

Partnership for South Hampshire Level 1 Strategic Flood Risk Assessment

PART 5 – Portsmouth City Council

Final Report (Version 3)

Project number: 60653132

November 2023

Quality information

Prepared by

Phoebe Ruddock
Graduate Engineer

Megan Beadle
Graduate Engineer

Tamara Provencher
Consultant

Becci Ward
Consultant

Checked by

Sarah Littlewood
Principal Consultant

Verified by

Emily Craven
Associate Director

Approved by

Sarah Littlewood
Project Manager

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	28 th April 2023	Version 1: Draft for review by Portsmouth CC, Coastal Partners, and Environment Agency.	EC	Emily Craven	Associate Director
2	29 th August 2023	Version 2: Updated following stakeholder comments, and in light of revised PPG.	EC	Emily Craven	Associate Director
3	17 th November 2023	Version 3: Updated following stakeholder comments.	SL	Sarah Littlewood	Principal Consultant

Prepared for:

Portsmouth City Council

Prepared by:

AECOM Limited
Midpoint, Alencon Link
Basingstoke
Hampshire RG21 7PP
United Kingdom

T: +44(0)1256 310200
aecom.com

© 2023 AECOM Limited.

AECOM Limited ("AECOM") has prepared this Report for the sole use of Portsmouth City Council ("Client") in accordance with the terms and conditions of appointment (Consultancy Agreement for SFRA) dated 22.05.2021 ("the Appointment").

AECOM shall have no duty, responsibility and/or liability to any party in connection with this Report howsoever arising other than that arising to the Client under the Appointment. Save as provided in the Appointment, no warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by AECOM.

This Report should not be reproduced in whole or in part or disclosed to any third parties for any use whatsoever without the express written authority of AECOM. To the extent this Report is reproduced in whole or in part or disclosed to any third parties (whether by AECOM or another party) for any use whatsoever, and whether such disclosure occurs with or without the express written authority of AECOM, AECOM does not accept that the third party is entitled to rely upon this Report and does not accept any responsibility or liability to the third party. To the extent any liability does arise to a third party, such liability shall be subject to any limitations included within the Appointment, a copy of which is available on request to AECOM.

Where any conclusions and recommendations contained in this Report are based upon information provided by the Client and/or third parties, it has been assumed that all relevant information has been provided by the Client and/or third parties and that such information is accurate. Any such information obtained by AECOM has not been independently verified by AECOM, unless otherwise stated in this Report. AECOM accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to AECOM from the Client and/or third parties.

Table of Contents

1.	Introduction.....	1
2.	Local policies and plans	2
2.1	Shoreline Management Plans.....	2
2.2	Catchment Flood Management Plans.....	3
2.3	Lead Local Flood Authority Plans	4
2.4	Other relevant plans.....	6
3.	Sources of flood risk and expected effects of climate change	8
3.1	Geology and Hydrology	8
3.2	Flooding from the Sea.....	8
3.3	River flooding.....	12
3.4	Groundwater flooding.....	12
3.5	Surface water and sewer flooding.....	13
3.6	Reservoir flooding.....	17
3.7	Other water bodies	17
4.	Cumulative impact of development and land use change	19
4.1	Cumulative impact assessment	19
4.2	Cross boundary considerations	19
5.	Current control, mitigation, and management measures	20
5.1	Defences.....	20
5.2	North Portsea Island Scheme	21
5.3	Southsea Coastal Scheme	21
5.4	Flood Warning Service.....	22
5.5	Residual Risk.....	22
6.	Opportunities to reduce the causes and impacts of flooding	24
6.1	Flood and Coastal Erosion Risk Management (FCERM) schemes	24
6.2	Safeguard land for defence improvements	26
6.3	Maintenance of watercourses and flood defences.....	28
6.4	River restoration	28
6.5	Flood storage.....	29
6.6	Working with natural processes	30
6.7	Surface water management.....	31
6.8	Flow routing	33
6.9	Risk of groundwater flooding	34
6.10	Consulting with Water companies.....	34
6.11	Emergency Planning.....	35
7.	Recommendations of how to address flood risk in development.....	36
7.1	Sequential approach.....	36
7.2	Appropriate types of development	36
7.3	Finished floor levels	36
7.4	Protection against groundwater flooding.....	37
7.5	Access / escape.....	38
7.6	Places of safety	39
7.7	Emergency Plans.....	39
7.8	Flood resilience measures	40
7.9	Local Design Codes.....	42
8.	Next Steps	43
8.1	Next steps.....	43
8.2	Future monitoring and update.....	43

Appendix A Figures	44
Appendix B Tidal Flood Risk Mapping.....	45

Figures

Figure 2-1 Map of the policies in South East Hampshire catchment, CFMP 2009.....	4
Figure 3-1 Overtopping along Eastern Road frontage, January 2015 (LFRMS)	9
Figure 3-2 Historic surface water flooding incidents, reproduced from Portsmouth PFRA.....	15
Figure 3-3 Submerged cars during the September 2000 flood event (LFRMS)	16
Figure 5-1 North Portsea coastal Scheme	21
Figure 6-1 Example of Floodplain Compensation Storage (Environment Agency 2009).....	30

Tables

Table 1-1 SFRA User Guide	1
Table 2-1 North Solent SMP Policies	2
Table 2-2 South East Hampshire CFMP Policies	3
Table 3-1 Tidal flooding events.....	9
Table 5-1 Coastal flood defences in Portsmouth	20
Table 6-1 Land to safeguard for flood defences and land raising.....	26

Acronymns

Acronym	Definition
AEP	Annual exceedance probability
BGS	British Geological Survey
CFMP	Catchment flood management plan
DWMP	Drainage and wastewater management plan
FCERM	Flood and coastal erosion risk management
FRA	Flood Risk Assessment
FSA	Flood storage area
GIS	Geographical Information System
GWMP	Groundwater management plan
LFRMS	Local flood risk management strategy
LFRZ	Local flood risk zone
LLFA	Lead local flood authority
LPA	Local planning authority
NPPF	National planning policy framework
PCC	Portsmouth City Council
PFRA	Preliminary Flood Risk Assessment
PfSH	Partnership for South Hampshire
PICSS	Portsea Island Coastal Strategy Study
PPG	Planning practice guidance
SFRA	Strategic flood risk assessment
SMP	Shoreline management plan
SOP	Standard of protection
SuDS	Sustainable Drainage Systems
SWMP	Surface water management plan
RBD	River basin district
RFCC	Regional flood and coastal committee
WWNP	Working with natural processes

1. Introduction

- 1.1.1 AECOM has been commissioned by Portsmouth City Council on behalf of ten planning authorities in South Hampshire (the 'Partnership for South Hampshire' (PfSH)) to prepare an updated Strategic Flood Risk Assessment (SFRA). The PfSH SFRA covers the administrative areas of Portsmouth City, Havant Borough, Gosport Borough, Fareham Borough, Eastleigh Borough, Southampton City, Winchester City, Test Valley Borough, New Forest District and New Forest National Park Authority.
- 1.1.2 This document should be read in conjunction with SFRA Report Part 1. Together with Part 1, this document forms the SFRA for Portsmouth City Council (CC).
- 1.1.3 Recommendations are made throughout this report for Portsmouth CC to consider when developing their Local Plan, drafting strategic policies and establishing requirements for development management.

Table 1-1 SFRA User Guide

PART 1 MAIN REPORT	CONTENT
1 Introduction	Explains the need for the study and the objectives. Provides a user guide and identifies who has been consulted. Identifies when the SFRA may need to be updated in the future.
2 Legislation and Policy Framework	Provides an overview of the latest legislation and national and regional policies in relation to flood risk and coastal change.
3 Datasets	Identifies the datasets used to inform the SFRA and describes the approaches taken to use and update data as part of the SFRA.
4 Applying the Sequential Test	Describes how the sequential test should be applied using the SFRA.
5 Preparing Flood Risk Assessments	Describes how site specific FRAs should be prepared.
Appendix A: GIS Floodplain Analysis Methodology	Records the methodology applied for the GIS floodplain analysis to determine those areas that may be sensitive to changes in flood level in the future.
Appendix B: Coastal Modelling Technical Notes	East Solent Flood Inundation Model Re-Simulations Technical Note (Hayling Island, Portsea Island, Gosport to Warsash) Southampton Water Model Re-Simulation Technical Note
LPA SPECIFIC REPORTS	CONTENT
PART 2 TEST VALLEY BOROUGH	For each LPA, mapping of the flood risk datasets is provided as well as a report covering the following topics: 1 Introduction. 2 Local policy and plans. 3 Sources of flood risk and expected effects of climate change. 4 Cumulative impact of development and land use change. 5 Current control, mitigation, and management measures. 6 Opportunities to reduce the causes and impacts of flooding. 7 Recommendations of how to address flood risk in development
PART 3 WINCHESTER CITY	
PART 4 HAVANT BOROUGH	
PART 5 PORTSMOUTH CITY	
PART 6 GOSPORT BOROUGH	
PART 7 FAREHAM BOROUGH	
PART 8 EASTLEIGH BOROUGH	
PART 9 SOUTHAMPTON CITY	
PART 10 NEW FOREST DISTRICT AND NATIONAL PARK	

2. Local policies and plans

The SFRA Report Part 1 Section 2 provides a high level overview of the national and regional planning context for coastal change and flood risk management in the PfSH SFRA project area. This Section provides a summary of the local policy and guidance for Portsmouth CC.

2.1 Shoreline Management Plans

- 2.1.1 The role of Shoreline Management Plans (SMPs) is to establish flood risk management policies in relation to coastal change, addressing the risks in a sustainable manner. There are four policy options: Hold the Line, Advance the Line, Managed Realignment, No Active Intervention.
- 2.1.2 This area is covered by the North Solent SMP¹ (which extends from Selsey Bill (Chichester) to Hurst Spit (New Forest)), and for which a review is currently underway. The policies for the Portsmouth CC administrative area are summarised in Table 2-1 and the policy units are shown in Appendix A Figure 10.

Table 2-1 North Solent SMP Policies

Policy Unit	Location	Policies for the Short Term (0-20 yrs, Epoch 1), Medium Term (20-50 yrs, Epoch 2) and Long Term (50-100 yrs, Epoch 3)
5A20	Farlington Marshes	Hold The Line in the short term. Hold The Line in the medium and long term subject to further studies. A change in defence management in the medium or longer-term may be required to enable Managed Realignment.
5A21	Farlington Marshes to Cadour Drive	Hold The Line in the short, medium, and long term.
5API01	Portsmouth Harbour entrance (east) to Langstone Harbour entrance (west, harbour)	Hold The Line in the short, medium, and long term.
5API02	Portsmouth Harbour entrance (east) to Langstone Harbour entrance (west, open coast)	Hold The Line in the short, medium, and long term.

Portsea Island Coastal Strategy

- 2.1.3 The Portsea Island Coastal Strategy Study² (PICSS) (21 April 2011) builds on the policies in the SMP and sets out how the coastline surrounding Portsea Island will be managed for the next 100 years. PICSS identifies 7 independent flood cells across Portsea Island. Flood Cell 1 'Southsea' and Flood Cell 4 'North Portsea Island' were identified as priority frontages. Further description of the defences in these locations is provided in Section 5.2 and Section 6.1. Coastal Partners have started the development and construction of options for these frontages, described further in Sections 5 and 6.
- 2.1.4 The PICSS stipulates that Flood Cell 2 'Fraser Battery', Flood Cell 3 'Eastney Lake', Flood Cell 5 'Tipner', Flood Cell 6 'Continental Ferry Port', and Flood Cell 7 'HMS Naval Base' may not secure funding from the Flood & Coastal Erosion Risk Management Grant in Aid, and therefore should make their own provisions to deliver flood risk management infrastructure.
- 2.1.5 It was intimated within the Portsea Island Coastal Strategy that developers in Flood Cell 5 'Tipner' would be expected to invest in improving coastal defences to improve the standard of protection, and that implementation of the preferred option (hold the line of defence and improve the standard of protection to 0.5% AEP) for Flood Cell 2 'Fraser Battery' should primarily be funded by the landowner and developer in this location.
- 2.1.6 Likewise, the strategy stated that funding for defence works was likely to be sourced from the Ministry of Defence in Flood Cell 7 'HMS Naval Base', and through a joint funding scheme between the port operatives and Portsmouth CC in Flood Cell 6 'Continental Ferry Port'.

¹ North Solent Shoreline Management Plan, 2010 <https://www.northsolentsmp.co.uk/>

² Portsmouth City Council, Environment Agency, Halcrow, April 2011, Portsea Island Coastal Strategy Study. <https://coastalpartners.org.uk/project/portsea-island-coastal-strategy>

Portchester Castle to Emsworth FCERM Strategy

2.1.1 The Portchester Castle to Emsworth Flood and Coastal Erosion Risk Management (FCERM) Strategy³, has been developed by the Environment Agency, in partnership with Havant BC, Portsmouth CC, Fareham BC, and Chichester DC. The Strategy identifies the best way of managing coastal flood and erosion risk over the next 100 years. The estimated whole life cost to implement the recommendations in the strategy is £113 million (excluding inflation). The key benefits of delivering the preferred options are:

- Reduced flood risk to 901 residential and 178 commercial properties for 2020, increasing to 4,257 residential and 433 commercial properties by 2110 across the whole Strategy area.
- Reduced flood risk from typically a 5% annual exceedance probability (AEP) (1 in 20yr event) to a 1.33% AEP (1 in 75yr event), sustained for 100 years.
- Improved flood risk and erosion protection to M27, A3(M), the South Coast Rail Link.
- Improved flood risk protection for numerous heritage and recreation sites and features such as Portchester Castle.
- Farlington Marshes, South Moor, Warblington and Conigar Point - maintain existing defences for the next 20 years. This will provide sufficient time to develop the long-term management options for the sites and establish compensatory habitat as required. The selection of a preferred long-term option requires further detailed studies which are currently underway and will inform the next SMP.

2.1.2 Further information is provided in Section 6.1.

2.2 Catchment Flood Management Plans

2.2.1 The role of Catchment Flood Management Plans (CFMPs) is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. CFMPs are produced by the Environment Agency. The CFMP considers all types of inland flooding, from rivers, groundwater, surface water and tidal flooding. Shoreline Management Plans consider flooding from the sea.

2.2.2 The Portsmouth CC administrative area is covered by the South East Hampshire CFMP⁴. The policies for the sub-areas within Portsmouth are summarised in Table 2-2 and Figure 2-1.

Table 2-2 South East Hampshire CFMP Policies

Sub-area & Preferred Policy Summary of proposed actions

Portsmouth and Langstone Harbours Policy 5 Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.	Increased storminess resulting from climate change will put increased pressure on the urban drainage network. Promote greater resilience to flooding through flood proofing, emergency planning and flood warning. Develop a collaborative Surface Water Management Plan (SWMP) to address current and future pressures on drainage network. New developments will need to manage drainage so that there is no net increase in flood risk. Avoid inappropriate development in areas at risk of flooding. Develop emergency response plan to mitigate flood risk in Portsmouth and Gosport.
--	--

³ Environment Agency, September 2012, Portchester Castle to Emsworth Flood and Coastal Erosion Risk Management Strategy. <https://coastalpartners.org.uk/project/portchester-castle-to-emsworth-strategy/>

⁴ Environment Agency, December 2009, South East Hampshire Catchment Flood Management Plan, Summary Report <https://www.gov.uk/government/publications/south-east-hampshire-catchment-flood-management-plan>

Map of the policies in the South East Hampshire catchment.

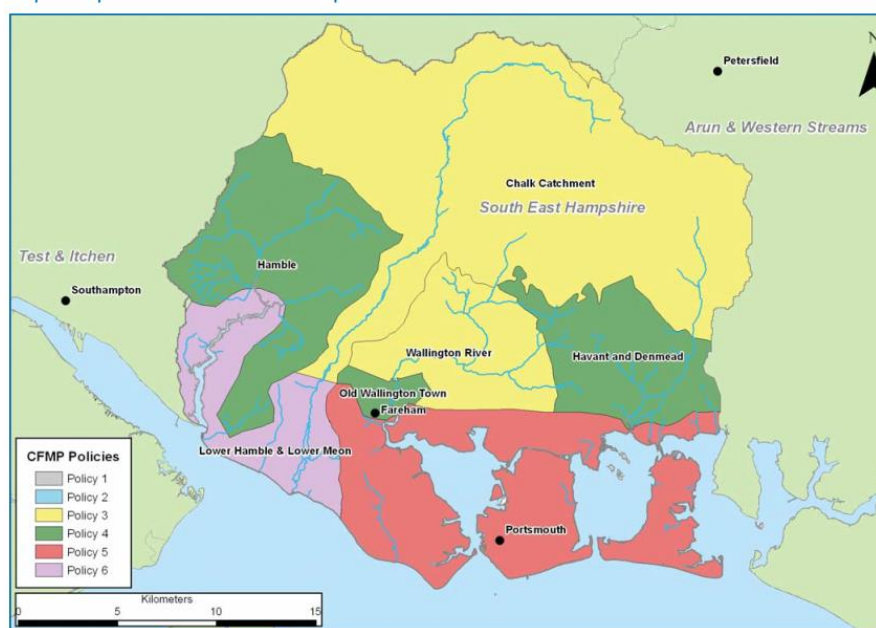


Figure 2-1 Map of the policies in South East Hampshire catchment, CFMP 2009

2.3 Lead Local Flood Authority Plans

2.3.1 Portsmouth CC are the Lead Local Flood Authority (LLFA) for their administrative area. Portsmouth CC have plans in place to assess and manage flood risk in the study area, including:

- Preliminary Flood Risk Assessment
- Surface Water Management Plan
- Local Flood Risk Management Strategy
- Portsmouth Local Plan 2038 Development and Tidal Flood Risk Position Statement⁵

Preliminary Flood Risk Assessment

2.3.2 In accordance with the 2009 Flood Risk Regulations, Portsmouth CC prepared a Preliminary Flood Risk Assessment (PFRA) for the area. The PFRA⁶ is a high-level screening exercise informed by a national methodology set out by the Environment Agency which identifies areas with the highest risk of flooding in England. Those with populations more than 30,000 people at risk are identified as 'Flood Risk Areas' and may require further assessment. For areas below this threshold, the LLFA should assess information on past historic and future potential floods and identify areas for which Surface Water Management Plans or other similar plans may be required.

