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Flood Risk Assessment and outline SuDS strategy

For the proposed dwellings at

Porthcreassa, Isle of Scilly.

TQ21 0JR

Prepared by

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Innervision Design Ltd

March 2022

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design

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1 Executive Summary

A The developed area of the site lies wholly within Flood Zone 1;

B There is no documented evidence of flood risk from any other sources;

C Residual risk can be managed by appropriate floor levels and resilience measures;

D Safe access and egress will be available subject to advance warning;

E Surface water arising is to be managed on site via direct outfall to the sea;

F The development does not impact on flood risk elsewhere; and assuming the mitigation, warning and evacuation procedures can be maintained over the lifetime of the development the proposed development consisting of a two dwelling houses located within Flood Zone 1 is considered acceptable.

2 Introduction

2.1 Site location

The proposed site is on land at Porthcreassa, Isle of Scilly, TR21 0JQ (see Figure 1). The site is located immediately to the East of Porthcreassa bay.

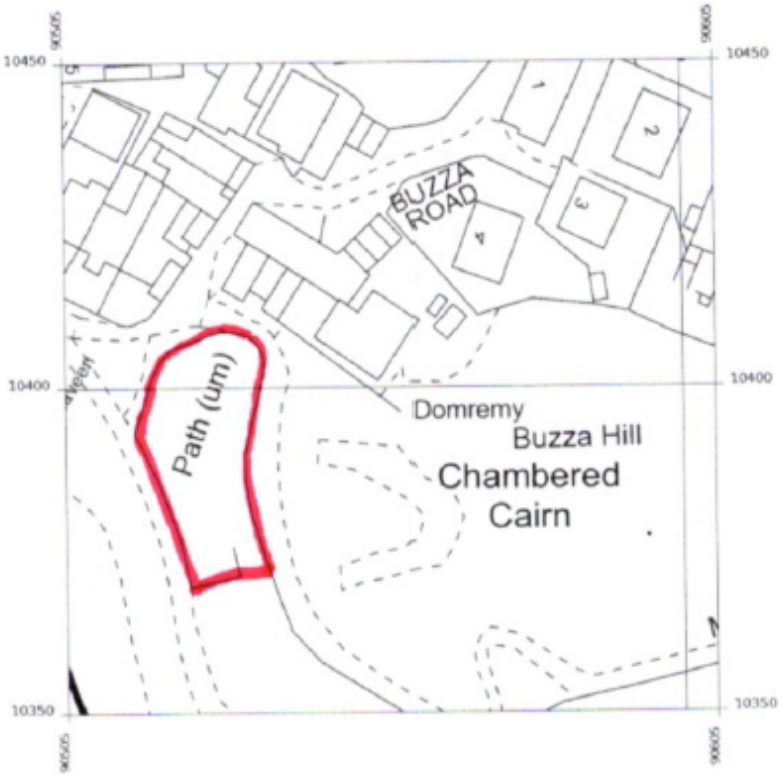


Figure 1: Site location plan, as indicated.

2.2 Development description

The proposal is for two new dwellings together with associated landscaping.

2.3 Site geology

Geological mapping data from within the vicinity indicate Isles Of Scilly Intrusion - Granite.

3 Policies

In preparation for this Flood Risk Assessment (FRA), National Planning Policy Framework[5] and British Standards on Assessing and Managing Flood Risk[2] were reviewed, and their related policies were referred to in this report.

Furthermore, the Environment Agency was consulted in order to establish the flood zone of the proposed site. In addition, planning policies from the local Council were also reviewed including its Strategic Flood Risk Assessment.

Some of key planning policies are summarised as below.

3.1 National Planning Policy Framework (NPPF)

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

3.1.1 Paragraph 158 - Sequential test

The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.

3.1.2 Paragraph 163

When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

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

- the development is appropriately flood resilient and resistant;
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

4 Flood risk analysis

4.1 Sources of potential flooding

Flood risk from various sources at the site is analysed in this section. It is concluded that the site is not at direct flood risk but is however at a residual risk from tidal overtopping events.

4.1.1 Flood risk from sea and rivers

Flooding can take place from flows that are not contained within the channel due to high levels of rainfall in the catchment.

The site is not at risk from fluvial flooding.

Flooding can occur from the sea due to a particularly high tide or surge, or combination of both.

The site is not at risk from direct tidal flooding.

Figure 2: Site location relative to Flood Zones 2 and 3. The extent here is the undefended 1 in 200yr + Climate change.

4.1.2 Historic flood events

Non identified.

4.1.3 Flood risk from groundwater

Groundwater flooding occurs when water levels in the ground rise above surface levels. It is most common in low-lying areas underlain by permeable rock (aquifers), usually due to extended periods of wet weather.

Based on the local granite geology, and noting there are no basements proposed this site is considered to be at a very low risk form ground water flooding.

4.1.4 Flood risk from sewer and highway drains

Flooding occurs when combined, foul or surface water sewers and highway drains are temporarily over-loaded due to excessive rainfall or due to blockage.

With reference to the council's SFRA there is no documented evidence of flood risk from highway drainage networks at the proposed site.

Hence, the risk of sewer and highway flooding to the proposed site can be considered to be Low.

4.1.5 Flood risk from surface water

Flooding occurs when rainfall fall on a surface (on or off the site) which acts as runoff which has not infiltrated into the ground or entered into a drainage system.

The site is at Low risk from Surface water flooding associated with the adjacent road and river channel. The site is not shown to be at risk from surface water flooding Figure 3.

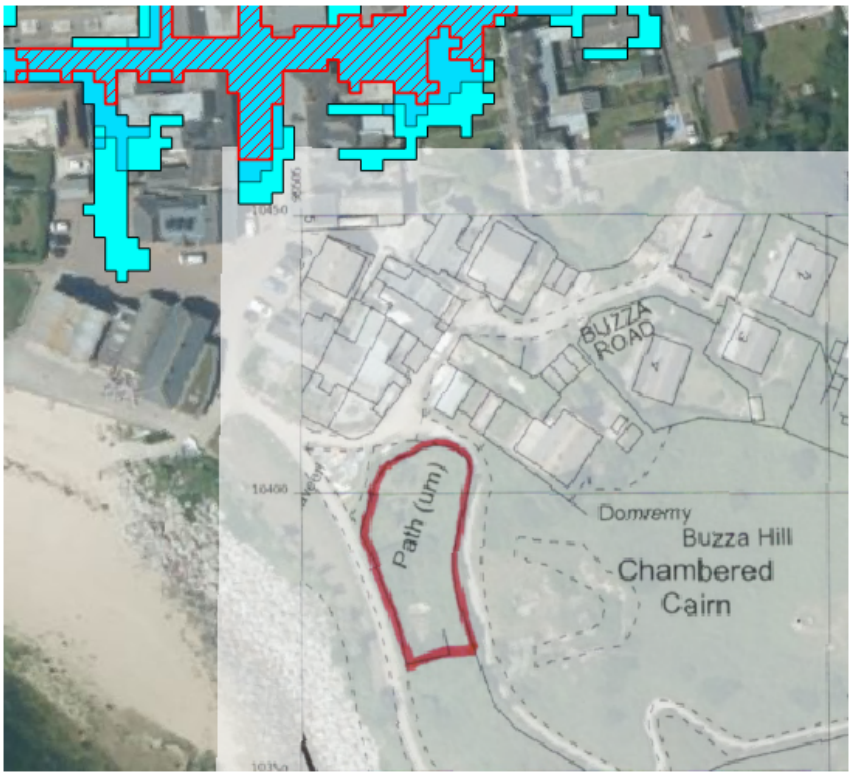


Figure 3: Area at risk from design period 1 in 1001yr surface water flooding relative to proposed development. (Source: EA RoFSW data)

4.1.6 Flood risk from infrastructure failure

The site is not shown to be at flood risk due to reservoir failure.

