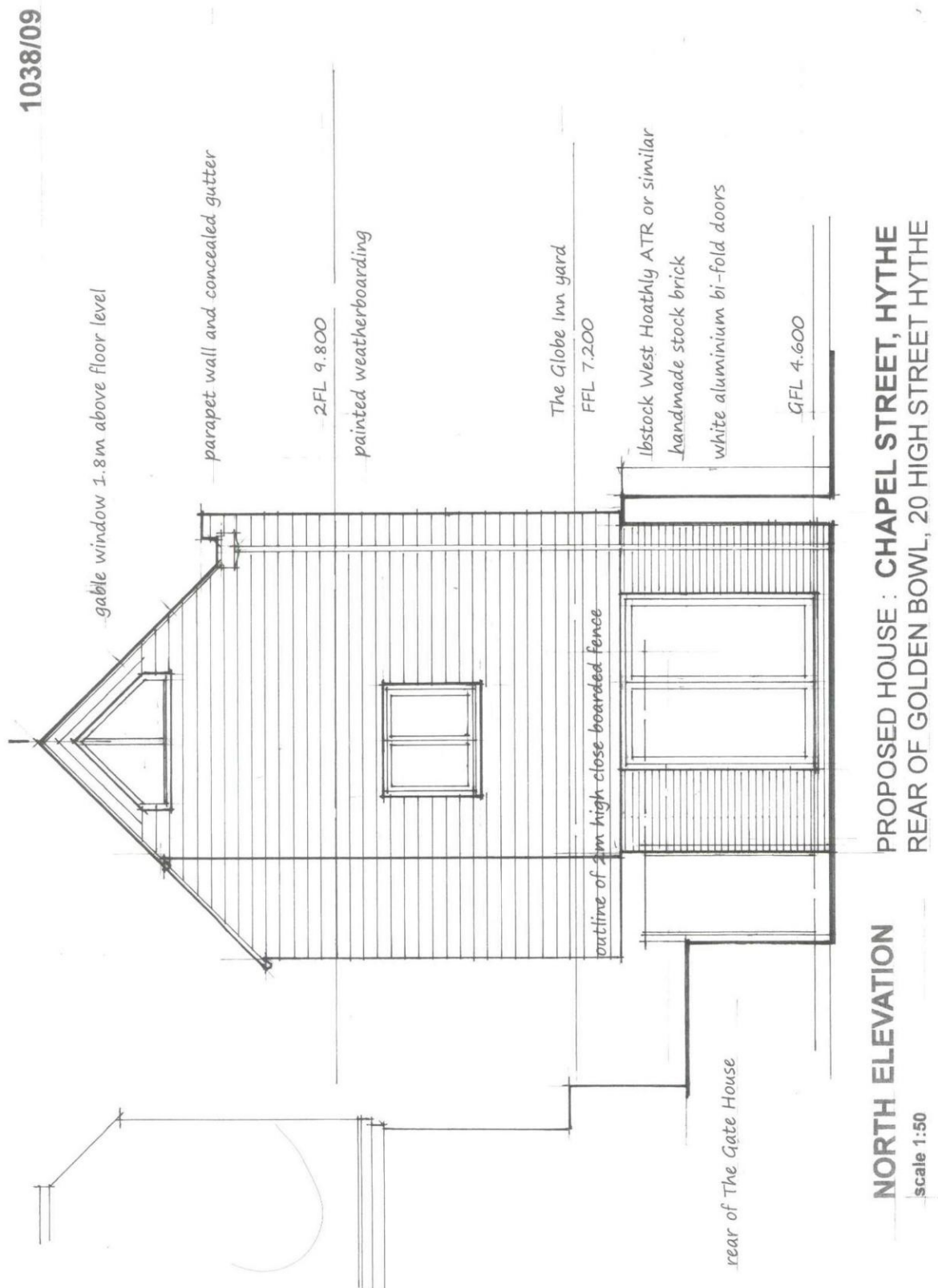


Figure A3.3 North Elevation

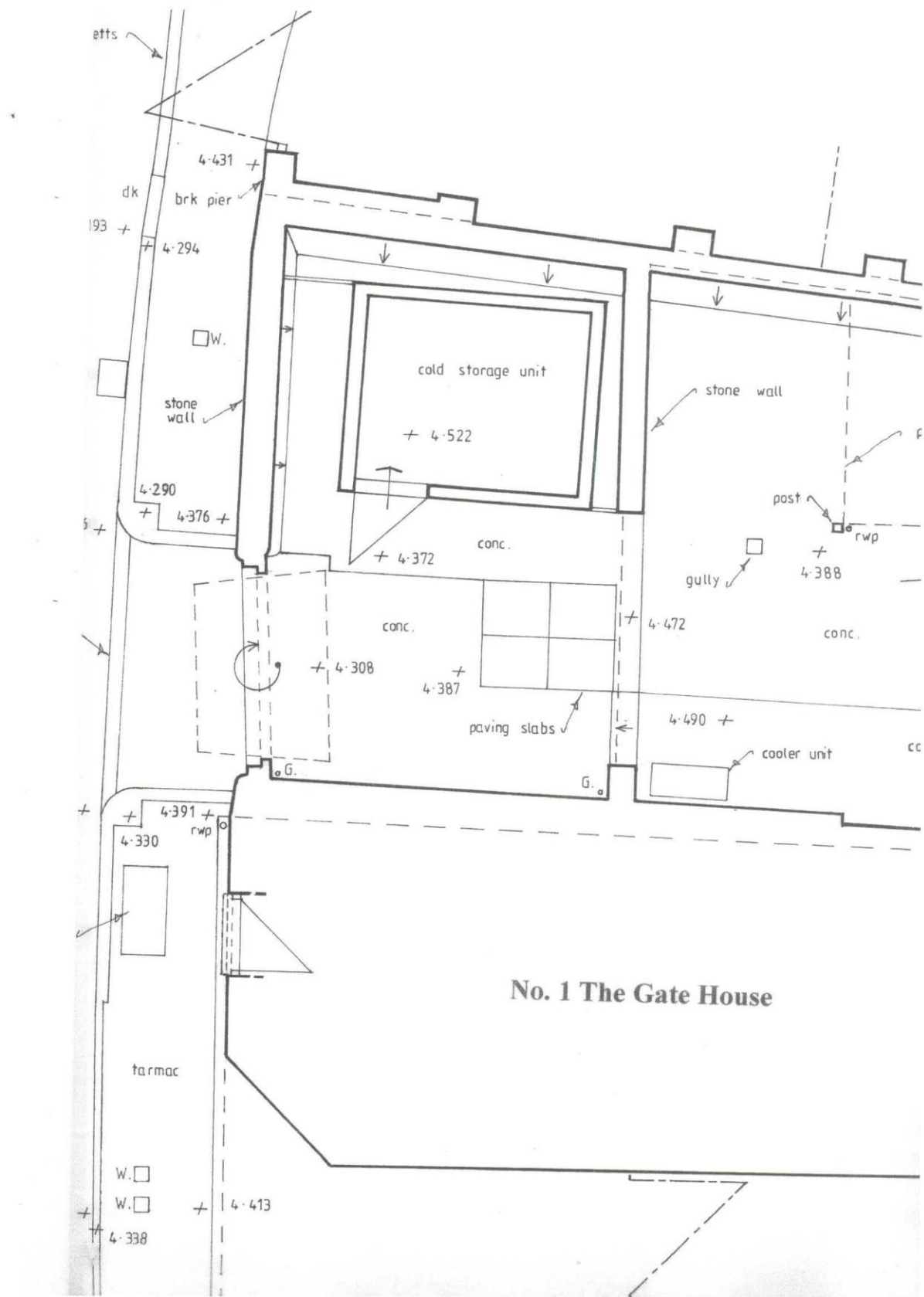


Figure A4. Topography survey

APPENDIX – B: CORRESPONDENCE

Ref: Y18/0025/SH / LD
Direct Dial: 01303 853538
E-mail: planning@shepway.gov.uk
Date: 19th January 2018

Mr K Kennelly
C/o Mr K Barker
Keith Barker Designignn
25 Lucy Avenue
Broadmead Village
Folkestone
CT19 5UF

Dear Sir / Madam,

INVALID APPLICATION

APPLICATION NUMBER: Y18/0025/SH/INVALID

LOCATION: REAR OF 20 HIGH STREET, HYTHE, KENT CT21 5AT

I acknowledge receipt of your application which was received on 8th January 2018.

Unfortunately the application is invalid and until we receive the following information, it cannot be registered or progressed any further:

1. The proposed development may be Community Infrastructure Levy (CIL) liable so the application must be accompanied by a completed CIL Additional Information Form. A copy of the form can be downloaded here https://ecab.planningportal.co.uk/uploads/1app/forms/cil_questions.pdf.
2. According to our records the site is situated within a flood zone and it will therefore be necessary to provide a Flood Risk Assessment unless you can obtain a letter from the Environment Agency stating that one is not required. Even if a statement is not required please provide details showing the ground and levels in accordance to Ordnance Datum Newlyn.
3. An archaeological desktop assessment is required to be submitted as the site is within an area where the presence of buried archaeology is known or suspected (within an area of archaeological potential). This should take into consideration all known records relating to the site to gauge the archaeological potential of a site and understand how best to work with and protect it during development.