2.3.3 The PFRA did not identify any Flood Risk Areas above the Environment Agency threshold within Portsmouth. PCC reviewed the PFRA in 2017 and did not identify any no flood risk areas.

2.3.4 The PFRA provides useful information on historic flood events, which informs this SFRA.

Surface Water Management Plan

2.3.5 As a LLFA, Portsmouth CC is required to investigate and manage flood risk from non-main river sources within the administrative area. This takes the form of a Surface Water Management Plan (SWMP). SWMPs outline the preferred surface water management strategy in a region, taking account of the risks posed by sewers, drains, groundwater, and runoff from land, small watercourses, and ditches.

⁵ Portsmouth Local Plan 2038 Development and Tidal Flood Risk Position Statement: <https://www.portsmouth.gov.uk/wp-content/uploads/2021/09/DRAFT-Development-and-Tidal-Flood-Risk-position-statement-final.pdf>

⁶ Portsmouth City Council, 2011, Portsmouth Preliminary Flood Risk Assessment. <https://www.portsmouth.gov.uk/wp-content/uploads/2020/04/Preliminary-Flood-Risk-Assessment.pdf>

SWMPs can function at different geographical scales and at differing levels of detail, from strategic to detailed. Strategic and intermediate studies build up a picture of current flood risk within an area, normally county wide, to determine key locations for detailed study. Detailed studies identify the causes and consequences in discrete locations, and evaluate the viability of certain flood risk mitigation measures.

2.3.6 PCC prepared a detailed SWMP in 2019⁷ to form part of the evidence base, along with the wider Local Flood Risk Management Strategy (LFRMS), for the emerging Portsmouth Local Plan. The Portsmouth SWMP stresses the importance of ongoing partnership with other flood risk management authorities and communication with various Portsmouth CC departments. Rather than each stakeholder working on individual issues separately, joining together all parties and sharing information allows for a cumulative flood risk improvement in an economically efficient way. The key partnerships and stakeholders Portsmouth CC is working with include:

- Environment Agency
- Southern Water
- Highways England
- Network Rail
- Coastal Partners
- Hampshire County Council
- Contractors working on behalf of Portsmouth CC to maintain and manage roads, footways, structures, and highways such as Colas Ltd and Ensign Highways Ltd.

2.3.7 As a detailed SWMP, this report takes information from the previous strategic and intermediate studies, current mapping, previous flood risk incidents, local flood risk and the implementation of surface water improvements to identify key areas for the more detailed assessment. Five key areas at risk of surface water flooding, termed Local Flood Risk Zones (LFRZs), were identified:

- Farlington Marshes
- Southsea (Great Morass)
- Cosham (north of south coast railway line)
- War Department Sewer, Hillsea
- Pier Road (Little Morass)

2.3.8 The SWMP identified Farlington Marshes as high priority for flood mitigation and Southsea as high priority, but no mitigation recommended at this time. Cosham has experienced repeated incidents of flooding incidents in recent years, and to address this, flood mitigation work is currently being undertaken by Portsmouth CC in partnership with Southern Water in this area. The other two areas were rated as low priority meaning further assessment will only be taken forward if current knowledge in the areas changes. Therefore, a detailed assessment was undertaken for Farlington Marshes and Southsea, which included analysis of flood mechanisms and potential options to alleviate the flood risk.

2.3.9 Although considered low priority in the SWMP, Southern Water are currently undertaking sewer renovation works at the Pier Road pumping station, which should reduce the risk of surface water flooding in the surrounding area.

2.3.10 An Action Plan was created as part of the Portsmouth SWMP, which sets out how the identified potential options for flood risk management would be taken forward, both in respect to programme and those responsible. Details of the Action Plan are provided in Section 6.7. The Action Plan will only be effective if each stakeholder agrees to its responsibilities and commits to undertaking the actions within the specified timescales.

2.3.11 Although SWMP have a clear focus on surface water flooding, there is close interaction between groundwater levels and surface water flooding in Portsmouth. Tamworth Park and Stanley Avenue were identified as LFRZs for consideration associated with groundwater flooding within the Portsmouth

⁷ Portsmouth City Council, 2019, Surface Water Management Plan. <https://www.portsmouth.gov.uk/wp-content/uploads/2020/04/Surface-water-management-plan.pdf>

SWMP and were highlighted as being highly likely to have been influenced by groundwater levels in the 'Groundwater Level Trends in Portsmouth 2014-2019' report⁸. Assessment of these areas is being investigated in a separate study.

Local Flood Risk Management Strategy

2.3.12 As a LLFA, Portsmouth CC are required to develop a Local Flood Risk Management Strategy (LFRMS)⁹ for the area. This strategy sets out how Portsmouth CC will work with the Environment Agency, neighbouring local authorities, emergency services and water companies to reduce all forms of flood risk across the city. The objectives outlined below were agreed by representative from Portsmouth CC Drainage, Planning and Coastal teams, the Environment Agency, and Southern Water:

- Improve knowledge and understanding of all sources of flood risk across Portsmouth,
- Identify and work in partnership with other authorities, stakeholders and the community who have a role in flood risk management,
- Increase public awareness of all flood risk across Portsmouth,
- Ensure that planning decisions are properly informed by flooding issues, by avoiding development at inappropriate locations and reducing flood risk wherever possible,
- Maintain, and improve where necessary and affordable, flood risk management infrastructure and systems to reduce flood risk,
- Identify through an action plan, appropriate measures, and schemes to manage flood risks providing balanced community and environmental benefits, and establish who is responsible for delivery of these measures,
- Compile a funding plan for schemes listed on the action plan,
- For identified schemes, demonstrate compliance with the EU Water Framework Directive through a Strategic Environmental Assessment and Habitats Regulations Assessment, and
- Detail all procedures in place to mitigate a flood event, including flood response and recovery.

2.3.13 The Portsmouth LFRMS goes into detail about the different types of flooding Portsmouth is at risk from now and in the future, how different flood risk parties work together, an overview of flood risk in each Portsmouth Ward, and an Action Plan for each party.

2.4 Other relevant plans

Greenprint for South Hampshire

- 2.4.1 Since the COVID-19 pandemic, there has been a demand from the public for more permanent and sustainable change, focusing more on the wellbeing of people and environmental impact. The Greenprint for South Hampshire: The Opportunities Ahead¹⁰ is a report written by members of the Green Halo Partnership, Future South, and the Southern Policy Centre. It sets out a possible way forward, embracing ideas and partners from within and beyond the immediate PFSH area. The Greenprint is a model for policy making which could reflect commitment to a green recovery, shaping plans and programmes across sectors to deliver a world class economy in a world class environment.
- 2.4.2 Many communities across South Hampshire face common economic, social, and environmental opportunities and challenges. Working together under a common planning framework to find shared solutions will be more effective and beneficial for all parties, rather than trying to solve problems individually and potentially exacerbating issues elsewhere, or developing inconsistent, incompatible approaches in different localities.

⁸ Portsmouth City Council, 2020, Groundwater Level Trends in Portsmouth 2014-2019

⁹ Portsmouth City Council, 2015. Local Flood Risk Management Strategy <https://www.portsmouth.gov.uk/wp-content/uploads/2020/04/Local-flood-risk-management-strategy.pdf>

¹⁰ Partnership for South Hampshire, September 2020, A Greenprint for South Hampshire: The Opportunities Ahead <https://www.push.gov.uk/wp-content/uploads/2020/09/Item-6-Greenprint-for-South-Hampshire-30.09.20.pdf>

Southern Water DWMP

- 2.4.3 Water and sewerage companies must produce Drainage and Wastewater Management Plans (DWMPs) covering a minimum of 25 years, setting out how they intend to improve and maintain a robust and resilient drainage and wastewater system in the face of risks to the network such as climate change and population growth. Companies will need to produce final plans in 2023 and the production of plans will be made statutory through the Environment Act.
- 2.4.4 Southern Water has developed 11 DWMPs across their entire operational region¹¹. The East Hampshire Catchment DWMP covers the Portsmouth CC administrative area.
- 2.4.5 The East Hampshire Catchment DWMP highlights that storm overflows, nutrients and pollution are the main concerns for this river basin. The Budds Farm wastewater system which serves the Portsmouth CC area is already at significant risk from rainfall related flooding and this is likely to increase because of climate change unless measures are taken. The sewer system will need to adapt to reduce the volume of rainfall entering the sewer network. This adaptation may provide the capacity within the wastewater system to allow for future growth and therefore reduce both the need for significant increases in the capacity of the existing wastewater systems and reduce discharges from storm overflows.

¹¹ Southern Water, Drainage and Wastewater Management Plans <https://www.southernwater.co.uk/dwmp>

3. Sources of flood risk and expected effects of climate change

This Section provides a description of the local geology and hydrology in the study area, and an assessment of the risk of flooding from all sources based on available datasets. Refer to Part 1 Main Report for details of the datasets.

3.1 Geology and Hydrology

Geology

- 3.1.1 The majority of Portsea Island is underlain by low and moderately permeable bedrock formations, including Wittering Formation, Portsmouth Sand Member, Whitecliff Sand Member, London Clay Formation, Bognor Sand Member and Lambeth Group. The northern part of the island and the mainland of Portsmouth's administrative area is underlain by highly permeable chalk formation that outcrops at Portsdown Hill. Several springs arise from the chalk aquifer, specifically within the Drayton and Farlington areas. Low to moderately permeable superficial deposits overlay most of the bedrock, reducing the permeability of most areas in terms of surface water runoff generation. The superficial deposits include River Terrace Deposits covering most of the area, Head to the north, and pockets of Storm Beach Deposits, Tidal Flat Deposits and Raised Marine Deposits.
- 3.1.2 Portsmouth is extremely flat and low lying, with a large proportion of the area ranging between 1-4m AOD⁷. Portsea Island rises in the centre to approximately 8m AOD, and on the mainland the elevations quickly rise from the coastline to approximately 80m AOD along the northern border.

Hydrology

- 3.1.3 Portsmouth has approximately 45km of open costal frontage, with 32km around Portsea Island and 11.5km on the mainland. 3km of drainage channels are designated as Main Rivers in Portsmouth, and approximately 47% of the area is within Flood Zones 2 and 3.
- 3.1.4 The Catchment Data Explorer¹² identifies no watercourses within the Portsmouth administrative area. However, two main rivers do flow through: Great Salterns Drain in the eastern part of Portsea Island, and Farlington Marshes Gutter which drains Farlington to the Langstone harbour. The LFRMS⁹ identifies several ordinary watercourses but notes that these do not pose flood risk to any properties.
- 3.1.5 Portsmouth Harbour is a large, industrialised estuary and includes one of the four largest expanses of mudflats and tidal creeks on the south coast of Britain¹³. Along with Langstone and Chichester Harbours to the east of Portsmouth, Portsmouth Harbour forms an unusual intertidal ecosystem receiving comparatively little freshwater and possessing a characteristic hydrology arising from only narrow connections to the sea via the Solent.

3.2 Flooding from the Sea

- 3.2.1 The risk of flooding from the sea is the main source of flood risk to the area. Flooding can develop through a combination of factors coinciding, including spring (high) tides, strong coastal winds, and low atmospheric pressure.
- 3.2.2 High tide conditions can lead to tide locking, when flap valves at surface water outfalls close to stop sea water entering the system. This prevents drainage channels from discharging and instead surface water accumulates upstream of the outfalls. During heavy rainfall events this can result in flooding from manholes and gullies. The combination of heavy rainfall events and high tides can therefore contribute to significant surface water flooding. This is further discussed in Section 3.5.

¹² Environment Agency Catchment Data Explorer. <https://environment.data.gov.uk/catchment-planning>

¹³ Ramsar Sites Information Service, 1995, Portsmouth Harbour <https://rsis.ramsar.org/RISapp/files/RISrep/GB720RIS.pdf>

Flood Map for Planning

- 3.2.3 The Flood Zones on the Flood Map for Planning provide an indication of the risk of flooding from rivers and the sea ignoring the presence of flood defences. (Refer to Table 3-1 in the Main Report for more information on Flood Zones).
- 3.2.4 Appendix A Figure 1 shows Flood Zones 2 and 3 for the study area. A significant proportion of the study area is within Flood Zone 3, high probability of flooding from the sea, including the northern and eastern parts of Portsea Island, as well as along the southern frontage. Flood Zone 3 also extends across Farlington and north of the A27.
- 3.2.5 Appendix A Figure 1 identifies those areas that have a reduced risk of tidal flooding due to the presence of defences. This includes Southsea, and the northern band of Portsea Island from Alexandra Park to Anchorage Park as well as land between Hayling Avenue and Tangier Road in the eastern central part of the Portsea Island. Flood defences are further described in Section 5.1 and Appendix A Figure 2.

Historic flooding

- 3.2.6 The following areas have historically experienced flooding during storm tides, Broad Street in Old Portsmouth; Southsea Common; the Eastern Road near Great Salterns Quay, and Southampton Road (A27) to the northwest of Port Solent. These areas are located within the mapped Flood Zones 2 and 3. Details of some specific tidal flooding events are provided in the Portsmouth PFRA¹⁴ and the Portsmouth LFRMS¹⁵ and summarised in Table 3-1.

Table 3-1 Tidal flooding events

Location	Description	Date	Comments
Eastern Road A2030, south of Burrfields Road junction, Milton	Overtopping of sea defences causing flooding of the A2030 to a depth of 300mm. The road was closed until floodwater cleared.	01/01/2014	Highway drainage system has since been renovated and brought up to full functionality. Sea defence raising to the south of the site has been undertaken in 2016 as part of Flood Cell 4 works (Milton Common). This included removal of the Great Salterns Quay structure which is thought to have contributed to the overtopping.
The Pyramids, Southsea	Overtopping of sea defences causing flooding to lower ground areas of The Pyramids Complex, including the plant rooms.	14/02/2014, 20/11/2016	Flood defences, both passive and manual, have been installed along with associated landscaping works to benefit water flow away from the building.



Figure 3-1 Overtopping along Eastern Road frontage, January 2015 (LFRMS)

- 3.2.7 Recorded Flood Outlines published by the Environment Agency, as seen in Appendix A Figure 2, provide additional historic flood information. These show two tidal events in the southwestern corner of Portsea Island. There are several other flood events recorded of unknown source, all grouped in the southwestern corner of Portsea Island. All recorded flood events took place within the extent of Flood

¹⁴ Portsmouth City Council, 2011, Portsmouth Preliminary Flood Risk Assessment Annex 1. <https://www.portsmouth.gov.uk/wp-content/uploads/2020/05/Preliminary-Flood-Risk-Assessment-annex-123.pdf>

¹⁵ Portsmouth City Council, 2015, Local Flood Risk Management Strategy. <https://www.portsmouth.gov.uk/wp-content/uploads/2020/04/Local-flood-risk-management-strategy.pdf>

Zones 2 and 3 on Portsea Island, and therefore they are all thought to be attributed to tidal flooding. The two tidal events occurred in March 2008, whilst the dates for the remainder of the events is unknown.

3.2.8 Other records of past tidal flooding include:

- Incidents of wave overtopping along Southampton Road in the Paulsgrove ward frontage which causes localised disruption to traffic and residential areas along the frontage, and
- Very few incidents of wave overtopping in the following wards: Cosham, Drayton and Farlington, Hilsea and Copnor.

3.2.9 Other historic events where no clear main flood source was identified but tidal flooding was thought to play a role are outlined at the end of this Section.