Hence the flood risk to the site from reservoir failure is considered to be Low.

4.1.7 Impact on flood risk elsewhere

Compensation storage volume

Not required

Surface water arising

In line with NPPF para 163, all surface water arising must be managed in full alignment with the SuDS hierarchy as required under provisions made under the Town and Country Planning Act 1990.

While not required for Planning permission consent all SW on site must be also be designed, installed and tested in full accordance with Part H of the Building Regulations 2010 (as amended 2013), Requirement H3, as made under the Building Act 1984.

By the managing surface water on site, in line with best practice and Building Regulations Statues the development will not increase flood risk elsewhere.

4.2 Sequential test

With he site is shown to lay wholly in Flood Zone 1, the flood risk sequential test is therefore required to be passed.

4.3 Flood risk vulnerability and flood zone "compatibility"

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	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

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

Figure 4: Flood risk vulnerability and flood zone compatibility[4]

With reference to Figure 4, the proposed development is classified as "More Vulnerable" and has been shown to lie in Flood Zone 1 (refer to Section 4.1.1). This is considered to be appropriate development.

5 Levels

5.1 Ground levels

5.1.1 On site

The lowest point on the site is found to be 6.12m AOD.

At the footprint of the Southerly dwelling the elevation is 6.18m AOD.

5.1.2 At the line of defence

The site is separated from the tidal waters by an strip of elevated ground, the top of which is shown to coincide with the extents of the 1 in 200yr + CC projected to 2117 undefended flood extent.

The height of this raised ground is found to be 7.035m AOD, see Figure 5.

Figure 5: Section through defence and site as indicated.

5.2 Flood level data

Design period 1 in 200y+ CC flood levels are estimated in relation to the top of the defence as 7.035m.

5.2.1 Freeboard

A minimum 300mm should be provided.

5.2.2 Floor levels - Southern plot

All floor levels to be no less than 7.035 + 0.3 = **7.34m AOD**

Site levels indicate that existing ground level at the location of the Southern most proposed dwelling range from 6.183m at the West side to 6.8m on the East side.

FFL of the ground floor will therefore need to be circa 1.5m above external ground levels at the West and 0.54m on the East side.

5.2.3 Floor levels - Northern plot

All floor levels to be no less than 7.035 + 0.3 = **7.34m AOD**

Site levels indicate that existing ground level at the location of the Northern most proposed dwelling range from 6.88m at the West side and rising steeply to 9.5m on the East side.

FFL of the ground floor will therefore need to be circa 0.46m above external ground levels at the West.

5.2.4 Floor level residual risk

Where this is not possible the design must incorporate flood resilience and resistance and manage the flood risk from any over topping events as a residual risk.

6 Management of residual risk

Any residual risk can be safely managed by the provision floor resilience measures where floor levels cannot be achieved, the provision of safe access and egress, signing up to flood warning schemes and preparation of a domestic flood plans.

6.1 Flood resistance and resilience measures

Although the site is located in Flood Zone 1 (based on revised climate change allowances) a Residual flood risk from an over topping events exist and hence it is a recommendation of this report that flood risk mitigation measures must be incorporated into the development.

In accordance with the document "Improving the Flood Performance of New Buildings - Flood Resilient Construction"[3] a series of design approaches should be planned to mitigate the flood risk based on the flow chart as at Figure 6.

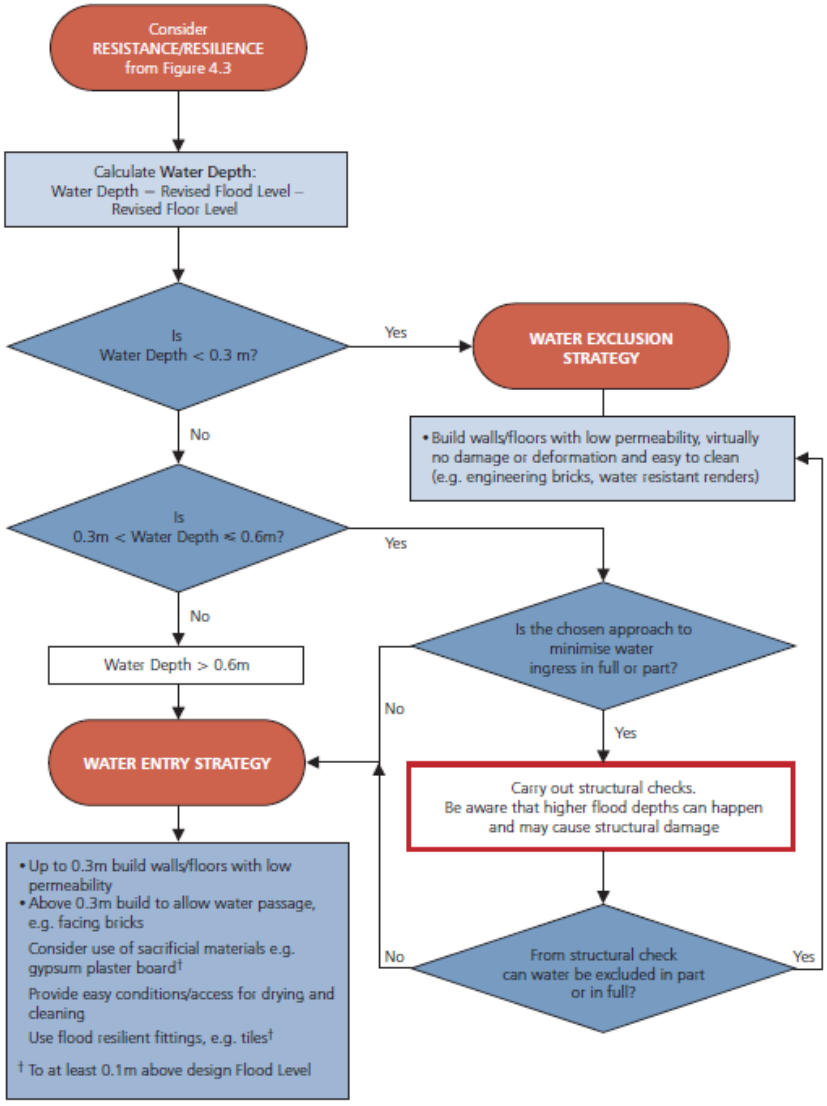


Figure 6: Design strategies for resistance and resilience[3]

Table 1 provides guidance on which materials are most suitable, suitable and unsuitable, when considering construction work involved in this project. This report recommends the use of materials from the "most suitable" column were this is at all possible on site, however they are not mandatory requirements.

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 glues and steel or brass fittings.	Timber with PVA glues and mild steel fittings

Table 1: Summary of Material Suitability for Building Components[1]

6.2 Flood mitigation measures

The designer is also recommended to consider the provision of a combination of the following flood mitigation measures, to be installed if at all practicable, for use within and around the dwellings for use in any flooding event:

- Flood resilient doors: Specifically designed to prevent ingress of flood water - passive system (see also Figure 7).
- Door defence: Bespoke barriers fitted externally across doors and low windows and/or the provision of filled sandbags (see also Figures 8 & 9).