Please resubmit with the information requested **quoting the Y18/0025/SH/INV application number above** within 21 days from the date of this letter. If sending via email, please send to the planning inbox (planning@shepway.gov.uk) and not to myself.

Please note – If you have paid a fee then your payment has been processed, but the application will remain invalid and will not be progressed until the required information has been provided. If we do not receive this information within 21 days or you notify us in writing that you do not wish to proceed with the application, your payment will be refunded.

Yours faithfully



Miss Louise Daniels
Planning Officer

KSL 79272 UE - RE: 180307/nw21 FW: Data Request to carry out a flood risk assessment for the Land at Chapel Street, Hythe. Rear of 20 High Street CT21 5AT

KSL Enquiries

<ksle@environment-agency.gov.uk>

4/4/2018 10:00

To vidura.vithana@brightonconsulting.co.uk

Dear Vidura

RE: KSL 79272 UE - RE: 180307/nw21 FW: Data Request to carry out a flood risk assessment for the Land at Chapel Street, Hythe. Rear of 20 High Street CT21 5AT

Thank you for your enquiry which was received on 05 March 2018.

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

Please find attached Product 4. Please refer to the Open Government

Licence<<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>> which explains the permitted use of this information.

Please be aware that the Environment Agency supply data, but we do not interpret it for use in a Flood Risk Assessment. Flood Risk Assessment's should be completed by a suitably competent and qualified person.

You may be interested in the following guidance / information publically available:

* 'Planning Practice Guidance' - provides information about planning considerations in areas at risk of flooding.
<http://planningguidance.planningportal.gov.uk/><https://urldefense.proofpoint.com/v2/url?u=http-3A__planningguidance.planningportal.gov.uk_&d=CwMFAG&c=cUkzcZGZt-E3UgRE832-4A&r=1UyPKAlYr-sXK3vLo-yIBly9gc5jlvil7vCC0nYsP1k&m=kBuyRXGXO0P3FzmnB396K_FZi8UQjMq0wcF7GqsJW34&s=6qKuAkPjo2_r0Uda8EwUYXQlt1TFsyZfVXiHak3fiWY&e=>

* 'Planning applications: assessing flood risk' - information about completing Flood Risk Assessments. <https://www.gov.uk/planning-applications-assessing-flood-risk><https://urldefense.proofpoint.com/v2/url?u=https-3A__www.gov.uk_planning-2Dapplications-2Dassessing-2Dflood-2Drisk&d=CwMFAG&c=cUkzcZGZt-E3UgRE832-4A&r=1UyPKAlYr-sXK3vLo-yIBly9gc5jlvil7vCC0nYsP1k&m=kBuyRXGXO0P3FzmnB396K_FZi8UQj

Mq0wcF7GqsJW34&s=YEWxhc0PCKTzrU0DaAsErWfOBdH3hFZoHS3tHVnE7Kg&e=>

* 'Site specific flood risk assessment: Checklist' - a checklist to help ensure you have considered all the relevant factors in your flood risk assessment.

<http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/site-specific-flood-risk-assessment-checklist/><https://urldefense.proofpoint.com/v2/url?u=http-3A__planningguidance.planningportal.gov.uk_blog_guidance_flood-2Drisk-2Dand-2Dcoastal-2Dchange_site-2Dspecific-2Dflood-2Drisk-2Dassessment-2Dchecklist_&d=CwMFAg&c=cUkzcZGZt-E3UgRE832-4A&r=1UyPKAlYr-sXK3vLo-ylBly9gc5jlvil7vCC0nYsP1k&m=kBuyRXGXO0P3Fzmnbn396K_FZi8UQjMq0wcF7GqsJW34&s=6rxkBfFNS6ZE4n06iUciFan36xazJ1bBD8RTKRdnHv4&e=>

* Climate change allowance guidance - (for a product 4 including fluvial information)

We attach a copy of the Kent and South London guidance. The guidance will vary slightly from area to area. This is due to the different characteristics of river basins in each area.

We recommend that you discuss your proposals with the Local Planning Council at the earliest opportunity. They will be able to advise you on a wide range of planning matters in addition to flood risk.