Coastal Modelling

3.2.10 As part of this SFRA update, coastal modelling has been updated, to determine the impact of predicted tidal flooding. Details of the modelling undertaken are presented in SFRA Part 1 Appendix B. Maps showing the outputs for some of the key model scenarios are presented in Appendix B of this Report. (The full set of outputs have been provided to the LPAs as GIS files).

Flood Zone 3b Functional Floodplain

3.2.11 The Functional Floodplain is defined in the NPPF as 'land where water from rivers or the sea has to flow or be stored in times of flood'. The Functional Floodplain (also referred to as Flood Zone 3b), is not separately distinguished from Flood Zone 3a on the Flood Map for Planning. Rather the SFRA is the place where LPAs should identify areas of Functional Floodplain in discussion with the Environment Agency.

3.2.12 The PPG states that the identification of Functional Floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. With this caveat, as a starting point the Functional Floodplain will normally comprise land having a 3.3% AEP or greater annual probability of flooding (1 in 30 year), with existing flood risk management infrastructure operating effectively.

3.2.13 Portsmouth is largely protected from flooding from the sea during the 3.3% AEP event due to the presence of flood defences. Modelling of the 3.3% AEP event has been undertaken to identify areas at more frequent risk of flooding from the sea. (It is noted that this modelled scenario just applies the still water level and does not account for wave action). These areas are shown in Appendix A Figure 11 and include:

- Northern part of Trafalgar Wharf.
- The northern part of Portsea Island, along Hillsea Moat and a small area to the east close to Buckby Lane. Flood defence improvement works are planned for Ports Creek (refer to Section 6.1) which are due for completion in 2025. Once these are in place, the north of Portsea Island will be protected during the 3.3% AEP event.
- Part of Portsmouth Point, Old Portsmouth.
- The northern coastline of Eastney Lake, adjacent to the Eastney and Milton Allotments and Milton Nature Reserve.

3.2.14 Land is not needed to store tidal flood water given the proximity of the wider Solent. Therefore, a review of these areas has been undertaken in the light of these local circumstances and in agreement with the Environment Agency these areas will be included within the Flood Zone 3a definition and no Flood Zone 3b associated with the sea will be defined.

3.2.15 Where development is proposed within an area at 3.3% AEP or greater annual probability of flooding from the sea, particularly within the floodplains of tidal watercourses or constrained estuaries, further evidence may be required to confirm the assumption that the area at 3.3% AEP or greater annual probability of flooding does not provide a flood conveyance and/or storage function.

3.2.16 Appendix A Figure 11 can be used to identify areas which may be at risk of more frequent flooding.

3.2.17 In locations where there is existing development and the SMP policy is to hold or advance the line, it may be appropriate to consider redevelopment. Should development be proposed in these areas, it will need to pass the Sequential Test and the Exception Test where applicable. A site specific FRA will need

to demonstrate that the development will be safe for its lifetime, and not increase flood risk elsewhere. It is considered that this can be implemented through the Flood Zone 3a designation, and it is not considered sustainable to apply the planning requirements of a Flood Zone 3b designation.

- 3.2.18 In locations where the SMP policies indicate no future maintenance or improvements to defences¹⁶, PCC should consider using the 3.3% AEP flood extent to define Coastal Change Management Areas (CCMA) to ensure prospective developers are made aware of the potential risks and inappropriate development is avoided.
- 3.2.19 It is noted that areas close to defences and low lying areas behind defences may also be susceptible to flooding because of wave action which is not included in the 3.3% modelled scenario presented in Appendix A Figure 11. This should be considered as part of site specific FRAs.

Future flood risk

- 3.2.20 Climate change is expected to increase the frequency, extent, and impact of flooding in coastal areas, because of sea level rise. Coastal modelling scenarios have been undertaken to show predicted future changes in flood extent within the study area. This modelling was undertaken for the years 2055 and 2122. The Environment Agency's guidance on the application of climate change allowances¹⁷ states that LPAs should assess both the higher central (70th percentile) and the upper end (95th percentile) allowances for SFRAs. This is described in the following three sections.

Defended Model Scenarios

- 3.2.21 Maps showing the maximum flood depths and maximum hazard ratings for some of the key defended model scenarios are presented in Appendix B of this Report.
- 3.2.22 **Present Day Flood Risk:** Appendix B Figures 3 and 10 show that for the 0.5% AEP event for the year 2022, the key areas at risk are along the southern edge of Portsea Island including Southsea. This is the area that the planned Southsea Coastal Scheme will provide protection to (refer to Section 6.1). Flooding is also shown to occur in the south-eastern corner where the holiday parks are located. Along the east of Portsea Island, flooding is shown to affect Eastern Road and to the south of Great Salterns Lake. Work is currently underway as part of Phase 4 of the North Portsea Island Scheme to provide a greater level of defence along the Eastern Road and Kendall's Wharf frontage (refer to Section 6.1). In the north of Portsea, there is some risk of flooding to properties to the west of Anchorage Park. The flow route towards this area is through Hillsea Moat. This area will be protected further as part of Phase 5 of the North Portsea Island Scheme for Ports Creek.
- 3.2.23 There are three routes to access Portsea Island: M275, A3 London Road, and A2030 Eastern Road. During the 0.5% AEP event for present day (2022), with the existing flood defences in place, wave overtopping is shown to impact a small section of the M275 route (Low hazard rating); the A3 route remains dry; parts of the route along the Eastern Road are shown to flood, with Low hazard rating.
- 3.2.24 **'Higher Central' Climate Change Allowance:** Appendix B Figures 4 and 11 show the 0.5% AEP event for the year 2055 (higher central allowance), and Appendix B Figures 5 and 12 show the 0.5% AEP event for the year 2122 (higher central allowance). By 2055, flood extents increase slightly, but the access routes remain dry or Low hazard. By 2122, flooding extends further inland and flood depths and hazard ratings increase. In Southsea, flooding extends inland as far as Albert Road. On the eastern edge of Portsea, flooding extends to the railway line. In the north flooding affects Hillsea. All access routes to Portsea Island are affected by flooding during this event. The M275 has a section of Significant hazard rating just to the north of the Rudmore Roundabout. The A3 and A2030 Eastern Road are both shown to be at Extreme hazard.
- 3.2.25 **'Upper End' Climate Change Allowance:** Appendix B Figures 6 and 13 show the 0.5% AEP event for 2122 (upper end allowance) and Figures 7 and 14 show the 0.1% AEP event for 2122 (upper end allowance).
- 3.2.26 All these modelled scenarios present the situation with the current flood defences in place. The planned improvements along Ports Creek, Eastern Road, Kendall's Wharf and Southsea will further contribute to reduce the risk of flooding.

¹⁶ Currently only relevant to SMP Policy Unit 5A20 Farlington Marshes, refer to Section 2 Table 2-1.

¹⁷ Flood risk <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#sea-level-allowances>

Undefended Model Scenarios

- 3.2.27 Model scenarios have also been undertaken *without defences*, to help inform how the Flood Zones on the Flood Map for Planning may alter in the future. Appendix B Figures 8 and 15 show the undefended 0.5% AEP event for 2122 (upper end) and Figures 9 and 16 show the undefended 0.1% AEP event for 2122 (upper end).

Future flood zones

- 3.2.28 To provide an indication of how the Flood Zones may change in the future as a result of climate change, a future Flood Zone 2 and future Flood Zone 3 have been generated, included in Appendix B Figure 2.
- 3.2.29 Flood Zones 2 and 3, as shown on the Flood Map for Planning (Rivers and Sea), are generally described as presenting the risk of flooding from the sea *assuming defences are not in place*. However, it is noted that, somewhat counterintuitively, in some locations the maximum flood extent is greater during the defended model simulation compared to the undefended simulation. The removal of raised flood defences from the model enables water to flow back out to sea as the tide recedes prior to the next peak tide, whereas during the defended scenarios the floodwater remains in the model domain and accumulates with the next tidal cycle leading to higher flood levels and greater flood extents.
- 3.2.30 As a result, the future Flood Zones presented in this SFRA are derived from the maximum flood extent from both the undefended and defended scenarios, rather than solely the undefended scenario. This is further described in SFRA Part 1 Appendix B1.

3.3 River flooding

- 3.3.1 Portsmouth has two designated Main Rivers, Great Salterns Drain and Farlington Marshes Gutter. The LFRMS notes that the floodplains of these watercourses are undeveloped and do not pose a risk of flooding to properties. These watercourses flow into the tidal watercourse Broom Channel within Langstone Harbour and therefore the risk of tidal flooding is a more dominant source of flooding for these watercourses. Great Salterns Lake into which Great Salterns Drain flows, is pumped out during high tide to prevent the water level from building up and impacting upon upstream drainage.
- 3.3.2 There is no specific modelling of these watercourses available to inform the SFRA.
- 3.3.3 The Surface Water Management Plan (SWMP) notes that there are no ordinary watercourses apart from widespread short lengths of land drains and ditches, which do not have any known history of residential flooding, however flooding of the golf course has occurred from smaller ditches. There are also several unmapped (and in many cases unnamed) minor watercourses in Portsmouth such as on Southsea Golf Course and Farlington Marshes, which provide additional surface water flow pathways within the Portsmouth CC administrative area.
- 3.3.4 Climate change is expected to bring wetter winters and increased summer storm intensity, both of which may increase the frequency, extent, and impact of flooding from these watercourses in the future. There is no specific modelling of these watercourses available to inform the SFRA. The Risk of Flooding from Surface Water mapping in Appendix A Figure 3 is a useful tool for identifying flowpaths into these watercourses and how they may increase in the future.
- 3.3.5 **Recommendation:** It is recommended that Portsmouth CC use the High Probability flood extent in the Risk of Flooding from Surface Water mapping (Appendix A Figure 3) to delineate fluvial Flood Zone 3b Functional Floodplain for these watercourses. The Low Probability flood extent should be used as an indication of areas that will experience surface water flooding in the future because of climate change.

3.4 Groundwater flooding

- 3.4.1 The BGS dataset 'Susceptibility to Groundwater Flooding' is mapped in Appendix A Figure 5. This map does not show the risk of groundwater flooding, rather it identifies areas where geological conditions could enable groundwater flooding to occur. A suite of rules founded upon geological, hydrogeological, and topographic data were used to assign a class value indicating the susceptibility to groundwater flooding to each vector polygon. The three classes are as follows:
- A: Limited potential for groundwater flooding to occur
 - B: Potential for groundwater flooding of property situated below ground level

- C: Potential for groundwater flooding to occur at surface
- 3.4.2 The remaining areas are not considered to be prone to groundwater flooding. The 'Susceptibility to Groundwater Flooding' should be used, in conjunction with other relevant information, to establish the relative risk of groundwater flooding, and is most suitable for informing land-use planning decisions at the strategic scale. The dataset should not be employed in isolation to inform land-use planning decisions at any scale and should not be utilised for this purpose at the site scale. The map shows much of the Portsmouth administrative area mainland and north of Portsea Island to have limited potential for groundwater flooding to occur. However, most of the administrative area has either potential for groundwater flooding of property situated below ground level or potential for groundwater flooding to occur at the surface.
- 3.4.3 'Areas Susceptible to Groundwater Flooding' is a national dataset produced by the Environment Agency which shows the proportion of 1km squares where geological and hydrogeological conditions show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring but provides a useful tool to identify where further studies may be useful. This dataset is mapped in Appendix A Figure 4.

Groundwater level trends

- 3.4.4 Portsmouth CC published the 'Groundwater Level Trends in Portsmouth 2014-2019' report after monitoring groundwater levels over a five year period¹⁸. This study concluded the following points about groundwater levels in the Portsmouth administrative area:
- Groundwater levels are relatively close to the surface in many areas and located within the superficial deposits,
 - Groundwater levels within Portsea Island suggest that the island is functioning as a mainly separate groundwater area from the wider mainland geology,
 - The groundwater levels respond to rainfall, drainage, and tides to varying degrees,
 - Groundwater levels follow topography and in low lying areas may be close to or at the surface at times of high groundwater levels,
 - Areas of pumped drainage are associated with lower groundwater levels, and
 - Groundwater levels are likely to rise with sea levels over the coming decades, resulting in an increased need for pumped drainage in low lying areas.

Historic records

- 3.4.5 Groundwater flooding often occurs in combination with other mechanisms of flooding. Historic records of groundwater flooding are summarised in Section 3.5 along with surface water and sewer flooding.

3.5 Surface water and sewer flooding

- 3.5.1 The Risk of Flooding from Surface Water (RoFSW) mapping is presented in Appendix A Figure 3. This map shows there to be areas of low, medium, and high probability spread across the administrative area, with the highest concentration on the mainland spreading north of the railway in Cosham, Drayton and Farlington, as well as a relatively even distribution around areas of development on Portsea Island.
- 3.5.2 Sewer flooding is defined by Southern Water as incidents caused by an escape of water and sewage from a public sewer due to a blockage, sewer collapse, rising main burst, equipment failure or from too much water entering the system. Sewer flooding does **not** include extreme storms with a probability of occurring of less than once in 20 years, as the sewer system is not designed to accommodate such events.
- 3.5.3 As noted in Section 3.2, the risk of flooding from land drains and the sewer system is exacerbated during tide locking conditions, when flap valves at surface water outfalls close to stop sea water entering the system. This prevents drainage channels from discharging and instead surface water accumulates upstream of the outfalls. During heavy rainfall events this can result in flooding from manholes and gullies.

¹⁸ Portsmouth City Council, 2020, Groundwater Level Trends in Portsmouth 2014-20192014-2019.

- 3.5.4 There are many surface water outfalls discharging to the sea in Portsmouth, which are mapped within Figure 6.6 of the SWMP. Tide locking therefore has the potential to have a significant knock-on effect on the risk flooding from the contributing drainage systems.

Historic Flooding

- 3.5.5 Locations of historic flood events recorded by Southern Water in the region are presented in Appendix A Figure 2. The mapping shows more than 80 events to have taken place across Portsmouth, with the largest clusters to the southwest and centre of Portsea Island.
- 3.5.6 The Portsmouth PFRA also presents mapping of historic surface water flooding incidents, as shown in Figure 3-2. This highlights one historic flood event with significant consequences in Southsea. On 15th September 2000, following a 1 in 108 year storm event, Southsea suffered its worst flooding in recent memory, resulting in affecting 257 residential properties, 15 commercial and two schools (St Swithun's and Mayville High) as well as Clarendon Road, Waverly Road, and Clarence Parade (as recorded in Annex 1 of the PFRA). The combination of a month's worth of rain falling within a day and the failure of Eastney Pumping station caused this event, with floodwaters reaching over 1000mm in some areas.

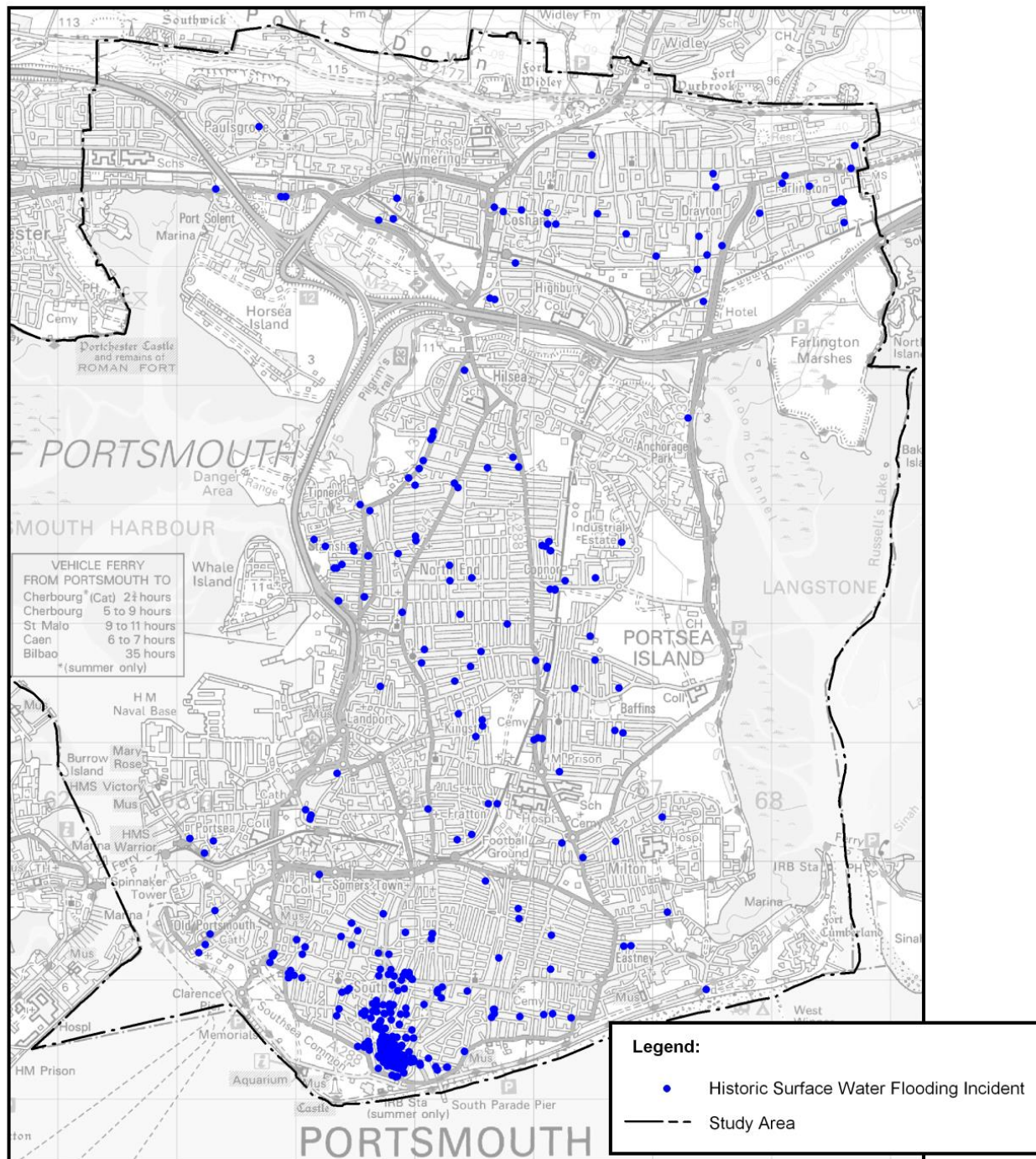


Figure 3-2 Historic surface water flooding incidents, reproduced from Portsmouth PFRA

- 3.5.7 Southern Water have invested in Portsmouth sewer system since 2012, including surface water separation, additional improvements to the sewer network, property level protection measures and in Southsea, sewer lining to prevent groundwater ingress to the sewers.