- Anti flood air bricks: Where these are unavoidable, these offer replacements for standard air bricks these prevent water entering the sub floor void - passive system i.e. fully automatic (see also Figure 10).
- Air brick and flue covers (see also Figure 11).
- No service penetrations or other openings (cat flaps and letter boxes included) below 1m above FFL.

Figure 7: UPVC doors under flood conditions. These appear to offer reasonable flood resilience

Figure 8: Flood gate example.

Figure 9: Sand bag defence.

Figure 10: Anti flood air brick. Example from CSI products

Figure 11: Air brick covers. Example from Buffalo products

6.3 Access and Egress

The NPPF stipulates that, where required, safe access and escape routes should be available to/from new developments in flood risk areas. Access routes should be such

that occupants can safely access and exit buildings in design flood conditions.

The site has direct access to Church Street, as shown in Figure 12, hence this will be the proposed access egress route. It is noted that while the site is outside of the predicted flood zone, the access and egress routes are through areas at flood risk. Given the flood risk is tidal these roads will remain flood free for a period of time before the onset of flooding, however advance flood warning is required.

The hazard rating along the escape route is classed as “Low” to “Danger for Some” (Figure 13).

Figure 12: Access/Egress options as indicated.

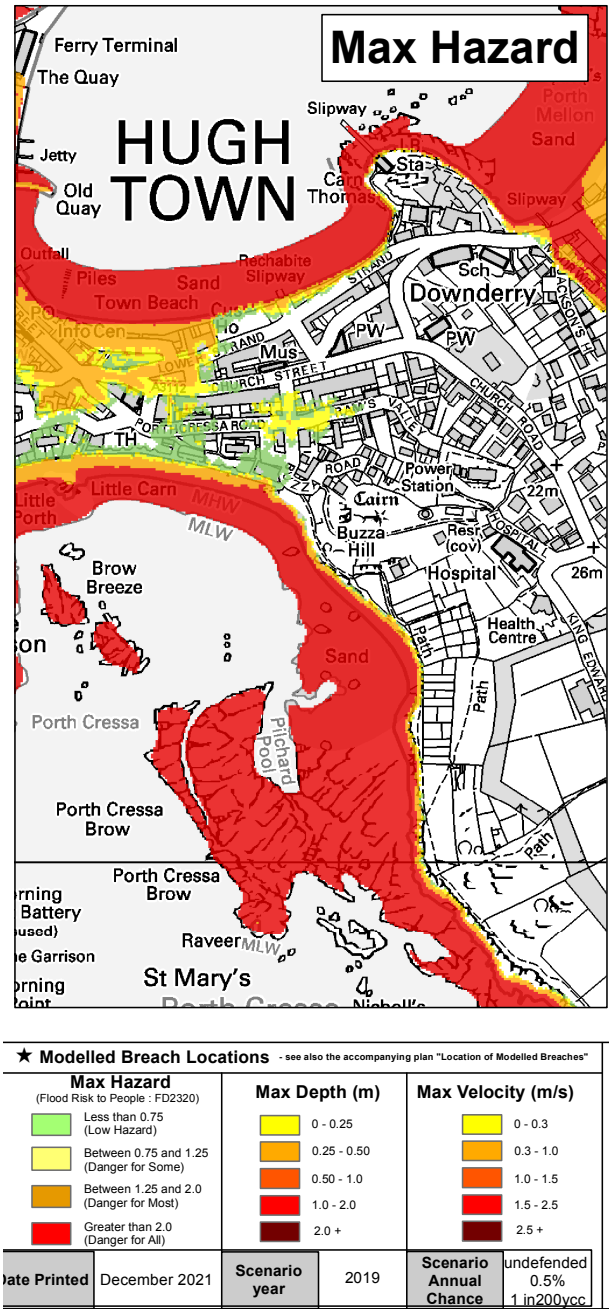


Figure 13: Hazard rating for the undefended (worst case) 1 in 200yr + CC flood event (as provided by the EA -Appendix B)

6.4 Warning schemes

Since it has been established that the site is sited in close proximity to an area at risk of flooding the owners of any dwellings on the site would be advised to sign up to the E.A. "Flood Warnings Direct" which is a free service providing flood warnings by phone, text or email. See `https://www.fws.environment-agency.gov.uk/app/olr/register`, or call the E.A. on 0345 988 1188 for full information.

They should also be made aware of any Island based local warning schemes and procedures.

6.5 Flood Plan

Given the site is at a residual risk from flooding the project team will also provide the owners of any dwelling with a proforma Flood Plan (See Appendix A for an example). The plan will provide guidance on emergency response procedures in the event of flooding to the site. This will:

- Provide details of who to contact and how;
- Provide details of how to turn off gas, electricity and water mains supplies;
- Provide details of designated safe egress routes out of the building and out of the local area at risk;
- Provide details of E.A. Flood warning codes;
- Provide details of local radio stations
- Provide a check list of essential items.

7 Surface water disposal strategy (outline)

7.1 Overview

Given the direct access to the sea the impermeable nature of the bedrock, all surface water arising from the site can be disposed of directly into this tidal water via silt trap gullies at the base of all rainwater pipes (for the removal of gross solids and sediments). Back flow valves will be required on final outfall chambers. Water butts will be installed however to help reduce potable water demand.

Surface water discharging direct to coastal waters is not subject to SuDS requirements.

7.2 Local bylaws

Local bylaw consents to discharge into the sea may be required.

8 Conclusions

Given that:

- The developed area of the site lies wholly within Flood Zone 1;
- There is no documented evidence of flood risk from any other sources;
- Residual risk can be managed by appropriate floor levels and resilience measures;
- Safe access and egress will be available subject to advance warning;
- Surface water arising is to be managed on site via direct outfall to the sea;
- The development does not impact on flood risk elsewhere; and assuming the mitigation, warning and evacuation procedures can be maintained over the lifetime of the development the proposed development consisting of a two dwelling houses located within Flood Zone 1 is considered acceptable.

References

[1] J Wingfield; M Bell; P Bowker. Improving the flood resilience of buildings through improved material, methods and details. Technical Report WP2c, CIRA, 2005.

[2] BSI. BS 8533:2011. Technical report, 2011.

[3] CIRIA, CLG, EA and DEFRA. Improving the flood performance of new buildings. Flood resilient construction, 2007.

[4] Department for Communities and Local Government. Technical guidance to the national planning policy framework. 2018.

[5] Ministry of Housing, Communities and Local Government. National planning policy framework. 2021.

A Emergency flood plan (example)

Personal flood plan

Name

Environment Agency

Are you signed up to receive flood warnings?
If not call Floodline on 0345 988 1188 to see if your area receives free flood warnings.

Let us know when you've completed your flood plan by calling Floodline on **0345 988 1188.** This will help us learn more about how people are preparing for flooding.

General contact list	Company name	Contact name	Telephone
Floodline	Environment Agency		0345 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/who can you help?

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

Be prepared for flooding. Act now

Personal flood plan

What can I do NOW?

Environment Agency

- 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/ who you can help ☐
- 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 if a flood is expected in your area?