Environment Agency pre application service

We are able to supply a preliminary opinion outlining the key environmental issues and opportunities which is free. For more detailed advice, guidance, review of draft report, meetings etc we can organise a cost recovery agreement which is charged at £84 per hour.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297018/LIT_9015_c2822b.pdf

We encourage early discussions to ensure environmental issues and opportunities are considered early in the planning process. If you would like a free preliminary opinion or our cost recovery service please complete the form in the link below and email back to kslplanning@environment-agency.gov.uk<<mailto:kslplanning@environment-agency.gov.uk>>

Please refer to the Open Government

Licence<https://urldefense.proofpoint.com/v2/url?u=http-3A__www.nationalarchives.gov.uk_doc_open-2Dgovernment-2Dlicence_version_3_&d=CwMFAg&c=cUkzcZGZt-E3UgRE832-4A&r=1UyPKAlYr-sXK3vLo-ylBly9gc5jlvil7vCC0nYsP1k&m=kBuyRXGXO0P3Fzmnbn396K_FZi8UQjMq0wcF7GqsJW34&s=OcubBFlyDiHvinfEXq_hsyJjOLThk2PUvWbNV-5t-kQ&e=>> which explains the permitted use of this information

I trust this information is of use. If you have any further questions, please contact us and we will be happy to help.

Please Note - The data provided in this flood data product does not include the new climate change allowances published on gov.uk<https://urldefense.proofpoint.com/v2/url?u=http-3A__gov.uk&d=CwQFAG&c=cUkzcZGZt-E3UgRE832-4A&r=1UyPKAlYr-sXK3vLo-ylBly9gc5jlvil7vCC0nYsP1k&m=kBuyRXGXO0P3Fzmnbn396K_FZi8UQjMq0wcF7GqsJW34&s=LsK1SLjZHHu3W91ifGllacD60v-K-mgySisD7qofGDU&e=> on 19/02/2016. See further note within the data product.

If you have any further queries or if you'd like us to review the information we have provided under the Freedom of Information Act 2000 and Environmental Information Regulations 2004 please contact us within two months and we will happily do this for you.

We would be really grateful if you could spare five minutes to help us improve our service. Please click on the link below and fill in our survey - we use every piece of feedback we receive:http://www.smartsurvey.co.uk/s/EnvironmentAgencyCustomerSurvey/?a=KSL&https://urldefense.proofpoint.com/v2/url?u=http-3A__www.smartsurvey.co.uk_s_EnvironmentAgencyCustomerSurvey_-3Fa-3DKSL&d=CwMFAG&c=cUkzcZGZt-E3UgRE832-4A&r=1UyPKAlYr-sXK3vLo-ylBly9gc5jlvil7vCC0nYsP1k&m=kBuyRXGXO0P3Fzmnbn396K_FZi8UQjMq0wcF7GqsJW34&s=lmxGxEqkwlavh5gkddPrr8vEqllUsSuiwSBI93WJyl8&e=>

Kind regards
Laura

Laura Buschini
Customers & Engagement Officer
Kent South London & East Sussex

Environment Agency | 0208 4749353 | Jabber 49353 | Orchard House | Endeavour Park | London Road | West Malling | Kent | ME19 5SH
[Email_footer_419x75 copy]<<http://www.gov.uk/floodsdestroy>>

APPENDIX – C: FLOOD PLAN

Personal flood plan

Name



Which flood warnings are you registered to receive?

River:

Quickdial no:

Reach:

General contact list	Company name	Contact name	Telephone
Floodline	Environment Agency		0845 988 1188
Electricity provider			
Gas provider			
Water company			
Telephone provider			
Insurance company and policy number			
Local council			
Local radio station			
Travel/weather info			

Key locations

Service cut-off	Description of location
Electricity	
Gas	
Water	

Who can help?

Relationship	Name	Contact details	How they can help?
Relative			
Friend or neighbour			

Be prepared for flooding. Act now

Personal flood plan

What can I do NOW?



Put important documents out of flood risk and protect in polythene ☐

Check your insurance covers you for flooding ☐

Look at the best way of stopping floodwater entering your property ☐

Make a flood plan and prepare a flood kit ☐

Find out where you can get sandbags ☐

Identify who can help you ☐

Identify what you would need to take with you if you had to leave your home ☐

Understand the flood warning codes ☐

What can you do when you receive a flood warning?

Actions	Location
Home	
● Move furniture and electrical items upstairs	
● Put flood boards, polythene and sandbags in place	
● Make a list now of what you can move upstairs or away from the risk	
● Turn off electricity, water and gas supplies	
● Roll up carpets and rugs	
● Unless you have time to remove them hang curtains over rods	
● Move sentimental items to safety	
● Put important documents in polythene bags and move to safety	
Garden and outside	
● Move your car out of the flood risk area	
● Move any large or loose items or weigh them down	
Business	
● Move important documents, computers and stock	
● Alert staff and request their help	
● Farmers move animals and livestock to safety	
Evacuation - Prepare a flood kit in advance	
● Inform your family or friends that you may need to leave your home	
● Get your flood kit together and include a torch, warm and waterproof clothing, water, food, medication, toys for children and pets, rubber gloves and wellingtons	

Be prepared for flooding. Act now

APPENDIX – D: SURFACE WATER STORAGE CALCULATION

Calculated by: Vidura Vithana
Site name: 20 High St.
Site location: Hythe

Site coordinates

Latitude: 51.07120° N
Longitude: 1.08086° E

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the drainage scheme.