Figure 3-3 Submerged cars during the September 2000 flood event (LFRMS)

3.5.8 Other recorded incidents of flooding associated with surface water, groundwater and local drainage systems include:

- Farlington Marshes acts as a flood storage area for the upstream network in high tides. It has also previously flooded due to overtopping in storm conditions. Parts of the upstream network including Drayton and Farlington have a history of flooding. Large parts of Portsea Island drain through Great Salterns Golf Course before discharging via a recently upgraded pump system through an outfall to the sea; during extensive heavy rainfall events localised flooding occurs around the golf course. The flooding has been hugely reduced since 2015 Southern Water improvements including a new open water course through the golf course.
- Surface water flooding has affected transport and properties around Penrose Close, caused by the overloaded Western Interceptor sewer running along the west of Portsea Island. However, surface water flooding affecting the residential properties on Penrose Close hasn't been recorded since 2010. The pumping station at Stamshaw Park has recently been upgraded by Southern Water, which will confer a reduction in surface water flood risk to the area around Penrose Close. Surface water flooding caused by a possible groundwater issue has affected Hambrook Street and surrounding transport and properties. The surface water flooding on Hambrook Street and Bellevue Terrace are currently being addressed by Southern Water through the upgrade of Pier Road pumping station. Recent improvements have meant that the flooding has not been repeated recently. Three flood events occurred to the north of Farlington Marshes in the Drayton and Farlington ward, and it is likely that a combination of groundwater, tidal influence, rainfall, and inability for the sewerage system to cope all contributed to these events.
- Several recent flood events affected private properties externally in the Hilsea ward; it is likely that defective sewer systems, groundwater, impermeable ground, rainfall, and tide-locking contributed to the flooding.
- Several historic flood events have affected private properties and a main road in the Copnor ward; it is likely that these were caused by a fault in the local combined sewerage network. Following improvements to the sewerage network that were completed in 2015 by Southern Water, no further incidents of flooding have occurred.
- Several historic surface water flood events have occurred in small pockets across the Nelson ward, thought to be caused by inadequacies in the localised sewerage system (these are presently being addressed by Southern Water).
- Pockets of surface water flooding have been recorded across the Baffins ward, along with incidents of wave overtopping along the Eastern Road frontage (it is likely that there was groundwater influence on one of the more recent events). The groundwater influenced flood events have not recurred since 2014. Coastal defence improvements currently underway will significantly reduce the risk of wave overtopping along the Eastern Road frontage.
- A few localised pockets of surface water flooding have been recorded across the Fratton ward, Charles Dickens ward, Milton ward and Central Southsea ward, most likely caused by blocked gullies or pipes.
- There are records of coastal flooding to properties in the St Thomas ward, especially in the Old Portsmouth area; this flooding is likely influenced by groundwater levels and seawater infiltration to the trunk sewers. Improvements by Southern Water to the sewerage network in Old

Portsmouth and Southsea over the past 10 years are likely to reduce the risk of coastal flooding because of seawater infiltration into trunk sewers.

- The St Jude ward was severely affected in 2000 by flooding, likely caused by the low topography of the Great Morass and Little Morass areas, groundwater, tide-locking, and sewerage network issues.
- Cosham has suffered recent flood events just to north of railway line, which PCC and Southern Water are currently working towards resolving with the assistance of Environment Agency funding.

Future flood risk

- 3.5.9 Section 3.2 of Part 1 Main Report describes the impact of climate change on surface water flood risk and summarises the peak rainfall intensity climate change allowances for the study area which range from 20% - 45% depending on the specific location and epoch under consideration.
- 3.5.10 The RoFSW does not include specific scenarios to determine the impact of climate change on the risk of surface water flooding and it is not within the scope of this SFRA to undertake such modelling. However, a range of three annual probability events have been modelled, 3.3%, 1% and 0.1%, and therefore it is possible to use with caution the 0.1% outline as a substitute dataset to provide an indication of the implications of climate change on surface water flood risk in the future.
- 3.5.11 Given the historic records of flooding from surface water, groundwater, and sewer systems, coupled with the predictions for rising sea levels and greater rainfall intensity, it is likely that the frequency and severity of flooding from these sources will increase in the future.

3.6 Reservoir flooding

- 3.6.1 Appendix A Figure 6 presents the Risk of Flooding from Reservoirs dataset for the study area. This identifies Farlington Marshes to potentially be at risk of flooding in the unlikely event of the failure of the Farlington No.6, Farlington No.7, Farlington No.8, and Farlington No.9 reservoirs. Portsmouth Water are the undertaker for all these reservoirs.

3.7 Other water bodies

- 3.7.1 There are several other water bodies present in the study area. These are summarised below. There is no specific mapping of flood risk or historical records of flooding associated with these water bodies.
- 3.7.2 There are two moats within Portsmouth, historically used as defences. Long Curtain Moat is in the southwest, and Hilsea Moat is in the north, parallel to Ports Creek. These are likely to be lined with low permeability compacted material to maintain water levels.
- 3.7.3 Port Solent is an inland marina in the northwest, entered from Paulsgrove Lake. A double lock system is in place to maintain water levels. The marina is built with reclaimed land on what was part of Paulsgrove Lake.
- 3.7.4 On the west coast of Portsmouth is a HM Naval Base with docks. Water levels are managed by lock systems including dry docks.
- 3.7.5 Several inland waterbodies such as ponds and lakes are present in the study area:
- 2 balancing ponds adjacent to Western Road, north of Lakeside Development, which hold water during high tide events.
 - Large lake in Lakeside Development, surrounding the south side of industrial estate. This is reclaimed land with its own network of ditches feeding the lake, which has a triggered pump outlet under the motorway into Tipner Lake.
 - Horsea Lake, 1km long rectangular lake used for diver training and has no known drainage function
 - Various small ponds and lakes as part of Farlington Marshes.
 - Large lake at Farlington Marshes that acts as a floodwater storage area during high tide events.

- 1 balancing pond adjacent to Eastern Road, in northeast of the island which holds water during high tide events.
- Great Salterns Lake, downstream of the Great Salterns Recreation and Golf Course area. This is a critical asset as it collects approximately one quarter of the island's drainage.
- 3 Lakes (Frog, Duck, Swan) in Milton Common, eastern side of the island. No known drainage function, except from surrounding land mass.
- Baffins Pond, in Baffins Park area, centre of island. No known drainage function, except from surrounding land mass.
- Canoe Lake, recreational lake on south coast of Portsmouth used for pedal boating. No known drainage function, except from surrounding land mass.
- Long Curtain Moat - No known drainage function
- Hilsea Lines moats - No known drainage function, except from surrounding land mass
- Walton Road balancing pond - Hold waters in high tide events
- Tamworth Park pond - No known drainage function, except from surrounding land mass

4. Cumulative impact of development and land use change

4.1 Cumulative impact assessment

- 4.1.1 The NPPF states that strategic policies should be informed by a strategic flood risk assessment, and should consider cumulative impacts in, or affecting, local areas susceptible to flooding (paragraph 160).
- 4.1.2 When allocating land for development consideration should be given to the potential cumulative impact on flood risk with a catchment. Development increases the impermeable area within a catchment, which, if not effectively managed, can cause increased rates and volumes of surface water runoff and changes to floodplain storage, thereby resulting in increased flood risk further downstream. Whilst individual development with appropriate site mitigation measures should not result in measurable local effects with respect to hydrology and flood risk, the cumulative effect of multiple development may be more severe at downstream locations in the catchment. Locations where there are existing flood risk issues will be particularly sensitive to cumulative effects.
- 4.1.3 As described in SFRA Part 1 Section 3.7, as part of this SFRA an assessment of the study area has been undertaken to identify those catchments where there is greater potential for cumulative effects on flood risk. For each catchment, consideration has been made of the:
- i. The size and nature (rural or urban) of the catchment
 - ii. The risk of flooding in the catchment from rivers, surface water and groundwater, based upon data from the Hampshire Catchment Prioritisation Tool, and
 - iii. The scale of potential future development in the catchment, based upon a review of potential development sites and growth locations provided by the LPA.
- 4.1.4 Appendix A Figure 7 shows the outputs for Portsmouth. A red, amber, green rating has been used to highlight those catchments where there is a higher, medium, and lower potential for cumulative effects on flood risk. This figure shows that most of the administrative area has high potential for cumulative impact of development on flood risk.
- 4.1.5 It is recommended that Portsmouth CC consider area specific policies or guidance for new development to help reduce the cumulative impact, and where possible, identify opportunities for new development to provide cumulative betterment with respect to flood risk. This may be achieved through implementing the types of measures described in Section 6.

4.2 Cross boundary considerations

- 4.2.1 The Portsmouth administrative area has very few interactions with other Boroughs due to the topography, geology, and way the drainage systems work. However, there are still cross boundary flows that need to be considered, including:
- The northern edge of the Portsmouth CC administrative area drains northwards into the Potwell tributary and the River Wallington in the Winchester CC administrative area.
 - The River Wallington flows from Winchester, through Fareham, and discharges into Portsmouth Harbour, which is within the Portsmouth administrative area.
 - Bedhampton Springs, which are the source of Portsmouth's water supply, are within Havant¹⁹.
 - The section of coastline between Port Solent and Portchester Castle is divided between the Portsmouth CC and Fareham Borough Council administrative areas. There are many residential properties situated on this stretch of coastline, the majority of which are in the Fareham Borough Council administrative area.

¹⁹ Portsmouth City Council, 2019, Surface Water Management Plan. <https://www.portsmouth.gov.uk/wp-content/uploads/2020/04/Surface-water-management-plan.pdf>

5. Current control, mitigation, and management measures

5.1 Defences

- 5.1.1 A description of the coastal defences is provided in Table 5-1, as summarised in the Portchester to Emsworth Strategy³ and Portsea Island Coastal Strategy².

Table 5-1 Coastal flood defences in Portsmouth

Strategy	Location	Description of Coastal Defences
Portchester to Emsworth	Reach 1 Portchester to Paulsgrove	Mix of concrete wall, concrete bagwork wall, revetted embankment and sheet piling.
	Reach 2 Horsea Island	Concrete block revetment at Port Solent. Gabion wall surrounding MoD Diving School and landfill site. Very good to good condition.
	Reach 3 M27 & Farlington Marshes	Concrete block revetment for entire frontage. M27 refurbishment works recently completed – condition now good. Farlington: Condition generally poor, regular overtopping and repair maintenance required annually. Vehicle culvert under A27 provides flood route to Farlington.
Portsea Island Coastal Strategy	Flood Cell 1 Southsea (Old Portsmouth to Royal Marines Barracks)	Seawalls.
	Flood Cell 2 Fraser Battery (Langstone Harbour Entrance Channel)	Revetment, seawalls, gabions, timber structure.
	Flood Cell 3 Eastney Lake	Seawalls and natural shoreline.
	Flood Cell 4 Portsea North	Mix of embankments, seawalls, revetment systems. Including earth embankment with rock revetment toe at Anchorage Park . Earth embankments and rock revetment structure at Milton Common . Seawall at Tipner Lake .
	Flood Cell 5 Tipner	Embankments and seawalls.
	Flood Cell 6 Continental Ferry Port	Revetment, seawalls.
	Flood Cell 7 HM Naval Base	Seawalls.

- 5.1.2 Data provided by the Environment Agency from their Asset Information Management System (AIMS) is included in Appendix A Figure 2. This data is the best available for the SFRA but is not a complete dataset of the flood defences present in the study area. The National Coastal Erosion Risk Mapping (NCERM) is presented in Appendix B Figure 2 and provides a useful indication of the type of frontage, e.g., embankment, gabions, natural, revetment, seawall, timber structure, other etc.
- 5.1.3 The mapping in Appendix A Figure 2 shows that high ground lines the Great Salterns Drain and Farlington Marshes Gutter, the recorded design standard of protection (SOP) of which is 1% AEP (1 in 100 year). An embankment, with a reported design SOP of 4% AEP (1 in 25 year), surrounds the Farlington Marshes coastline. There is also a demountable defence across a footpath in Farlington Marshes that passes under the A27.
- 5.1.4 The section of coastline northwest of Anchorage Park is lined by embankments and engineered high ground.
- 5.1.5 The eastern and northern fringes of Paulsgrove Lake are protected by stretches of engineered high ground and stone revetments with a reported design SOP of less than 100% AEP (1 in 100 year). The western fringe of Paulsgrove Lake is protected by a concrete seawall with a reported design SOP varying between 4% AEP (1 in 25 year) and 2% AEP (1 in 50 year).

5.2 North Portsea Island Scheme

5.2.1 The North Portsea Island scheme covers 8.4km of Portsmouth's coastline and aims to reduce the risk of flooding from the sea to over 4,200 homes, 500 businesses, and critical infrastructure over the next 100 years²⁰. The scheme has been designed to increase the standard of protection along Portsmouth's coastline to a 1 in 500-year (plus allowance for climate change to 2100) event. The construction of this scheme began in 2015 and is being delivered in five construction phases, with completion planned in 2025. The phases already complete include:

- Phase 1: Construction of 1.4km of earth embankment with rock revetment toe at **Anchorage Park**, completed in 2016. Design height +4.30m AOD. Construction height varies between +4.50m AOD and +4.60m AOD on the northern frontage to allow for settlement. On the Eastern Road stretch, design height of +4.60m AOD. Constructed between +4.80m AOD and +5.10m AOD on the eastern frontage to allow for settlement.
- Phase 2: Construction of 1.5km of earth embankments and rock revetment structure at **Milton Common**, completed in 2016. Design height: +4.70m AOD (including 150mm settlement).
- Phase 3: Construction of 1.9km of a seawall at **Tipner Lake**, completed in 2019. Design height +4.5m AOD.

5.2.2 Two phases are yet to be completed, as described in Section 6.1.



Figure 5-1 North Portsea coastal Scheme

5.3 Southsea Coastal Scheme

5.3.1 Existing defences at Southsea are coming to the end of their lifespan and new defences are being constructed along the seafront. Details are provided in Section 6.1. At the time of preparing this SFRA, the first stage has been implemented, which comprises a vertical sea defence with existing high ground and short section of new secondary defence at Long Curtain Moat.

²⁰ Coastal Partners Protecting the Future of North Portsea Island. <https://coastalpartners.org.uk/project/protecting-the-future-of-north-portsea-island/>

5.4 Flood Warning Service

- 5.4.1 The Environment Agency provides a free Flood Warning Service²¹ for many areas at risk of flooding from the sea and because of elevated groundwater. Three different codes are issued depending on the type of flooding forecasted:
- Flood Alert – Flooding is possible, be prepared.
 - Flood Warning – Flooding is expected, immediate action is required.
 - Severe Flood Warning – Severe flooding, danger to life.
- 5.4.2 The Environment Agency's website offers up-to-date flood information, monitoring information of river and sea levels and latest flood risk forecast, as well as a page to sign up to warnings by phone, text, email, or fax²².
- 5.4.3 There are 8 Flood Warning Areas in Portsmouth CC which are shown in Appendix A Figure 9 and are as follows:
- Portchester
 - Port Solent, Farlington and Brockhampton
 - Hilsea
 - Eastern Portsmouth
 - Tipner and Stamshaw
 - Old Portsmouth
 - Southsea
 - Gosport
- 5.4.4 The Environment Agency publishes 'Water situation: area monthly' reports for England²³ for each of its areas. These reports identify monthly rainfall, soil moisture deficit, river flows, groundwater levels and reservoir levels. The Environment Agency also publishes 'Groundwater situation'²⁴ reports which provide the latest update on monitored groundwater levels and whether there are any groundwater alerts or warnings in force. These reports will give an indication as to when groundwater levels may be high and groundwater flooding may be imminent.
- 5.4.5 The Environment Agency also provide a targeted groundwater flood warning service through issue of groundwater "Flood Alerts" for specific locations and communities. As groundwater flooding rises more slowly than fluvial flooding, there is a lesser requirement for immediate action and there is unlikely to be a danger to life. On this basis the Environment Agency do not issue "Flood Warnings" or "Severe Flood Warnings" for this type of flooding and for groundwater flooding the Environment Agency only issue "Flood Alerts".