Actions	Location
Home	
• Move furniture and electrical items to safety	
• Put flood boards, polythene and sandbags in place	
• Make a list now of what you can move 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	

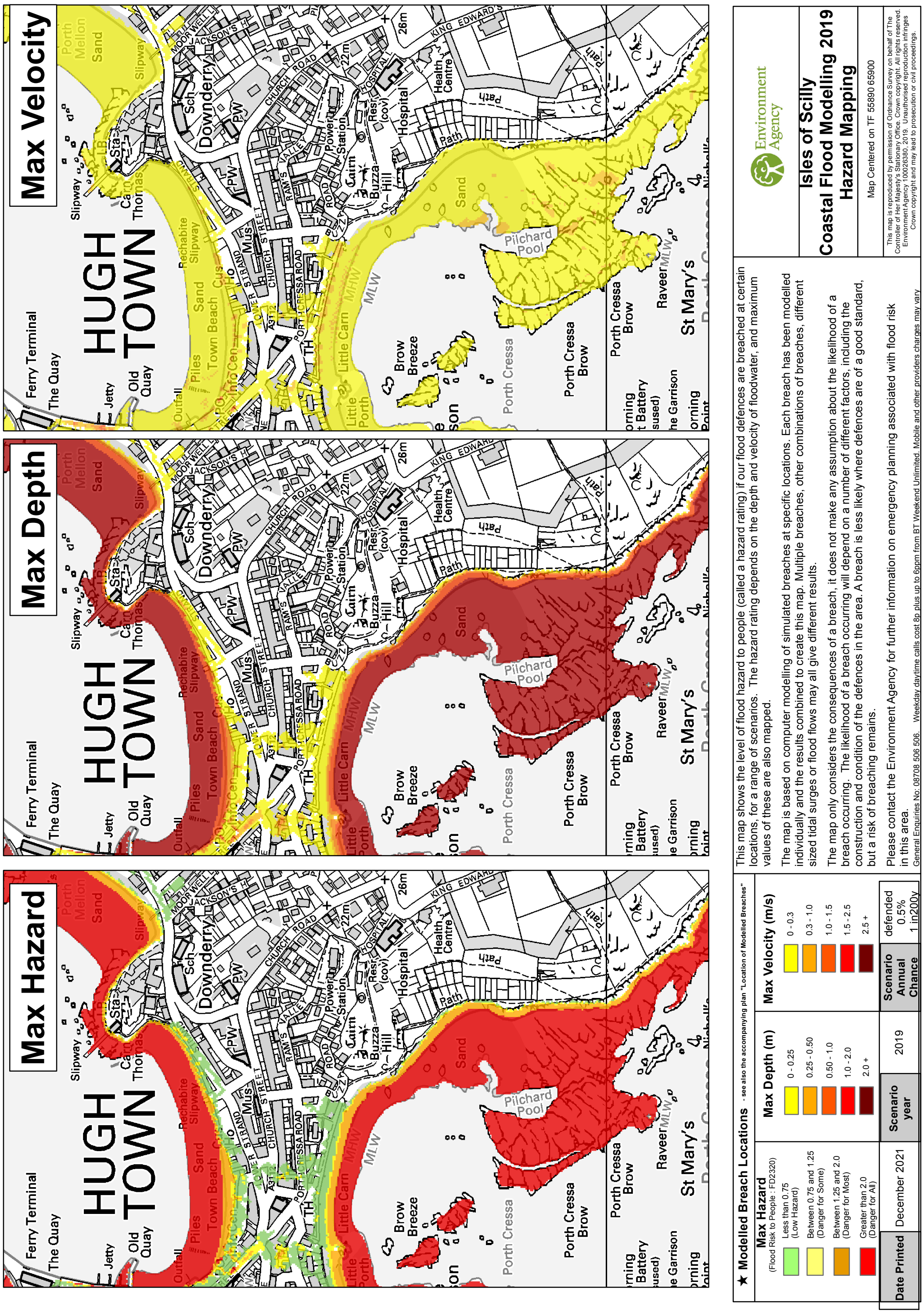
There are a range of flood protection products on the market to help you protect your property from flood damage. A directory of these is available from the **National Flood Forum** at **www.bluepages.org.uk**