Reference: 6340324
Date: 2018-04-07T07:54:37

Methodology

IH124

Site characteristics

Total site area (ha)	.023
Significant public open space (ha)	0
Area positively drained (ha)	0.023
Pervious area contribution (%)	30
Impermeable area (ha)	0.015
Percentage of drained area that is impermeable (%)	65
Impervious area drained via infiltration (ha)	0
Return period for infiltration system design (year)	10
Impervious area drained to rainwater harvesting systems (ha)	0
Return period for rainwater harvesting system design (year)	10
Compliance factor for rainwater harvesting system design (%)	66
Net site area for storage volume design (ha)	0.02
Net impermeable area for storage volume design (ha)	0.02

* Where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50 % of the 'area positively drained', the 'net site area' and the estimates of Qbar and other flow rates will have been reduced accordingly.

Design criteria

Volume control approach	Use long term storage	
	Default	Edited
Climate change allowance factor	1.4	1.4
Urban creep allowance factor	1.1	1.1
Interception rainfall depth (mm)	5	5
Minimum flow rate (l/s)	5	5
Qbar estimation method	Calculate from SPR and SAAR	
SPR estimation method	Calculate from SOIL type	
	Default	Edited
Qbar total site area (l/s)	0.04	--
SOIL type	2	2
HOST class	N/A	N/A
SPR	0.3	0.3

Hydrology

	Default	Edited
SAAR (mm)	708	708
M5-60 Rainfall Depth (mm)	20	20
'r' Ratio M5-60/M5-2 day	0.4	0.4
Rainfall 100 yrs 6 hrs	63	
Rainfall 100 yrs 12 hrs	92.4	
FEH/FSR conversion factor	1.2	1.2
Hydrological region	7	
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 10 year	1.62	1.62
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Site discharge rates

	Default	Edited
Qbar total site area (l/s)	0.04	0.04
Qbar net site area (l/s)	0.04	0.04
1 in 1 year (l/s)	5	5
1 in 30 years (l/s)	5	5
1 in 100 years (l/s)	5	5

Estimated storage volumes

	Default	Edited
Interception storage (m³)	1	1
Attenuation storage (m³)	0	0
Long term storage (m³)	0	0
Treatment storage (m³)	2	2
Total storage (excluding treatment) (m³)	1	1

This report was produced using the Storage estimation tool developed by HR Wallingford and available at 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 <http://uksuds.com/terms-and-conditions.htm>. The outputs from this tool have been used to estimate storage volume requirements. 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, CEH, Hydrosolutions or any other organisation for use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX – E: RECOMMENDED FLOOD RESILIENT MEASURES

Component	Recommended materials and methods for flood resilience
Flooring	- Concrete ground supported (pre-cast or in situ) or - Timber floors, fully sealed, made of marine plywood - D.p.m. - impermeable polythene membranes at least 1200 gauge with overlaps of 300mm and also 50mm taping overlap
Floor covering	- Clay tiles or Rubber sheet floors or Vinyl sheet floors/skirting - Use water resistant cement and grout
Internal partitions	Engineering bricks with waterproof mortar/Lime based plasters
External walls – to Max flood level (assumed 0.9m, i.e. from finished floor level to window sill level)	- Engineering bricks (Class A and B) or Reinforced concrete - Cement or Cement/lime renders - Mortars Cement :Sand – 1:3 below DPC, 1:6 above DPC - Auto closing air vents (ex: SMART AirBrick) - sealed and waterproof cover boards on doors
Sealing cracks / Weep holes / service inlets and service entry and exit points; duct sealing products, sealing external doors/windows	Silicone or similar products
Sewers/appliances	Anti-back flow valves for sewer pipes/Non-return valves
Doors	- Epoxy sealed/waterproof PVC, Aluminium or steel doors or - Timber doors fitted and sealed to frames
Insulation	Foam or closed cell types
Windows	- Made of Plastic or metal - Double glazed units and set in waterproof seals - Epoxy sealed timber with waterproof glues and steel or brass fittings
White goods, boiler, refrigerator	- Raise 300mm or more above the finished floor level on plinths. - Electric wiring above flood level