5.5 Residual Risk

- 5.5.1 The risk of flooding can never be fully mitigated, and there will always be a residual risk of flooding that will remain after measures have been implemented to protect an area or a particular site from flooding. This residual risk is associated with several potential risk factors including (but not limited to):
- a flooding event that exceeds that for which the flood risk management measures have been designed e.g., flood levels above the designed finished floor levels,
 - the structural deterioration of flood defence structures (including informal structures acting as a flood defence) over time, and/or

²¹ Environment Agency, Check for Flooding in England <https://check-for-flooding.service.gov.uk/>

²² Environment Agency, Sign up for Flood Warnings <https://www.gov.uk/sign-up-for-flood-warnings>

²³ Water situation: area monthly reports for England <https://www.gov.uk/government/publications/water-situation-local-area-reports>

²⁴ Groundwater: current status and flood risk <https://www.gov.uk/government/collections/groundwater-current-status-and-flood-risk>

- general uncertainties inherent in the prediction of flooding.
- 5.5.2 As part of the updated coastal modelling undertaken to inform this SFRA, scenarios have been undertaken to assess the residual risk of flooding. This includes model simulations without the inclusion of flood defences (the 'undefended' scenario) as well as the modelling of breach in flood defences in various locations.
- 5.5.3 Maps of the 'undefended' model scenarios are presented in Appendix B Figures 8, 9, 15 and 16.
- 5.5.4 In Portsmouth, breaches have been modelled at the following locations. Details of the modelling approach are included in Part 1 Main Report Appendix B, and results provided to Portsmouth CC as GIS layers:
- OLD1 Old Portsmouth.
 - HIL1 East side of Hilsea Bastion Gardens (immediately opposite M275).
 - POR1 West side of Paulsgrove Lake (Portchester).
 - HOR1 Southern side of Horsea Island.
 - ESN1 Eastern end of Eastney Beach.
 - ESN2 Western end of Eastney Beach.
- 5.5.5 The modelling of flood flows and flood levels is not an exact science, therefore there are inherent uncertainties in the prediction of flood levels used in the assessment of flood risk. Whilst the Flood Map for Planning Flood Zones and coastal modelling outputs provide a relatively robust depiction of flood risk for specific conditions all modelling requires the making of core assumptions and the use of empirical estimations.
- 5.5.6 Steps should be taken to manage these residual risks using flood warning and evacuation procedures, as described in Section 7.

6. Opportunities to reduce the causes and impacts of flooding

The NPPF appreciates that it may not always be possible to avoid locating development in areas at risk of flooding. This Section identifies opportunities to reduce the causes and impacts of flooding. These measures should be considered both at a strategic scale, when planning development across the LPA, as well as at a site specific level.

6.1 Flood and Coastal Erosion Risk Management (FCERM) schemes

6.1.1 The programme of Flood and Coastal Erosion Risk Management (FCERM) schemes²⁵ identifies three proposed schemes in the Portsmouth administrative area for the next 6 year period which will reduce the causes and impacts of flooding:

- Portsea Island – Flood Cell 4: North Portsea Island Coastal Flood and Erosion Risk Management Scheme
- Farlington Marshes Project
- Portsea Island – Flood Cell 1: Southsea Coastal Flood and Erosion Risk Management Scheme

6.1.2 A scheme has also been identified for the Portchester to Paulsgrove coastline. This section provides a summary of each of these four schemes.

Portsea Island – Flood Cell 4: North Portsea Island Coastal Flood and Erosion Risk Management Scheme

6.1.3 As discussed in Section 5.2, the North Portsea Island Scheme, aims to reduce flood risk to 4200 homes, 500 business, and critical infrastructure within North Portsea Island²⁶. Three out of five construction phases have already been completed. The remaining two phases include:

- Phase 4a and 4b: Construction of a seawall with road raising at (a) Eastern Road and (b) Kendall's Wharf, planned for completion in 2023, and
- Phase 5: Defences at Ports Creek, planned for completion in 2025.

Farlington Marshes Project

6.1.4 Farlington Marshes is one of Hampshire and Isle of Wight Wildlife Trust's flagship nature reserves and is home to an array of important habitats and wildlife²⁷. The marshes are currently protected by a 3.5km seawall, which is deteriorating in places. The sea wall is in poor to fair condition and some sections have been assessed as having a limited useful remaining life span. A significant breach of the sea wall could result in inundation of the Marshes and its terrestrial, freshwater, and saline lagoon habitats, resulting in damage to and loss of the designated interest features of the site with subsequent knock-on impacts to important species and habitats in the wider Natural Sites Network.

6.1.5 The project team are investigating options for future flood risk management of Farlington Marshes. Engagement with key stakeholders including Portsmouth CC, Natural England, Coastal Partners and the Hampshire and Isle of Wight Wildlife Trust has resulted in broad agreement that a Hold the Line (keep the current defence) strategy is the preferred management strategy for Farlington Marshes, at least until 2060. This is primarily due to the strategic importance of the site for its nature conservation interest and for public green space.

²⁵ Programme of flood and coastal erosion risk management (FCERM) schemes

<https://www.gov.uk/government/publications/programme-of-flood-and-coastal-erosion-risk-management-schemes>

²⁶ Coastal Partners Protecting the Future of North Portsea Island. <https://coastalpartners.org.uk/project/protecting-the-future-of-north-portsea-island/>

²⁷ Environment Agency Farlington Marshes Project Information Page. <https://consult.environment-agency.gov.uk/solent-and-south-downs/farlington-marshes/>

- 6.1.6 However, it is accepted that, due to sea level rise projections, sea defence raising is not a permanent solution for the protection of habitats at this site and that therefore an opportunity exists under this scheme to start planning for transition to a more sustainable solution.
- 6.1.7 Although there are low-lying homes within the wider coastal floodplain of which Farlington Marshes are a part, the existing sea wall does not directly provide protection to these.

Portsea Island – Flood Cell 1: Southsea Coastal Flood and Erosion Risk Management Scheme

- 6.1.8 Existing defences at Southsea are coming to the end of their lifespan, increasing the risk of flooding in Southsea. The Southsea Coastal Scheme aims to reduce the risk of flooding for more than 10,700 properties along the coast from Old Portsmouth to Eastney for the next 100 years²⁸. This will be achieved via the construction of new defences along the seafront, including:
- A vertical sea defence with existing high ground and short section of new secondary defence at Long Curtain Moat,
 - A grass bund running behind existing buildings at Clarence Pier (the location of a primary defence has also been identified as part of any future development of the area),
 - Existing beach widening, combined with a stepped revetment defence and a sloped grass bund at Southsea Common,
 - Rock armour combined with use of existing high ground or a new secondary defence at Southsea Castle,
 - Existing beach widening, combined with a stepped revetment defence and buried rock toe at The Pyramids Centre,
 - A stepped revetment defence with a buried rock toe at South Parade Pier,
 - Existing beach widening, combined with a stepped revetment defence and buried rock toe at Canoe Lake Park, and
 - A long term beach management and monitoring plan put in place to ensure adequate flood protection remains at Eastney Esplanade.
- 6.1.9 Construction of the scheme began in 2020 and is planned for completion in 2028.

Portchester to Paulsgrove FCERM Scheme²⁹

- 6.1.10 There are currently 361 residential and 108 commercial properties at risk from coastal flooding in Portchester and Paulsgrove. This is expected to increase with the effects of climate change to 662 residential and 141 commercial properties at risk by the year 2115.
- 6.1.11 In 2015 Coastal Partners secured funding to undertake a Flood and Coastal Erosion Risk Management options appraisal study in partnership with Fareham BC, Portsmouth CC, the Environment Agency, and Quadrant Estates to determine the best way to reduce the risk of flooding.
- 6.1.12 In February 2018 Coastal Partners secured technical and financial approval from the Environment Agency for the next stages of the project which proposed a £10.7 million scheme to deliver a 1 in 200 year standard of protection for the next 15 years. The outline design includes a new sloping revetment and raised concrete capping at Castle Shore Park, as well as an earth bund along Southampton Road.
- 6.1.13 However, releasing the £5.1 million of government grant approved by the Environment Agency relies upon private developer contributions of £3.075 million towards the wider defence scheme and £2.3 million towards defences on the Trafalgar Wharf site. Unfortunately, at present, despite intensive negotiations between Portsmouth CC and the private developer, a mutually agreeable method for securing the contribution has not been identified. Without 3rd party contributions the planned scheme will not go ahead in its current form.

²⁸ Coastal Partners Southsea Coastal Scheme <https://coastalpartners.org.uk/project/southsea-coastal-scheme/>

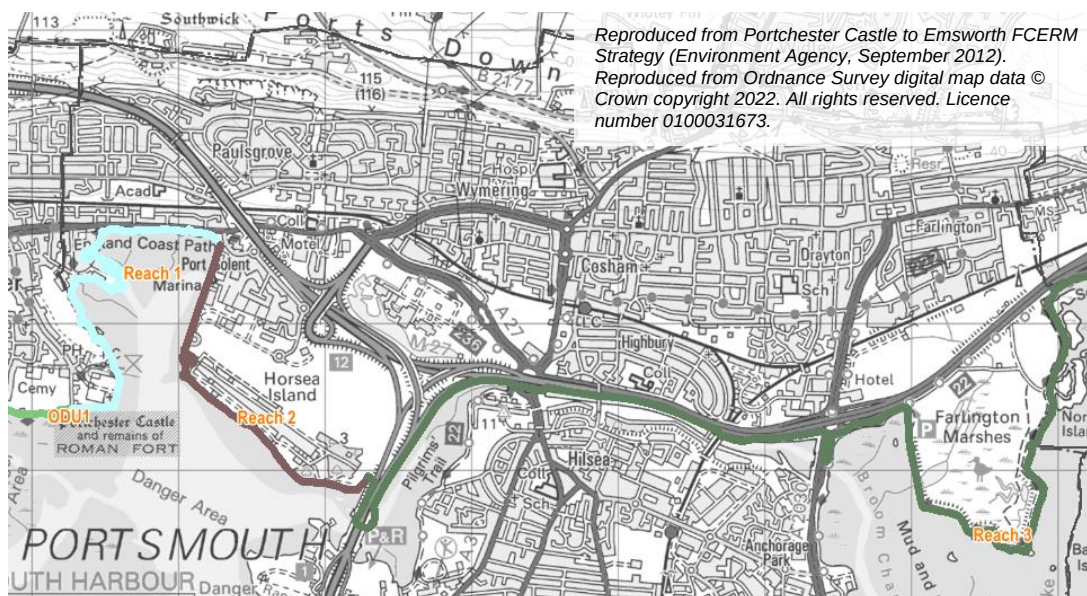
²⁹ Portchester to Paulsgrove Flood and Coastal Erosion Risk Management Scheme
<https://coastalpartners.org.uk/project/portchester-to-paulsgrove/>

6.2 Safeguard land for defence improvements

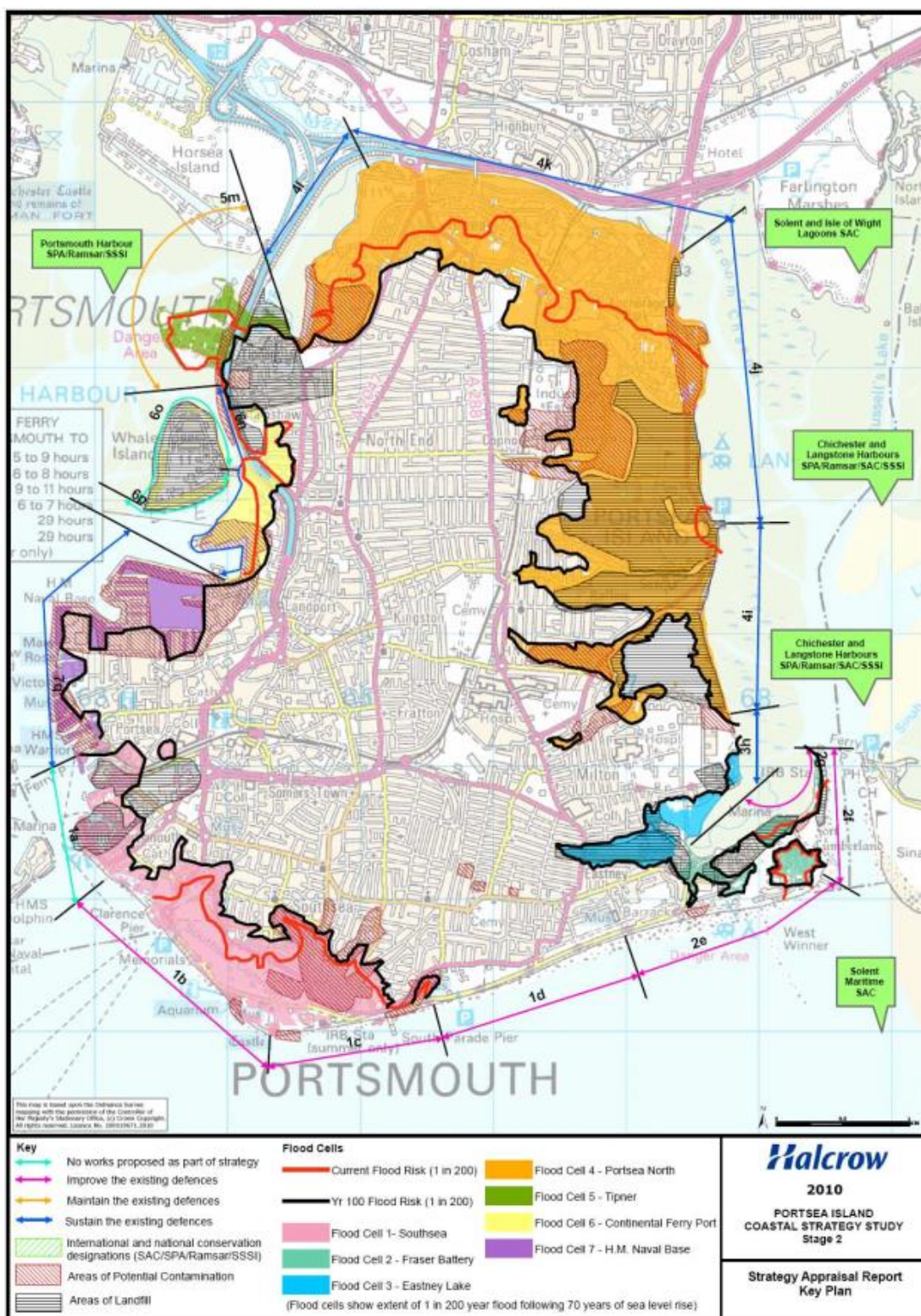
- 6.2.1 As detailed in Section 2, the policies with the Shoreline Management Plan for most of Portsmouth (except for Farlington Marshes) is to 'hold the line' in the short, medium, and long term. The Portchester Castle to Emsworth FCERM Strategy³ and Portsea Island Coastal Strategy Study² develop this policy and identify the preferred strategic options along sections of the coastal frontages.
- 6.2.2 It is vital that Portsmouth CC safeguard land in accordance with these Strategies for implementation of these flood defence improvement measures over the coming years. Details for specific sections that should be safeguarded are detailed in Table 6-1.

Table 6-1 Land to safeguard for flood defences and land raising

- **Reach 1: Portchester Castle to Paulsgrove:** As noted in Section 6.1.10, defence improvement works are required, with further raising in the future. Land should be safeguarded to enable future raising.
- **Reach 2: Horsea Island:** Land should be safeguarded to enable maintenance of revetment and seawalls in the medium term. Replacement, refurbishment, and general repair works will be required long term and therefore land should be safeguarded to enable this.
- **Reach 3 M27 & Farlington Marshes:** Safeguard land for the maintenance of the M27 revetment and the installation of flood gates at subway under M27 to the west of the trainline. Safeguard land to maintain Farlington Marsh revetment or Managed Realignment revetment and habitat establishment.