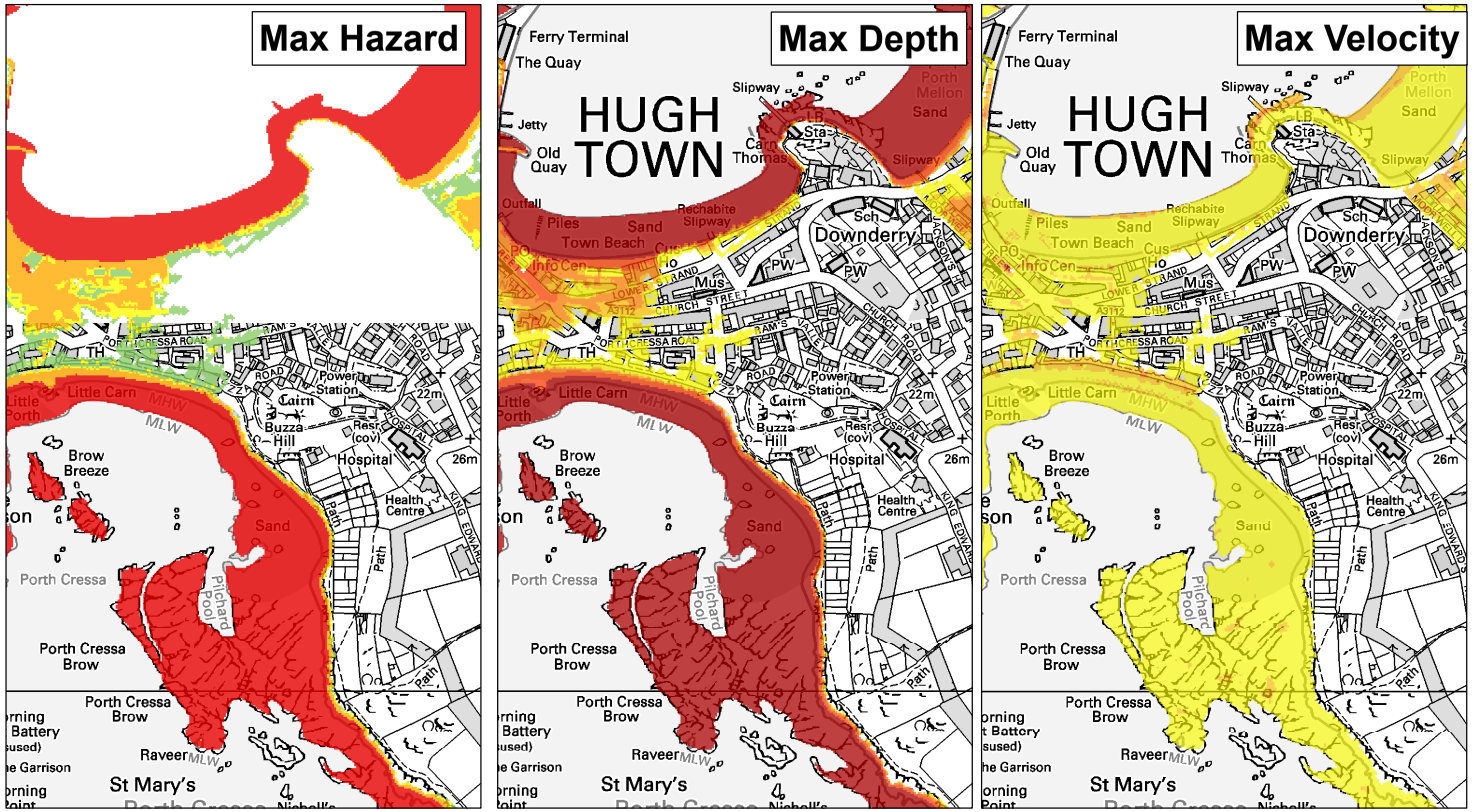
Be prepared for flooding. Act now

GEHO0709BQPU-E-E

Project No. 221875

B EA data


Max Hazard
Max Depth
Max Velocity
HUGH TOWN
Modelled Breach Locations
Max Hazard (Flood Risk to People : FD2320)
Less than 0.75 (Low Hazard)
Between 0.75 and 1.25 (Danger for Some)
Between 1.25 and 2.0 (Danger for Most)
Greater than 2.0 (Danger for All)
Max Depth (m)
0 - 0.25
0.25 - 0.50
0.50 - 1.0
1.0 - 2.0
2.0 +
Max Velocity (m/s)
0 - 0.3
0.3 - 1.0
1.0 - 1.5
1.5 - 2.5
2.5 +
Date Printed December 2021
Scenario year 2019
Scenario Annual Chance defended 0.5% 1 in200y
This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped.
The map is based on computer modelling of simulated breaches at specific locations. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results.
The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely where defences are of a good standard, but a risk of breaching remains.
Please contact the Environment Agency for further information on emergency planning associated with flood risk in this area.
Environment Agency
Isles of Scilly
Coastal Flood Modelling 2019
Hazard Mapping
Map Centered on TF 55890 65900



★ Modelled Breach Locations - see also the accompanying plan "Location of Modelled Breaches"					
Max Hazard (Flood Risk to People : FD2320)		**Max Depth (m)**		**Max Velocity (m/s)**	
Less than 0.75 (Low Hazard)		0 - 0.25		0 - 0.3	
Between 0.75 and 1.25 (Danger for Some)		0.25 - 0.50		0.3 - 1.0	
Between 1.25 and 2.0 (Danger for Most)		0.50 - 1.0		1.0 - 1.5	
Greater than 2.0 (Danger for All)		1.0 - 2.0		1.5 - 2.5	
		2.0 +		2.5 +	
Date Printed	December 2021	**Scenario year**	2019	**Scenario Annual Chance**	defended 0.5% 1 in200ycc

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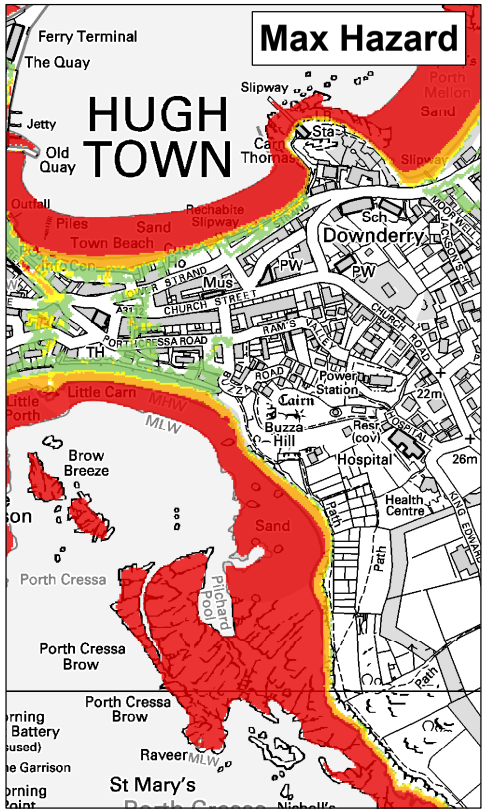
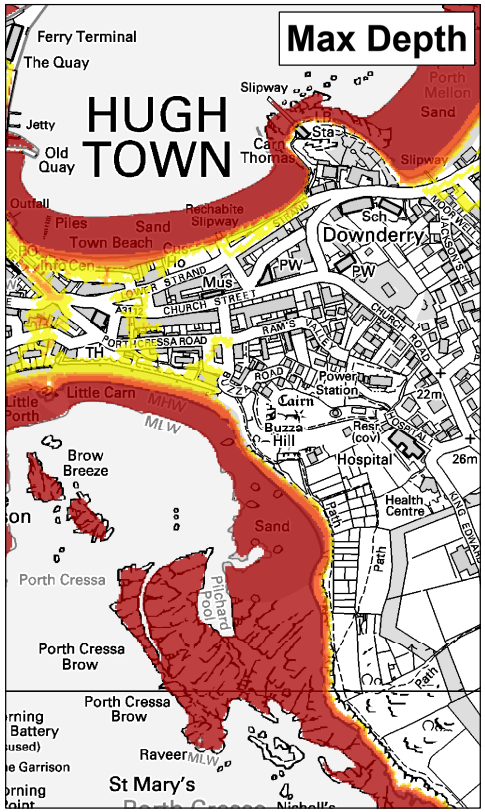
General Enquiries No: 08708 506 506. Weekday daytime calls cost 8p plus up to 6ppm from BT Weekend Unlimited. Mobile and other providers charges may vary

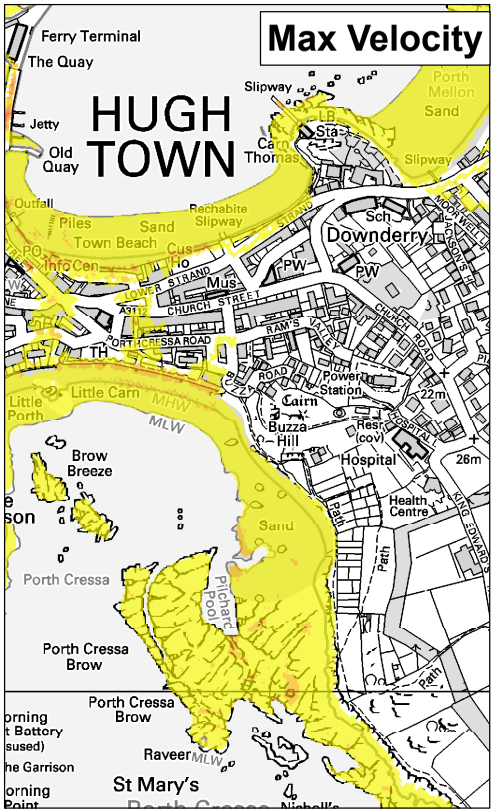
Environment Agency

Isles of Scilly Coastal Flood Modelling 2019 Hazard Mapping

Map Centered on TF 55890 65900







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	2.0 +	2.5 +

Date Printed	December 2021	**Scenario year**	2019	**Scenario Annual Chance**	defended 0.1% 1 in1000y