- **Flood Cell 1: Southsea:** As noted in Section 6.1.9, capital works are required. Land should be safeguarded for defence improvement works in the medium term. Replacement will be required in the long term and therefore land should be safeguarded to enable this.
- **Flood Cell 2: Fraser Battery:** Land should be safeguarded for defence improvement works in the medium term. Replacement will be required in the long term and therefore land should be safeguarded to enable this.
- **Flood Cell 3: Eastney Lake:** Land should be safeguarded for defence improvement works in the medium term. Replacement will be required in the long term and therefore land should be safeguarded to enable this.
- **Flood Cell 4: Portsea North:** As noted in Section 6.1.4, capital works are required. Land should be safeguarded for defence improvement works in the medium term. Replacement will be required in the long term and therefore land should be safeguarded to enable this.
- **Flood Cell 5: Tipner:** Land should be safeguarded for the replacement and maintenance of defences to secure protection against contamination in the medium term. Replacement and maintenance will be required in the long term and therefore land should be safeguarded to enable this.
- **Flood Cell 6: Continental Ferry Port:** Land should be safeguarded for defence improvement works in the medium term. Replacement will be required in the long term and therefore land should be safeguarded to enable this.
- **Flood Cell 7: H.M. Naval Base:** Replacement of defences will be required in the long term and therefore land should be safeguarded to enable this.



Extract from Portsea Island Coastal Strategy Study² (Key Plan 1 Study Area, page 9)

6.2.3 The Environment Agency typically seek a 16 metre set back from tidal flood defences for maintenance purposes. Under the Environmental Permitting (England and Wales) Regulations (2016)³⁰, an environmental permit is required for any activity within 16m of a sea defence structure, or within 16m of the bank of a tidal main river.

³⁰ The Environmental Permitting (England and Wales) Regulations 2016
<http://www.legislation.gov.uk/uksi/2016/1154/contents/made>

- 6.2.4 **Policy Recommendation:** Safeguard land for flood defence maintenance and future upgrades within Reach 1 – 3 and Flood Cell 1 – 7. Safeguard an adequate undeveloped buffer strip alongside tidal flood defence structures to allow future management and maintenance of flood defence structures. Developers and applicants should engage effectively to ensure an appropriate buffer is provided. Each case will be assessed on its own merits taking into consideration site characteristics and the management measures in place. Development adjacent to the coastal frontage should facilitate the delivery of improvements to and maintenance of flood defences, through site design and financial contribution.

6.3 Maintenance of watercourses and flood defences

Main River

- 6.3.1 The Environment Agency is likely to seek an 8 metre wide undeveloped buffer strip alongside main fluvial rivers and 16 metre along tidal main rivers for maintenance purposes and would also ask developers to explore opportunities for riverside restoration as part of any development.
- 6.3.2 Under the Environmental Permitting (England and Wales) Regulations (2016)³⁶, an environmental permit is required if works are to be carried out:
- on or near a main river
 - on or near a flood defence structure, or
 - in a floodplain.
- 6.3.3 Since requirements of the consenting process in relation to flood risk, biodiversity and pollution may result in changes to development proposals or construction methods, the Environment Agency aims to advise on such issues as part of its statutory consultee role in the planning process. Should proposed works not require planning permission the Environment Agency can be consulted regarding permission to do work on or near a river, or a flood or sea defence by contacting enquiries@environment-agency.gov.uk.
- 6.3.4 **Policy Recommendation:** Safeguard an adequate undeveloped buffer strip alongside fluvial and tidal Main Rivers or flood defence structures and prioritise riverside restoration.

Ordinary watercourse

- 6.3.5 Ordinary watercourses are watercourses that are not part of a main river and include streams, ditches, drains, cuts, culverts, dykes, sluices, sewers (other than public sewers) and passages, through which water flows.
- 6.3.6 As the LLFA, Portsmouth CC is responsible for the consenting of works to ordinary watercourses and has powers to enforce un-consented and non-compliant works. This includes any works (including temporary) that place or alter a structure within an ordinary watercourse or affect the flow or storage of water within an ordinary watercourse. Portsmouth CC will seek an undeveloped buffer strip to be retained alongside ordinary watercourses. Contact the Portsmouth CC Drainage Team at drainageteam@portsmouthcc.gov.uk for further information regarding ordinary watercourse consent³⁷.
- 6.3.7 **Policy Recommendation:** Safeguard an undeveloped buffer strip alongside ordinary watercourses for maintenance purposes. Developers should prioritise riverside restoration as part of development adjacent to ordinary watercourses.

6.4 River restoration

- 6.4.1 During the last century, many rivers were modified using hard engineering techniques to often straighten or canalise them. The disadvantages of these techniques have now become apparent which include the damage to the environment and ecosystems as well as an increase in flooding.

³⁶ The Environmental Permitting (England and Wales) Regulations 2016
<http://www.legislation.gov.uk/uksi/2016/1154/contents/made>

³⁷ Portsmouth City Council Flood Protection Policies. <https://www.portsmouth.gov.uk/services/environmental-health/safety/flood-protection-policies/>

- 6.4.2 River restoration contributes to flood risk management by supporting the natural capacity of rivers to retain water. By re-connecting brooks, streams and rivers to floodplains, former meanders, and other natural storage areas, and enhancing the quality and capacity of wetlands, river restoration increases natural storage capacity and reduces flood risk. Excess water is stored in a timely and natural manner in areas where values such as attractive landscape and biodiversity are improved and opportunities for recreation can be enhanced.
- 6.4.3 Returning rivers to a more natural state can often include the removal of structures such as weirs or culverts which can have multiple benefits for biodiversity in addition to improving the flow regime³⁸. Further guidance on river restoration is available from the Environment Agency³⁹.
- 6.4.4 Given the lack of significant watercourses or undeveloped floodplains, there are limited opportunities for the restoration of fluvial floodplains in the Portsmouth CC area.
- 6.4.5 **Policy Recommendation:** Where development is planned in urban areas, opportunities for de-culverting watercourse sections should be sought to bolster local channel capacity and conveyance.

6.5 Flood storage

- 6.5.1 Flood Storage Areas (FSAs) are natural or man-made areas that temporarily fill with water during periods of high river level, retaining a volume of water which is released back into the watercourse after the peak river flows have passed. There are two main reasons for providing temporary detention of floodwater:
- To compensate for the effects of catchment urbanisation, and
 - To reduce flows passed downriver and mitigate downstream flooding.
- 6.5.2 Providing flood storage within a development area or further upstream of a development can manage and control the risk of flooding. In some cases, it can provide sufficient flood protection on its own; in other cases, it may be chosen in conjunction with other measures. The advantage of flood storage is that the flood alleviation benefit generally extends further downstream, whereas other methods tend to benefit only the local area and may increase the flood risk downstream.
- 6.5.3 Further guidance on Flood Storage is provided within Chapter 10 of the Environment Agency's Fluvial Design Guide⁴⁰.
- 6.5.4 **Policy Recommendation:** Portsmouth CC should appraise the options for creating flood storage areas on the eastern side of Portsea Island and in the Farlington area.

Floodplain compensation

- 6.5.5 Where proposed development results in a change in building footprint, land raising or other structures such as bunds, the developer must ensure that it does not impact upon the ability of the floodplain to store water and should seek opportunities to provide betterment with respect to river floodplain storage.
- 6.5.6 Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain must be provided to ensure that the total volume of the floodplain storage is not reduced.
- 6.5.7 Floodplain compensation must be provided on a level for level, volume for volume basis on land which does not already flood and is within the site boundary. Where land is not within the site boundary, it must be in the immediate vicinity, in the applicant's ownership and linked to the site. Floodplain compensation must be considered in the context of the 1% AEP flood level including an appropriate allowance for climate change. When designing a scheme flood water must be able to flow in and out and must not pond. An FRA must demonstrate that there is no loss of flood storage capacity and include details of an appropriate maintenance regime to ensure mitigation continues to function for the life of the

³⁸ European Centre for River Restoration <https://www.ecrr.org/River-Restoration/Flood-risk-management/Healthy-Catchments-managing-for-flood-risk-WFD/Environmental-improvements-case-studies/Remove-culverts>

³⁹ Environment Agency, Fluvial Design Guidance Chapter 8
https://assets.publishing.service.gov.uk/media/60549ae1e90e0724c0df4619/FDG_chapter_8_-_Works_in_the_river_channel.pdf

⁴⁰ Environment Agency, Fluvial Design Guidance Chapter 10
https://assets.publishing.service.gov.uk/media/60549b7a8fa8f545cf209a29/FDG_chapter_10_-_Flood_storage_works.pdf

development. Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624⁴¹.

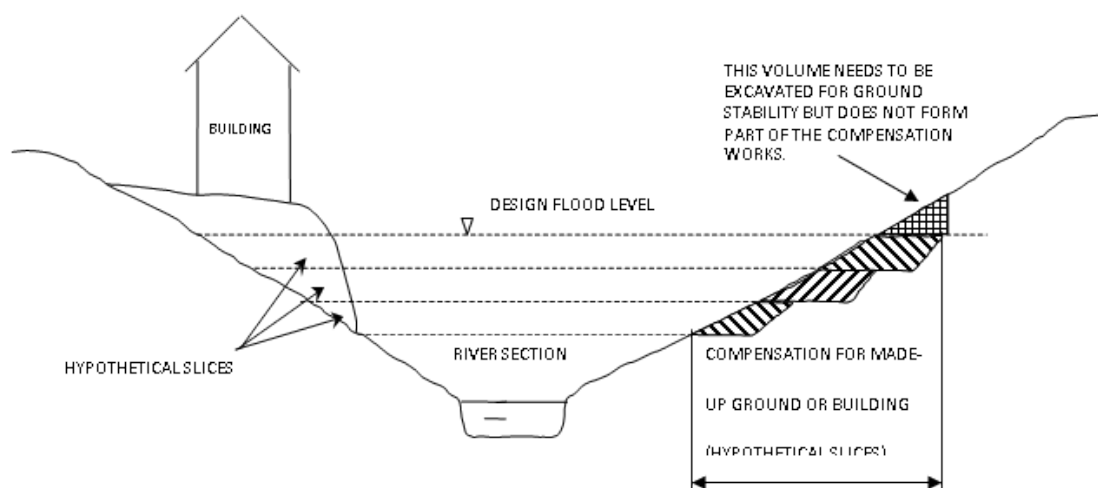


Figure 6-1 Example of Floodplain Compensation Storage (Environment Agency 2009)

- 6.5.8 The requirement for no loss of floodplain storage means that it is not possible to modify ground levels on sites which lie completely within the fluvial floodplain (when viewed in isolation), as there is no land available for lowering to bring it into the floodplain. It is possible to provide off-site compensation within the local area e.g. on a neighbouring or adjacent site, or indirect compensation, by lowering land already within the floodplain, however, this would be subject to detailed investigations and agreement with the Environment Agency to demonstrate (using an appropriate flood model where necessary) that the proposals would improve and not worsen the existing flooding situation or could be used in combination with other measures to limit the impact on floodplain storage.
- 6.5.9 Where car parks are specified as areas for the temporary storage of surface water and fluvial floodwaters, flood depths should not exceed 300mm given that vehicles may be moved by water of greater depths. Where greater depths are expected, car parks should be designed to prevent the vehicles from floating out of the car park. Signs should be in place to notify drivers of the susceptibility of flooding and flood warning should be available to provide sufficient time for car owners to move their vehicles if necessary.
- 6.5.10 **Policy Recommendation:** Where proposed development results in a change in building footprint, land raising, or other structures, that impact upon the ability of the fluvial floodplain to store water, floodplain compensation must be provided on a level for level, volume for volume basis on land which does not already flood and is within the site boundary.

6.6 Working with natural processes

- 6.6.1 Natural flood management involves techniques that aim to work with natural hydrological and morphological processes, features, and characteristics to manage the sources and pathways of flood waters. Techniques include the restoration, enhancement and alteration of natural features and characteristics, but exclude traditional flood defence engineering that works against or disrupts these natural processes.
- 6.6.2 Appendix A Figure 8 provides information from the Environment Agency's 'Working with Natural Processes – Evidence Directory'⁴² about where these measures could be applied. This map shows that although there are a lot of existing woodland constraints within the Portsmouth administrative area, there are still some opportunities to implement natural processes to alleviate flooding. There is potential opportunity for significant riparian woodland planting towards the east of the administrative area, as well as some potential to the north, the west, and the southeast. There is also opportunity for wider catchment woodland to the southeast. Further information about these datasets is included in SFRA

⁴¹ CIRIA (2004) CIRIA Report 624: Development and Flood Risk - Guidance for the Construction Industry

⁴² Working with Natural Processes – Evidence Directory

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/681411/Working_with_natural_processes_evidence_directory.pdf

Report Part 1. Riparian woodland planting also holds the potential to confer environmental benefits such as improved water quality, Biodiversity Net Gain, wildlife corridors, and carbon sequestration, in unison with natural flood management.

- 6.6.3 **Policy Recommendation:** Seek opportunities to implement natural flood management techniques in the administrative area such as the planting of riparian woodland and wider catchment woodland, to attenuate surface water runoff and groundwater recharge, both in, and preferably upstream of areas that contain vulnerable receptors at risk of groundwater, surface water, or fluvial flooding. There is potential for riparian woodland at Farlington Marshes, on the shoreline at Hilsea Bastion Gardens, and around Great Salterns Lake. There is also potential for wider catchment woodland to be created at Great Salterns Recreation Ground, Tangier Park, and Milton Common.

Green Infrastructure

- 6.6.4 Green Infrastructure (GI) is a strategically planned and managed network of natural and semi-natural green (land) and blue (water) spaces that intersperse and connect urban centres, suburbs, and rural fringe, consisting of:
- Open spaces e.g., parks, woodland, nature reserves and lakes,
 - Linkages e.g., river corridors, canals, pathways, cycle routes and greenways,
 - Networks of 'urban green' e.g., private gardens, street trees, verges, and green roofs.
- 6.6.5 The identification and planning of GI are critical to sustainable growth and flood risk management. GI can provide a wide range of ecosystem services, including climate mitigation and adaptation, and is central to climate change action. GI also provides additional green spaces for storm flows, freeing up water storage capacity in existing infrastructure and reducing the risk of damage to urban property, particularly in city centres and vulnerable urban regeneration areas. Additionally, GI can improve accessibility to waterways and water quality, supporting regeneration and improving opportunity for leisure, economic activity, and biodiversity.
- 6.6.6 South Hampshire currently benefits from a strategic GI network that includes rivers, country parks, the coast, large tracts of woodland and an extensive public rights of way network. Many local areas also benefit from smaller scale GI features. Maximising the potential of GI across South Hampshire is a critical environmental priority for PfSH, and hence a GI Strategy and associated GI Implementation Plan have been developed to provide an ambitious long term framework for GI and set out the strategic GI projects for South Hampshire into the future⁴³.
- 6.6.7 **Policy Recommendation:** Maximise the flood attenuation benefits conferred by its existing GI features in Farlington, Horsea Island, Hilsea (Alexandra Park), Southsea (Southsea Common), and on the eastern side of Portsea Island (Great Salterns Recreation Ground, Tangier Park, and Milton Common), through the enlargement of existing, and creation of new woodlands.

6.7 Surface water management

- 6.7.1 Development should be designed so that there is no increase in flood risk elsewhere and the development will be safe from surface water flooding. This must be the case during the 3.33% AEP and 1% AEP rainfall event including the relevant allowances for climate change (described in Part 1 Main Report Table 3-4) based on the lifetime of the development:
- For development with a lifetime beyond 2100, use the upper end allowances for the 2070s epoch.
 - For development with a lifetime of between 2061 and 2100 use the central allowance for the 2070s epoch.
 - For development with a lifetime up to 2060 use the central allowance for the 2050s epoch.

⁴³ Partnership for South Hampshire, 2019, Green Infrastructure, Flooding and Water Management
<https://www.push.gov.uk/work/planning-and-infrastructure/green-infrastructure-flooding-water-management/>

Sustainable Drainage Systems

- 6.7.2 Sustainable drainage systems (or SuDS) are designed to control surface water run off close to where it falls, combining a mixture of built and nature-based techniques to mimic natural drainage as closely as possible, and accounting for the predicted impacts of climate change.
- 6.7.3 Suitable surface water management measures should be incorporated into new development designs to reduce and manage surface water flood risk to, and posed by, the proposed development. This should ideally be achieved by incorporating Sustainable Drainage Systems (SuDS). Consideration of sustainable drainage systems early in the design process for development, including at the pre-application or master-planning stages, can lead to better integration, multi-functional benefits, and reduced land-take.
- 6.7.4 SuDS are typically softer engineering solutions inspired by natural drainage processes such as ponds and swales which manage water as close to its source as possible. Wherever possible, a SuDS technique should seek to contribute to each of the four following goals:
- Reduce flood risk (to the site and neighbouring areas),
 - Improve water quality,
 - Provide biodiversity, wildlife benefits and,
 - Provide amenity and landscape benefits.
- 6.7.5 Generally, the aim should be to discharge surface water run-off as high up the following hierarchy of drainage options as reasonably practicable:
1. Harvesting and recycling of rainwater,
 2. Into the ground (infiltration),
 3. To a surface water body,
 4. To a surface water sewer, highway drain, or another drainage system, and
 5. To a combined sewer. Discharge to the combined sewer should not increase the risk of combined sewer overflow (CSO).
- 6.7.6 SuDS techniques can be used to reduce the rate and volume and improve the water quality of surface water discharges from sites to the receiving environment (i.e., natural watercourse or public sewer etc.). The SuDS Manual⁴⁴ identifies several processes that can be used to manage and control runoff from developed areas. Each option can provide opportunities for storm water control, flood risk management, water conservation and groundwater recharge. Refer to the non-technical standards⁴⁵ for guidance on the design, maintenance, and operation of SuDS.
- 6.7.7 The NPPF⁴⁶ states that major developments (10 dwellings or more; or 1,000sqm non-residential floor space) should incorporate SuDS unless there is clear evidence that this would be inappropriate. The low to moderately permeable superficial deposits overlying much of the bedrock in the Portsmouth administrative area can make the installations of SuDS difficult, however not impossible, and SuDS options should always be considered. The Portsmouth Plan⁴⁷ states that SuDS should be provided wherever practicable to achieve a post development rate of surface and foul water to the combined system of no greater than the existing rate.
- 6.7.8 At present, Portsmouth CC as LLFA is a statutory consultee for matters relating to surface water management in new development. Schedule 3 of the FWMA places a duty on the local authority, likely to be the LLFA, to become a SuDS Approval Body (SAB). Schedule 3 will remove the automatic right to connect surface water to the public sewer network and will require all new development over a prescribed threshold (to be confirmed by secondary legislation) to use SuDS to manage surface water.

⁴⁴ CIRIA C753F SuDS Manual. Available from: <https://www.ciria.org/ItemDetail?iProductCode=C753F&Category=FREEPUBS>

⁴⁵ Sustainable drainage systems: non-statutory technical standards, 2015
<https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards>

⁴⁶ Ministry of Housing, Communities and Local Government, 2021, National Planning Policy Framework
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

⁴⁷ Portsmouth City Council, 2012, The Portsmouth Plan. <https://www.portsmouth.gov.uk/services/development-and-planning/planning-policy/the-portsmouth-plan-adopted-2012/>

In addition to the normal planning application process, developers will have to submit a SuDS application to the SAB, demonstrating compliance with National Standards. The SAB will approve applications and then adopt the SuDS for the lifetime of the development, with responsibility for maintenance.

- 6.7.9 At the time of writing (July 2023), Schedule 3 has not been enacted. However, the Jenkins Review⁴⁸ published in January 2023, made recommendations that Schedule 3 be enacted by Defra. The current indication by Defra is that Schedule 3 is likely to be enacted during 2024.
- 6.7.10 When considering planning applications, Portsmouth CC should ensure that the proposed minimum standards of operation are appropriate, and using planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the lifetime of the development.
- 6.7.11 **Policy Recommendation:** Strengthen the surface water runoff requirements for proposed developments in parts of the Portsmouth CC area that are at the greatest risk of surface water flooding in accordance with risk of flooding from surface water mapping (Appendix A Figure 3). In these locations it is recommended that Portsmouth CC set a requirement for a net reduction in surface water runoff rates for all developments.

Surface Water Management Plan Action Plan

- 6.7.12 The Portsmouth Surface Water Management Plan (SWMP) outlines local flood risk hotspots in Portsmouth and includes an Action Plan for mitigating the risks of flooding. The key measures detailed within the Action Plan include:
- Establishing a strong management team, engaging stakeholders and high level project support, developing a public awareness plan, and promoting integrated schemes,
 - Reviewing legislative changes, e.g., due to Brexit, and local policy updates,
 - Promoting the SuDS hierarchy,
 - Prioritising maintenance of local areas prone to high risk flooding and / or with a flood history,
 - Reviewing the Multi-Agency Flood Plan and Flood Response Plan, involving key transport providers such as Network Rail,
 - Hydraulic modelling to determine potential options for capital works to mitigate flood risk in Farlington Marshes, and
 - Preparing the business case for a scheme in Farlington Marshes if the review sees appropriate.

Limiting urban creep

- 6.7.13 **Recommendation:** In urban areas encourage the use of permeable surfacing. Discourage the paving or covering of permeable surfaces with impermeable surfacing.

6.8 Flow routing

- 6.8.1 Redevelopment in areas at risk of flooding from surface water, river flooding or groundwater flooding has the potential to affect flood routing and increase flood risk elsewhere. For example, redevelopment may give rise to backwater effects or divert floodwaters on to other properties.
- 6.8.2 Consideration should be given to configuring road and building layouts to preserve existing flow paths and improve flood routing, whilst ensuring that flows are not diverted towards other properties. Consideration should be given to the use of fences and landscaping walls to prevent causing obstruction to flow routes and increasing the risk of flooding to the site or neighbouring areas.
- 6.8.3 Opportunities should be sought within site design to make space for water, such as:
- Removing boundary walls or replacing with other boundary treatments such as hedges or fencing with gaps (for example post-and-rail or hit-and-miss).

⁴⁸ Defra, Updated July 2021, Surface water and drainage: a review of responsibilities
<https://www.gov.uk/government/publications/surface-water-and-drainage-review-of-responsibilities>

- Considering alternatives to solid wooden gates or ensuring that there is a gap beneath the gates to allow the passage of floodwater.
- Create under-croft car parks or consider reducing ground floor footprint and creating an open area under the building to allow flood water storage.
- Where proposals entail floodable garages or outbuildings, consider designing a proportion of the external walls to be committed to free flow of floodwater.

6.8.4 **Policy Recommendation:** All new development should not adversely affect flood routing and thereby increase flood risk elsewhere. Opportunities should be sought within the site design to make space for water.

6.9 Risk of groundwater flooding

6.9.1 **Policy Recommendation:** New development should not result in an increased risk of groundwater flooding elsewhere. Where development is proposed that involves significant works below ground and/or changes to drainage, further assessment (for example through a Hydrogeological Risk Assessment (HRA)) may be required to determine the potential impact on groundwater and identify proposed mitigation measures.

6.9.2 As described in Section 3.4, groundwater levels in the study area are relatively close to the surface in many areas and located within the superficial deposits. Additional subsurface development or additional infiltration has the potential to modify groundwater flows, leading to potential flooding elsewhere (and/or impacting on groundwater abstractions).

6.9.3 In areas at risk of groundwater flooding, development proposals should be assessed to identify:

- i. the depth and geometry of the penetration of works into the sub-surface from the construction of the proposed development (for example piled foundations, basements, excavation for services). These features can disrupt groundwater flow, alter groundwater levels, and therefore increase the risk of groundwater flooding at or around the site.
- ii. any changes in drainage, for example impermeable surfaces or infiltration/SuDS systems which could alter groundwater flow patterns and the elevation of the water table.

6.9.4 If the assessment identifies works below ground and/or changes in drainage a Hydrogeological Risk Assessment (HRA) (sometimes called a Basement Impact Assessment) may be required. The scope and detail required for the HRA will vary depending on the scale of sub-surface construction proposed and the local geological and hydrogeological conditions.

6.9.5 The HRA should be used to determine the geological and hydrogeological setting and whether sub-surface development will reach the water table. The water table will move up and down depending on rainfall; the assessment should consider the highest level. If the development does extend down to the water table, it may disrupt groundwater flow in the aquifer by creating a barrier and increase the risk of flooding. The HRA should identify the impact and any required mitigation measures.

6.9.6 In some settings there may be an aquifer at depth and, depending on the proposed depth of the development, this may also have to be assessed. A site specific ground investigation (GI) with trial pits and boreholes should be obtained to inform the FRA and HRA if there is uncertainty over the geological or hydrogeological conditions at any proposed development site.

6.9.7 The HRA should also identify changes in drainage as these may create additional inflows to ground which can also exacerbate groundwater flood risk.

6.10 Consulting with Water companies

6.10.1 Southern Water are responsible for maintaining surface, foul and combined public sewers to ensure effective drainage of the area. If flows are proposed to enter public sewers, as part of their pre-application service, Southern Water will assess whether the public system has the capacity to accept the flows or provide a solution that identifies necessary mitigation if not.

6.10.2 The SWMP notes that Southern Water have invested in Portsmouth sewer system since 2012, including surface water separation, additional improvements to the sewer network, property level protection

measures and in Southsea, sewer lining to prevent groundwater ingress to the sewers. Whilst this has created additional capacity in the sewer network and mitigated higher flows during wet weather to the wastewater treatment works, it was also designed to increase flood protection in the City. It is essential that this level of protection is not diminished by the re-introduction of surface water into the combined system.

- 6.10.3 **Recommendation:** As part of their Sites Allocation process, Portsmouth CC should consult with Southern Water to determine any areas with sewer capacity issues. Redevelopment provides an opportunity to separate combined sewer systems and reduce the causes and impacts of flooding associated with sewer systems and local surface water runoff.

6.11 Emergency Planning

- 6.11.1 Emergency planning can help manage flood related incidents. In the UK, emergency planning is performed under the direction of the 2004 Civil Contingencies Act (CCA), and seeks to prevent, or if not mitigate, the risk to life, property, business, infrastructure, and the environment.
- 6.11.2 Flood risk emergency planning involves developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to and recover from flooding. In development planning, a number of these activities are already integrated in national building control and planning policies e.g., the NPPF.
- 6.11.3 Safety is a key consideration for any new development and includes the likely impacts of climate change and, where there is a residual risk of flooding, the availability of adequate flood warning systems for the development, safe access and egress routes and evacuation procedures. It is a requirement under the NPPF that a flood emergency plan is prepared by applicants / developers for sites at risk of flooding (refer to Section 7.7).
- 6.11.4 Portsmouth CC is designated as a coast protection authority, and therefore possesses the duties and powers as specified under the Coast Protection 1949⁴⁹.
- 6.11.5 The following existing plans and arrangements for managing flood emergencies are relevant to the Portsmouth administrative area.

Portsmouth and Southampton Emergency Response Plan

- 6.11.6 Portsmouth CC and Southampton CC have prepared an Emergency Response Plan⁵⁰ together which sets out the management structures and procedures used by each Council to provide a coordinated and multi-agency response to incidents (including flooding). The plan is split into two parts, with the first covering the joint response of both Councils, and the second outlining each specific Council response.

Portsmouth Multi Agency Flood Response Plan

- 6.11.7 The Portsmouth Multi Agency Flood Response Plan⁵¹ outlines the tactical multi-agency management and response arrangements in preparation for, and response to, a flood event in Portsmouth. The plan provides information about flood warning areas, integrated emergency management, plan actions, communications, rescue, evacuations, and shelter. Further flood advice can be found on Portsmouth CC website⁵².
- 6.11.8 **Recommendation:** Portsmouth CC should review the flood risk information within this SFRA with their emergency planning team. Proposals for development that are likely to increase the number of people living or working in areas of flood risk require careful consideration, as they could increase the scale of any evacuation required. The tidal modelling shows that access routes off Portsea Island that are dry or Low hazard are available for the design event (0.5% AEP) for the year 2055, but not available during the design flood event (0.5% AEP) for the year 2122. (It is noted that this may change when the flood defence schemes at Eastern Road, Kendall's Wharf and Ports Creek are completed). Further discussion of safe access is included in Section 7.5.

⁴⁹ Coast Protection Act 1949 <https://www.legislation.gov.uk/ukpga/Geo6/12-13-14/74>

⁵⁰ Portsmouth City Council and Southampton City Council, 2018, Emergency Response Plan <https://www.portsmouth.gov.uk/services/environmental-health/safety/emergency-planning/>

⁵¹ Portsmouth City Council, 2011, Multi Agency Flood Response <https://www.portsmouth.gov.uk/services/environmental-health/safety/flooding/>

⁵² Portsmouth City Council, Flooding <https://www.portsmouth.gov.uk/services/environmental-health/safety/flooding/>

7. Recommendations of how to address flood risk in development

*When allocating sites for development, LPAs must apply the Sequential Test to **avoid** flood risk and steer development towards those areas at least risk of flooding. The process for applying the Sequential Test is described in Part 1 Section 4.*

*Following the application of the Sequential Test, it may not always be possible to **avoid** locating development in areas at risk of flooding. This section builds on the findings of the SFRA to provide guidance on the range of measures that could be considered on individual development sites to **mitigate** and **manage** the risk of flooding. These measures should be considered when preparing a site-specific FRA. This section outlines the approach that Portsmouth CC should consider in relation to flood risk planning policy and development management decisions.*

7.1 Sequential approach

- 7.1.1 **Policy Recommendation:** Apply a sequential approach to site planning.
- 7.1.2 Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development. Most large development proposals include a variety of land uses of varying vulnerability to flooding. The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas (considering all sources of flooding) e.g., residential elements should be restricted to areas at lower probability of flooding whereas parking, open space or proposed landscaped areas can be placed on lower ground with a higher probability of flooding.

7.2 Appropriate types of development

- 7.2.1 **Policy Recommendation:** Location of development must take into account the vulnerability of users.
- 7.2.2 Table 4-1 in SFRA Report Part 1 (reproduced from PPG Table 2) provides a compatibility matrix and determines which types of development are appropriate in areas of flood risk⁵³.

7.3 Finished floor levels

- 7.3.1 **Policy Recommendation:** All development within Flood Zones 2 and 3 should set finished floor levels above the design flood level (0.5% AEP) including an appropriate allowance for climate change and freeboard. More Vulnerable and Highly Vulnerable development should apply the upper end climate change allowance. Less Vulnerable development should apply the higher central climate change allowance.
- 7.3.2 Where developing in Flood Zone 2 and 3 is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) and Highly Vulnerable development types (as outlined in Table 2 of the PPG), is to ensure internal floor levels are raised a freeboard level above the design flood level including an appropriate allowance for climate change. For fluvial flooding, the design flood is the 1% AEP (1 in 100 year) event, and for tidal flooding it is the 0.5% (1 in 200 year) AEP event. Less Vulnerable development should also aim to raise floor levels. Where this is not achievable, flood resilience measures should be incorporated to make up the shortfall (refer to Section 1). These measures should be detailed within the FRA.
- 7.3.3 Guidance document “Accounting for residual uncertainty: an update to the fluvial freeboard guide – technical report”⁵⁶ explains how to determine the appropriate residual uncertainty allowances. The process involves identifying sources of uncertainty in the datasets upon which the assessment is based, estimating the magnitude of residual uncertainties, and determining the appropriate response. Section 3.2 focuses on applying the process for development planning. The resulting residual uncertainty

⁵³ Planning Practice Guidance Flood Risk and Coastal Change <https://www.gov.uk/guidance/flood-risk-and-coastal-change#table1>

allowances range from 300mm to 900mm. Most developments should use this guidance document to determine freeboard, the only exceptions to this being minor developments that fall under the standing advice for flood risk.

- 7.3.4 With reference to the 'Flood risk assessment: standing advice for flood risk'⁵⁷, finished floor levels should be a minimum of whichever is higher, 300mm above the general ground level of the site or 600mm above the estimated river or sea flood level.
- 7.3.5 In certain situations (e.g., for proposed extensions to buildings with a lower floor level or conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor levels to sufficiently meet the general requirements. In these cases, the Environment Agency and/or Portsmouth CC should be approached to discuss options for a reduction in the minimum internal ground floor levels provided flood resistance measures are implemented up to an agreed level.
- 7.3.6 There are also circumstances where flood resilience measures should be considered first. For both Less and More Vulnerable developments where internal access to higher floors is required, the associated plans showing the access routes and floor levels should be included within any site-specific FRA.

7.4 Protection against groundwater flooding

- 7.4.1 Although many of the resilience measures implemented for surface water and fluvial flooding are also suited to groundwater flooding, many traditional methods of flood protection, such as sandbags, may not be effective against flooding from groundwater. This is because water can come up through the floor and remain for a long time.
- 7.4.2 There are differences in impacts related to the long duration of groundwater flooding (weeks compared with days). These include potential structural impacts on foundations and impacts on sub surface drainage (both main sewer systems and local systems such as cess pits and soakaways).
- 7.4.3 Whilst the duration of groundwater flooding is problematic, as it generally takes some time to build up, there is generally a greater length of time to move valuable items or undertake a planned "evacuation".
- 7.4.4 *Resistance* measures are intended to limit entry of water to the building. Those that may be effective in a building include:
- Installing waterproof floors and sealing walls (including making good pointing, rendering etc.),
 - Sealing (tanking) basements and using sump pumps for clearance if water ingress cannot be prevented,
 - Covering susceptible ingress points such as airbricks (e.g., flood proof airbricks are available) and sealing weep holes,
 - Installing one-way valves, toilet plugs, and pipe bungs may prevent the entry of water from flooded sewers, and,
 - 'Sump and pump' – the use of a drain around a property to intercept rising groundwater and direct it to a sump, from where it is pumped to disposal.
- 7.4.5 *Resilience* involves modifying the interior of a building, for example by using materials that are less prone to damage by floodwater and / or dry quickly so that the post-flooding clean-up will be easier, cheaper, and quicker. Any surface water / fluvial resilience measure will be equally suitable for groundwater flooding. Typical measures include:
- Mounting electrical sockets, fittings, and equipment at high level above expected flood water,
 - Using solid or tile floors rather than fitted carpets,
 - Having readily demountable equipment (such as TVs etc.) that can be moved to a safe location,

- Raising less easily demountable portable equipment (e.g., kitchen fittings) to high level, and,
 - Using plaster and other building materials that are more resilient to long periods under damp conditions.
- 7.4.6 The Environment Agency provides advice on preparing properties for flooding in the following publications:
- Homeowners Guide to Flood Risk⁵⁸ – lists various measures that are applicable to flooding in general, and,
 - Flooding from groundwater⁵⁹ - Practical advice to help homeowners reduce the impact of flooding specifically from groundwater.