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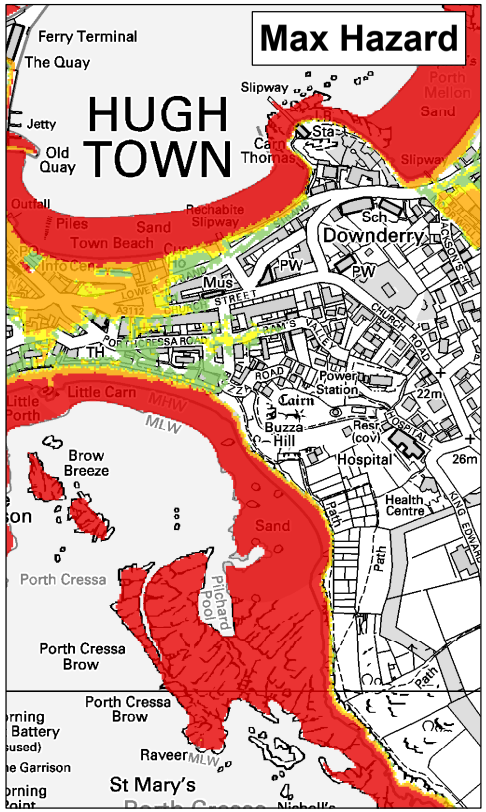

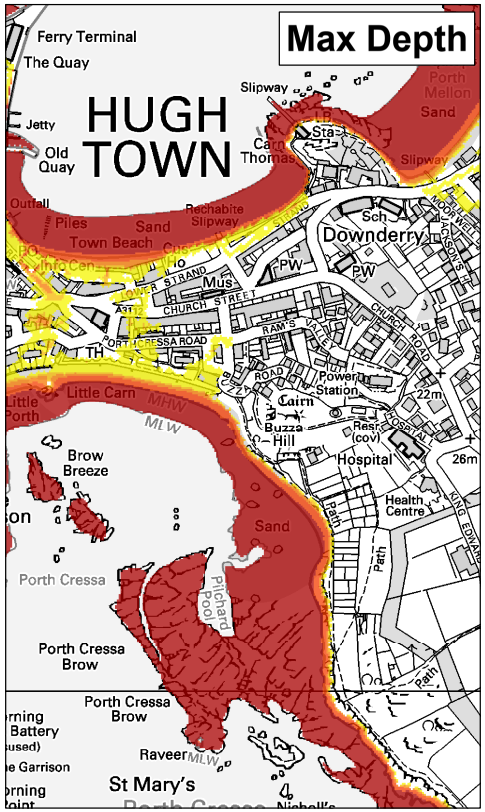

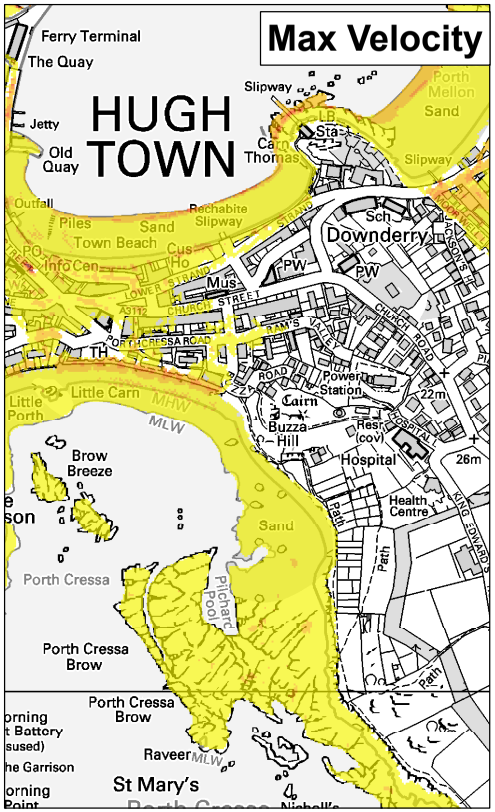

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- Greater than 2.0 (Danger for All)

Max Depth (m)

- 0 - 0.25
- 0.25 - 0.50
- 0.50 - 1.0
- 1.0 - 2.0
- 2.0 +

Max Velocity (m/s)

- 0 - 0.3
- 0.3 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 +

Date Printed	December 2021	**Scenario year**	2019	**Scenario Annual Chance**	defended 0.1% 1 in 1000 ycc

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped.

The map is based on computer modelling of simulated breaches at specific locations. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results.

The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely where defences are of a good standard, but a risk of breaching remains.

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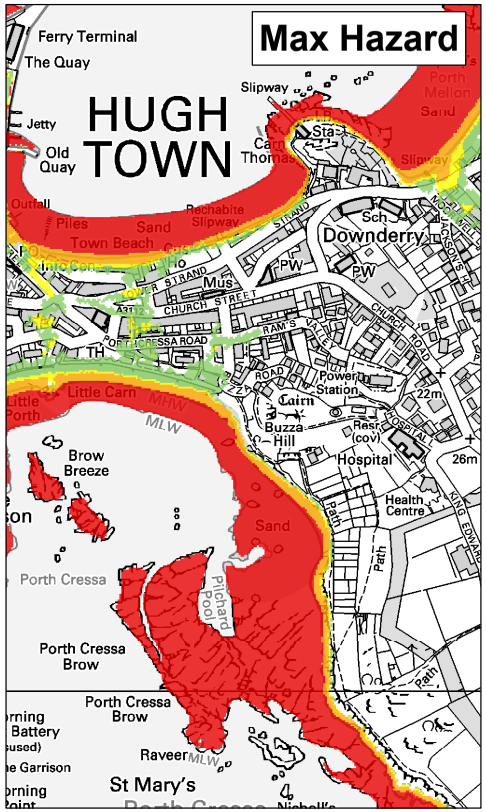
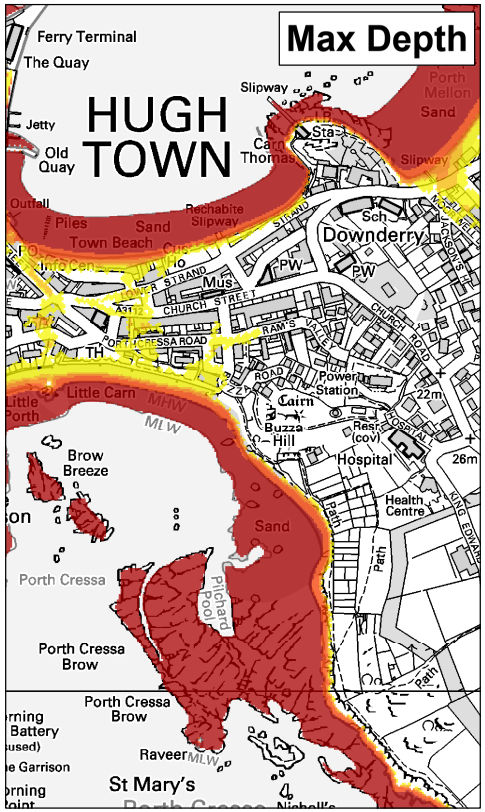
General Enquiries No: 08708 506 506. Weekday daytime calls cost 8p plus up to 6ppm from BT Weekend Unlimited. Mobile and other providers charges may vary