7.5 Access / escape

- 7.5.1 **Policy Recommendation:** New development must have safe access / escape during the design flood (0.5% AEP) including an appropriate allowance for climate change. More Vulnerable and Highly Vulnerable development should apply the upper end climate change allowance. Less Vulnerable development should apply the higher central climate change allowance.
- 7.5.2 For developments located in areas at risk of tidal or fluvial flooding safe access / escape must be provided for new development as follows in order of preference:
- Safe dry route for people and vehicles.
 - Safe dry route for people.
 - If a dry route for people is not possible, a route for people where the flood hazard (in terms of depth and velocity of flooding) is low and should not cause risk to people.
 - If a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles. However, the public should not drive vehicles in floodwater.
- 7.5.3 Where access and escape are important to the overall safety of development in areas of flood risk, the local planning authority should consult with emergency planning staff and, where appropriate with the emergency services, unless local standards or guidelines have been put in place in lieu of consultation.
- 7.5.4 A safe access/escape route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area (e.g., within Flood Zone 1) using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances (i.e. 1% AEP fluvial flood event and surface water event or 0.5% AEP tidal event including an appropriate climate change allowance). Where a dry route is not possible the FRA should provide an assessment of the flood hazard rating along the route and demonstrate that the route is a low hazard (as defined in the FD2320 Flood risk to people calculator⁶⁰). Hazard mapping is provided in Appendix B.
- 7.5.5 In exceptional circumstances, safe access above the design flood event (1% AEP fluvial flood level or 0.5% AEP tidal flood level) including climate change may not be achievable. In these circumstances the Environment Agency and the LPA should be consulted to determine whether the safety of the site occupants can be satisfactorily managed. This will be informed by the type of development, the number of occupants and their vulnerability and the flood hazard along the proposed escape route. For example, this may entail the designation of a safe place of refuge on an upper floor of a building, from which the occupants can be rescued by emergency services. It should be noted that sole reliance on a safe place of refuge is a last resort, and all other possible means to evacuate the site should be considered first. Provision of a safe place of refuge will not guarantee that an application will be granted.

⁵⁸ Homeowners guide to flood resilience. Know Your Flood Risk, July 2018. https://www.floodguidance.co.uk/wp-content/uploads/2018/07/KnowYourFloodRiskGuide_July18.pdf

⁵⁹ Environment Agency, 2011, Flooding from groundwater. <https://www.gov.uk/government/publications/flooding-from-groundwater>

⁶⁰ Defra Environment Agency Flood and Coastal Defence R&D Programme, 2004, https://assets.publishing.service.gov.uk/media/602a9348e90e070559970f9d/Operations_and_Maintenance_Concerted_Action_Report.pdf

- 7.5.6 The guidance document 'Flood Risk Emergency Plans for New Development' published by the Environment Agency and ADEPT⁶¹ provides more detail on safe access and escape.

7.6 Places of safety

- 7.6.1 **Policy Recommendation:** New development must be designed to include a place of safety during extreme flood conditions (0.1% AEP) including an allowance for climate change.
- 7.6.2 Tidal flooding occurs during exceptionally high tides or storm surges. As a result, there is advance warning of such events. The Environment Agency aim to provide a minimum 6 hours warning time for tidal flooding. As a result, it would be possible to evacuate properties prior to any significant tidal flooding taking place.
- 7.6.3 However, places of safety play an important role where, for whatever reason, evacuation in advance of flooding is not achieved, or in cases where flooding occurs because of a failure (e.g., breach) in the flood defences. Places of safety should be designed to facilitate rescue in case emergency care is needed or if it is unlikely to be safe for occupants/users to wait until flood waters have receded sufficiently.
- 7.6.4 Places of safety should be provided above the extreme flood level (0.1% AEP for tidal flooding) including an appropriate allowance for climate change.

7.7 Emergency Plans

- 7.7.1 **Evacuation** is where flood alerts and warnings provided by the Environment Agency enable timely actions by residents or occupants to allow them to get to safety unaided, i.e., without the deployment of trained personnel to help people from their homes, businesses, and other premises. **Rescue** by the emergency services is likely to be required where flooding has occurred, and prior evacuation has not been possible.
- 7.7.2 **Policy Recommendation:** For all development proposed in Flood Zone 2 or 3, an Emergency Plan should be prepared by developers to demonstrate what actions site users will take before, during and after a flood event to ensure their safety, and to demonstrate that their development will not impact on the ability of the local authority and the emergency services to safeguard the current population. For sites in Flood Zone 1 with access routes affected by flooding, it may also be necessary to prepare an Emergency Plan.
- 7.7.3 The Environment Agency has a tool on their website to create a Personal Flood Plan⁶². The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details. Where proposed development comprises non-residential extension <250m² and householder development (minor development), it is recommended that the use of this tool to create a Personal Flood Plan will be appropriate.
- 7.7.4 Emergency Plans should include:
- How flood warning is to be provided, such as:
 - Availability of existing flood warning systems,
 - Where available, rate of onset of flooding and available flood warning time, and,
 - How flood warning is given.
 - What will be done to protect the development and contents, such as:
 - How easily damaged items (including parked cars) or valuable items (important documents) will be relocated,
 - How services can be switched off (gas, electricity, water supplies),
 - The use of flood protection products (e.g., flood boards, airbrick covers),

⁶¹ ADEPT, Environment Agency, September 2019, Flood Risk Emergency Plans for New Development
<https://www.adeptnet.org.uk/floodriskemergencyplan>

⁶² Environment Agency Tool 'Make a Flood Plan' <https://www.gov.uk/government/publications/personal-flood-plan>

- The availability of staff/occupants/users to respond to a flood warning, including preparing for evacuation, deploying flood barriers across doors etc., and,
 - The time taken to respond to a flood warning.
 - Ensuring safe occupancy and access to and from the development, such as:
 - Occupant awareness of the likely frequency and duration of flood events, and the potential need to evacuate,
 - Safe access route to and from the development,
 - If necessary, the ability to maintain key services during an event,
 - Vulnerability of occupants, and whether rescue by emergency services will be necessary and feasible, and,
 - Expected time taken to re-establish normal use following a flood event (clean-up times, time to re-establish services etc.).
- 7.7.5 There is no statutory requirement for the Environment Agency or the emergency services to approve emergency plans. Portsmouth CC is accountable via planning condition or agreement to ensure that plans are suitable. Should there be an expectation that development will be coming forward in flood risk areas with implications on emergency planning, Portsmouth CC should consider working with their emergency planning officers to produce local guidelines setting out requirements for flood warning, evacuation, and places of safety, against which individual planning applications can then be judged. These should avoid additional burdens on emergency services, explore opportunities for development proposals to address any shortfall in emergency service and infrastructure capacity, and minimise the need for further consultation at planning application stage.

7.8 Flood resilience measures

- 7.8.1 **Policy Recommendation:** Where development or redevelopment is proposed in areas at risk of flooding, flood resilience measures should be implemented.
- 7.8.2 'Property Flood Resilience' is an approach to building design which aims to reduce flood damage and speed recovery and reoccupation following a flood. It uses a combination of flood resistance and recovery measures and is described in the industry-developed CIRIA Property Flood Resilience Code of Practice⁶³, which provides advice for both new-build and retrofit. It includes specific guidance for local authority planners.
- 7.8.3 Resistance and recovery measures are unlikely to be suitable as the only mitigation measure to manage flood risk, but they may be suitable in some circumstances, such as:
- Water Compatible and Less Vulnerable uses where temporary disruption is acceptable, and the development remains safe.
 - Where the use of an existing building is to be changed and it can be demonstrated that the avoidance measures are not practicable, and the development remains safe.
 - As a measure to manage residual flood risk from flood risk management infrastructure when avoidance measures have been exhausted.
- 7.8.4 Flood resistance and recovery measures cannot be used to justify development in inappropriate locations.
- 7.8.5 Where historic buildings are involved, early consultation with Historic England should be undertaken and their guide⁶⁴ on flood resilience for historic properties provides additional information.

⁶³ Kelly, D, Barker, M, Lamond, J, McKeown, S, Blundell, E and Suttie, E (2020) Guidance on the code of practice for property flood resilience, C790B, CIRIA, London (ISBN: 978-0-86017-895-8)

https://www.ciria.org/CIRIA/Resources/Free_publications/CoP_for_PFR_resource.aspx

⁶⁴ Historic England, April 2015, Flooding and Historic Buildings. <https://historicengland.org.uk/images-books/publications/flooding-and-historic-buildings-2ednrev/>

Flood Resistance 'Water Exclusion Strategy'

- 7.8.6 Flood resistant construction can prevent entry of water or minimise the amount that may enter a building where there is short duration flooding with water depth up to approximately 0.6 metres, depending on the building's characteristics. Where measures to exclude water in this way are proposed above this level, advice should be sought from a suitably qualified building surveyor, architect, or structural engineer.
- 7.8.7 There is a range of flood resistance and resilience construction techniques that can be implemented in new developments to mitigate potential flood damage. Flood resistance measures, or dry proofing, stops water entering a building up to a safe structural limit. Resistance measures can be passive, such as flood doors which are normally closed; or active, such as air brick covers or removable flood barriers. Passive measures are to be prioritised above active measures.
- 7.8.8 This form of construction needs to be used with caution and accompanied by measures that will speed-up flood recovery, as effective flood resistance can be difficult to achieve. Hydrostatic pressures exerted by floodwater can cause long-term structural damage, undermine the foundations of a building or cause leakage through the walls, floor, or sub-floor, unless the building is specifically designed to withstand such stresses. In addition, temporary and demountable defences are not appropriate for new-build developments.
- 7.8.9 There is a range of property flood protection devices available on the market, designed specifically to resist the passage of floodwater. These include removable flood barriers and gates designed to fit openings, vent covers and stoppers designed to fit WCs. These measures can be appropriate for preventing water entry associated with fluvial flooding as well as surface water and sewer flooding. The efficacy of such devices relies on their being deployed before a flood event occurs. It should also be borne in mind that devices such as air vent covers, if left in place by occupants as a precautionary measure, may compromise safe ventilation of the building in accordance with Building Regulations.

Flood Recovery 'Water Entry Strategy'

- 7.8.10 Flood recoverability measures (or wet proofing), accept that water will enter the building, but through careful design and changes to the construction will minimise damage and allow faster cleaning, drying, repairing and re-occupancy of the building after a flood. Measures are preferably passive, such as the use of resilient building materials, or active such as moving sensitive equipment or belongings to upper floors when flooding is expected.
- 7.8.11 Materials should be used which allow the passage of water whilst retaining their structural integrity and they should also have good drying and cleaning properties. Alternatively sacrificial materials can be included for internal and external finishes; for example, the use of gypsum plasterboard which can be removed and replaced following a flood event. Flood resilient fittings should be used to at least 0.1m above the design flood level. Recovery measures are either an integral part of the building fabric or are features inside a building that will limit the damage caused by floodwaters.
- 7.8.12 A variety of flood recovery tools can be implemented, such as:
- Using materials with either, good drying and cleaning properties or, sacrificial materials that can easily be replaced post-flood.
 - Design for water to drain away after flooding.
 - Design access to all spaces to permit drying and cleaning.
 - Raise the level of electrical wiring, appliances, and utility metres.
- 7.8.13 Structures such as (bus, bike) shelters, park benches and refuse bins (and associated storage areas) located in areas with a high flood risk should be flood resilient and be firmly attached to the ground and designed in such a way as to prevent entrainment of debris which in turn could increase flood risk and/or breakaway posing a danger to life during high flows.

7.9 Local Design Codes

- 7.9.1 **Recommendation:** It is recommended that Portsmouth CC incorporate expectations for future development with respect to flood risk into any emerging local design codes. The local design code would need to accord with the National Model Design Code⁶⁵ (parts 1 and 2) requirements on water and drainage and follow the approach to flood risk management set out in PPG paragraphs 003 and 004 (Assess, Avoid, Control, Mitigate, Manage), ensuring all development will be appropriately flood resistant and resilient, with reference to the CIRIA Property Flood Resilience Code of Practice. The local design code should be prepared with input from the Environment Agency and Portsmouth CC in their capacity as the LLFA.

⁶⁵ <https://www.gov.uk/government/publications/national-model-design-code>

8. Next Steps

8.1 Next steps

8.1.1 Portsmouth CC should use this SFRA and associated mapping to:

- Aid discussions with emergency planning teams,
- Develop their Local Plan and associated strategic policies,
- Safeguard land for flood risk management and green infrastructure,
- Carry out the sequential test for potential allocation sites,
- Carry out the sequential test for individual planning applications,
- Make decisions about individual planning applications,
- Decide whether a development can be made safe without increasing flood risk elsewhere,
- Identify the need for local design guidance or codes.

8.1.2 Where development must be allocated in areas at risk of flooding further assessment of the risk of flooding may be required, for example through the preparation of a Level 2 SFRA.

8.2 Future monitoring and update

8.2.1 This SFRA should be reviewed when there are changes to:

- The predicted impacts of climate change on flood risk,
- Detailed flood modelling - such as from the Environment Agency or Lead Local Flood Authority,
- Local Plans, spatial development strategies or relevant local development documents,
- Local flood management schemes,
- Flood Risk Management Plans,
- Shoreline Management Plans,
- Local Flood Risk Management Strategies, and,
- National planning policy or guidance.

8.2.2 The SFRA may also need to be reviewed after a significant flood event.

8.2.3 It is noted that the remaining phases of the North Portsea Island and Southsea Coastal Schemes, as described in Section 6.1 will have a significant impact on the defended risk profile, necessitating a focus in these areas on the management of residual (tidal) flood risk. The SFRA and supporting mapping should be updated when these schemes are completed, to ensure it remains up to date and is an effective tool for informing development planning decisions.

Appendix A Figures

- 1 Flood Zones
- 2 Recorded Flood Outlines
- 3 Risk of Flooding from Surface Water
- 4 Areas Susceptible to Groundwater Flooding
- 5 BGS Susceptibility to Groundwater Flooding
- 6 Risk of Flooding from Reservoirs
- 7 Potential for Cumulative Impact of Development on Flood Risk
- 8 Opportunities to Reduce the Causes and Impacts of Flooding
- 9 Flood Warning Areas
- 10 Flood Risk Management Policies
- 11 Risk of Flooding from the Sea (3.3% AEP Flood Extent)

Appendix B Tidal Flood Risk Mapping

- 1 Coastal Erosion Risk
- 2 Future Coastal Flood Zones

Maximum Flood Depth Figures

Defended

- 3 Maximum Flood Depth: Defended 1 in 200 Year (0.5% AEP) 2022
- 4 Maximum Flood Depth: Defended 1 in 200 Year (0.5% AEP) 2055 (Higher Central)
- 5 Maximum Flood Depth: Defended 1 in 200 Year (0.5% AEP) 2122 (Higher Central)
- 6 Maximum Flood Depth: Defended 1 in 200 Year (0.5% AEP) 2122 (Upper End)
- 7 Maximum Flood Depth: Defended 1 in 1000 Year (0.1% AEP) 2122 (Upper End)

Undefended

- 8 Maximum Flood Depth: Undefended 1 in 200 Year (0.5% AEP) 2122 (Upper End)
- 9 Maximum Flood Depth: Undefended 1 in 1000 Year (0.1% AEP) 2122 (Upper End)

Maximum Flood Hazard Figures

Defended

- 10 Maximum Flood Hazard: Defended 1 in 200 Year (0.5% AEP) 2022
- 11 Maximum Flood Hazard: Defended 1 in 200 Year (0.5% AEP) 2055 (Higher Central)
- 12 Maximum Flood Hazard: Defended 1 in 200 Year (0.5% AEP) 2122 (Higher Central)
- 13 Maximum Flood Hazard: Defended 1 in 200 Year (0.5% AEP) 2122 (Upper End)
- 14 Maximum Flood Hazard: Defended 1 in 1000 Year (0.1% AEP) 2122 (Upper End)

Undefended

- 15 Maximum Flood Hazard: Undefended 1 in 200 Year (0.5% AEP) 2122 (Upper End)
- 16 Maximum Flood Hazard: Undefended 1 in 1000 Year (0.1% AEP) 2122 (Upper End)