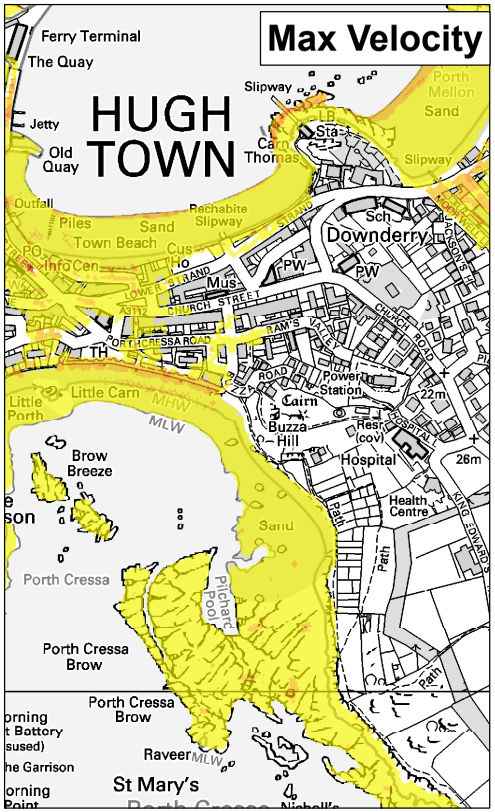
Environment Agency

Isles of Scilly Coastal Flood Modelling 2019 Hazard Mapping

Map Centered on TF 55890 65900







★ **Modelled Breach Locations** - see also the accompanying plan "Location of Modelled Breaches"

Max Hazard
(Flood Risk to People : FD2320)

- Less than 0.75 (Low Hazard)
- Between 0.75 and 1.25 (Danger for Some)
- Between 1.25 and 2.0 (Danger for Most)
- Greater than 2.0 (Danger for All)

Max Depth (m)
0 - 0.25
0.25 - 0.50
0.50 - 1.0
1.0 - 2.0
2.0 +

Max Velocity (m/s)
0 - 0.3
0.3 - 1.0
1.0 - 1.5
1.5 - 2.5
2.5 +

Date Printed	December 2021	**Scenario year**	2019	**Scenario Annual Chance**	undefended 0.5% 1 in200y

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped.

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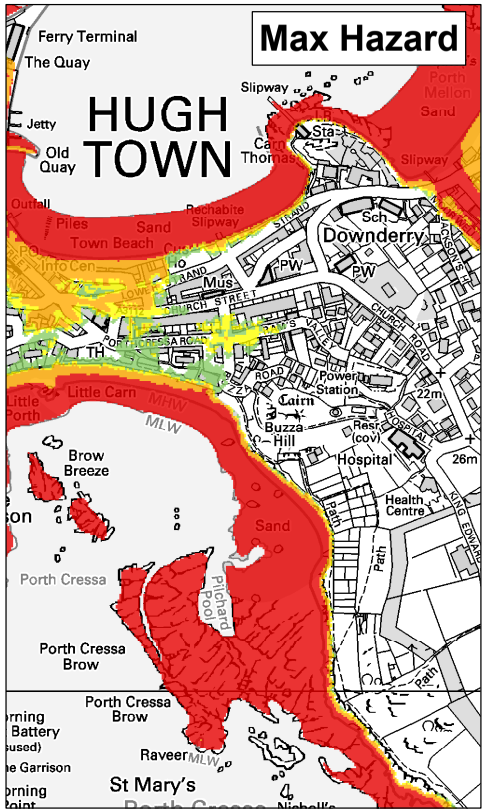
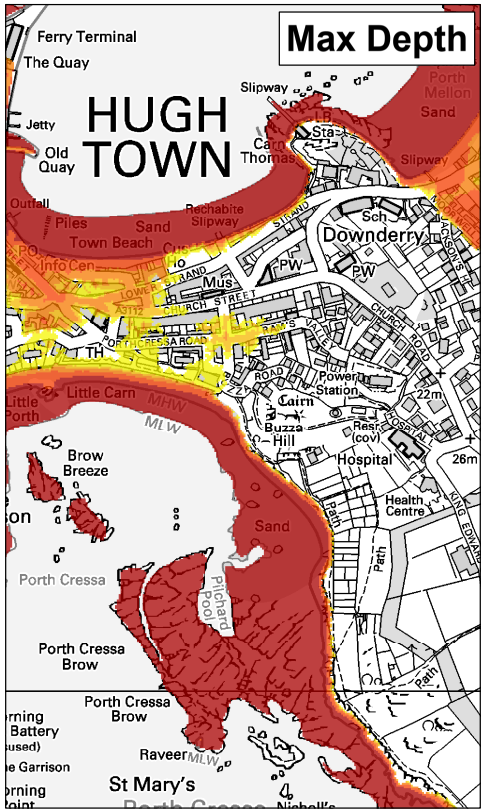
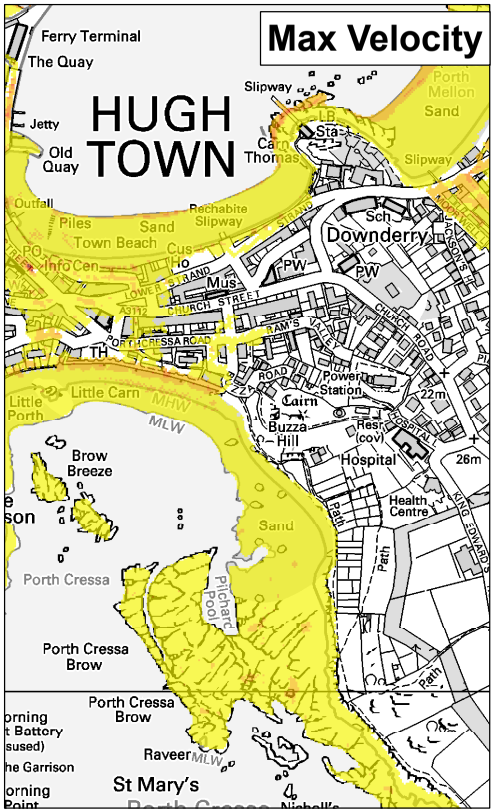
Isles of Scilly Coastal Flood Modelling 2019 Hazard Mapping

Map Centered on TF 55890 65900







★ **Modelled Breach Locations** - see also the accompanying plan "Location of Modelled Breaches"

Max Hazard (Flood Risk to People : FD2320)	Max Depth (m)	Max Velocity (m/s)
Less than 0.75 (Low Hazard)	0 - 0.25	0 - 0.3
Between 0.75 and 1.25 (Danger for Some)	0.25 - 0.50	0.3 - 1.0
Between 1.25 and 2.0 (Danger for Most)	0.50 - 1.0	1.0 - 1.5
Greater than 2.0 (Danger for All)	1.0 - 2.0	1.5 - 2.5
	2.0 +	2.5 +

Date Printed	December 2021	**Scenario year**	2019	**Scenario Annual Chance**	undefended 0.5% 1 in200ycc

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped.

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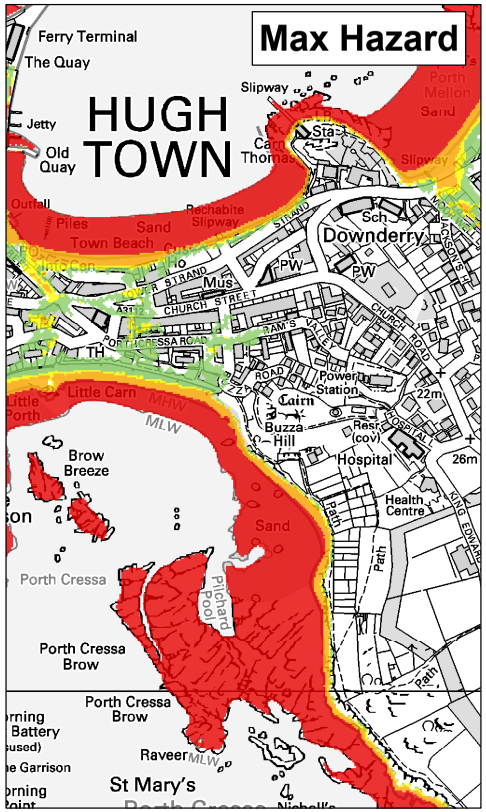
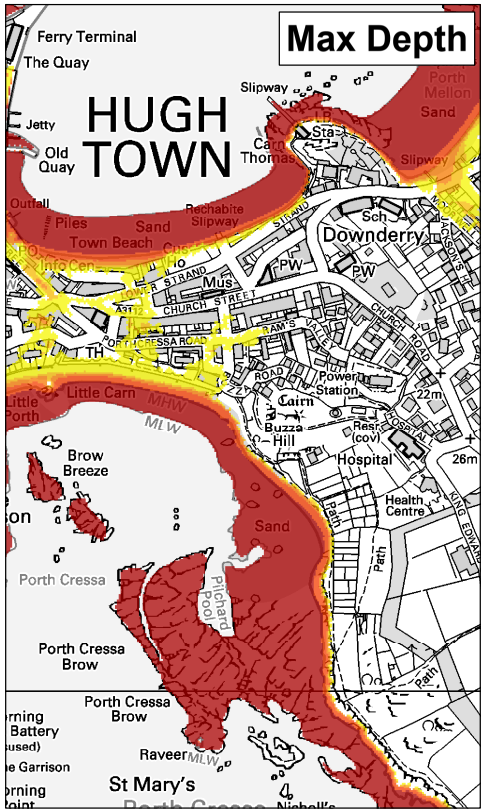
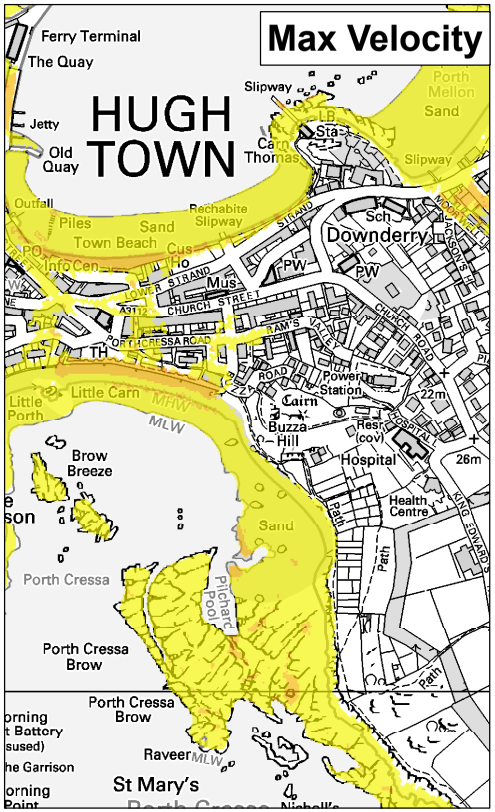
Isles of Scilly Coastal Flood Modelling 2019 Hazard Mapping

Map Centered on TF 55890 65900







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	2.0 +	2.5 +

Date Printed	December 2021	**Scenario year**	2019	**Scenario Annual Chance**	undefended 0.1% 1 in1000y

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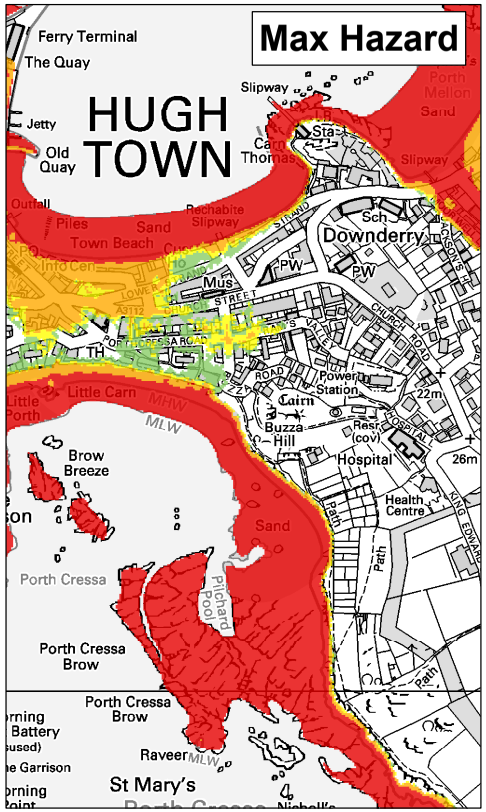

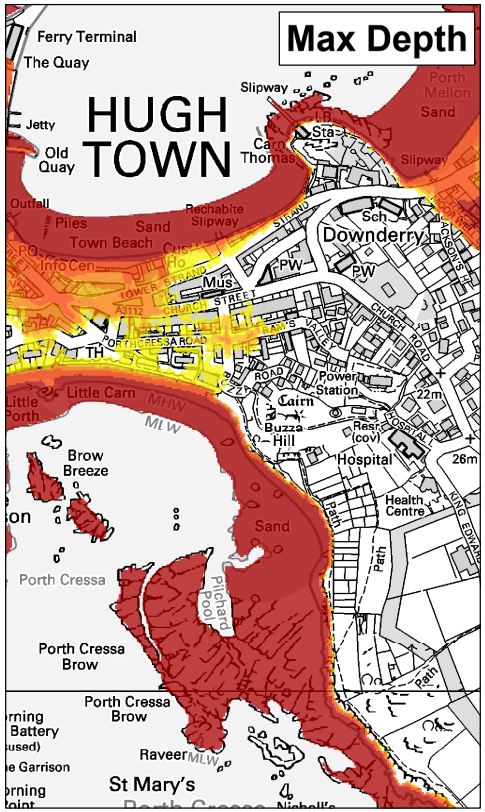

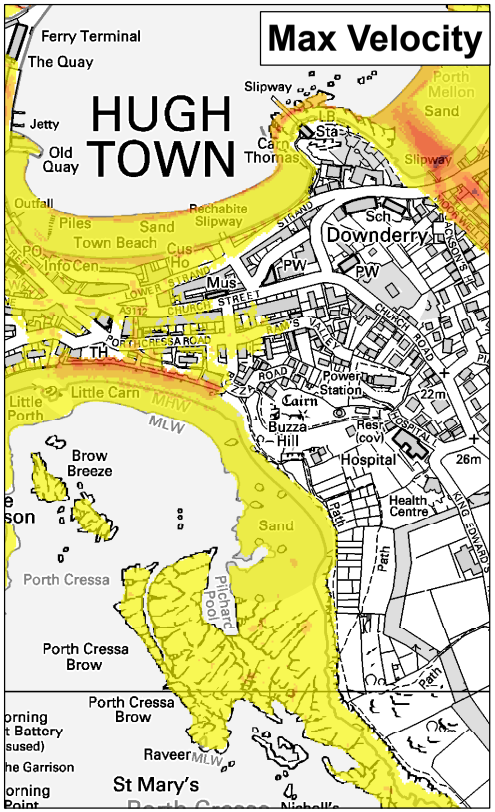

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