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Project title	River Avon Flood Risk Management Strategy: Bristol City Council	Job number	260498
cc	Phill Martin (Arup), Tom Styles (Arup), Philip Smith (Arup)	File reference	4.50
Prepared by	Adam Cross	Date	19th June 2020
Subject	River Avon Flood Risk Management Strategy – Consideration of Coastal Habitat Loss Technical Note		

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## 1 Introduction

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### 1.1 Background

Bristol City Council (BCC) has commissioned Ove Arup and Partners Ltd. (Arup) to undertake an update to the River Avon Tidal Flood Risk Management Strategy previously undertaken by AECOM in 2017<sup>1</sup>. Arup have been requested to undertake an update to the flood risk modelling and overall strategy to include both tidal and fluvial flows. This acknowledges the interaction between both tidal and fluvial flood risk in Bristol and the need for flood defences given the potential for flood events resulting from an increase in water level of both or either systems.

As part of the design process, consideration is to be given to the possibility of land take from development and a concern around coastal squeeze and habitat loss on intertidal habitats. This technical note specifically provides consideration of coastal squeeze and habitat loss in relation to this the proposed works of this amended Strategy.

#### 1.1.1 Strategic Context

As outlined in AECOM's Options Identification and Environmental Appraisal<sup>2</sup> and in relation to The Severn Estuary Strategy<sup>3</sup> and Flood Risk Management Plan<sup>4</sup>, a reduction in area of saltmarsh and mudflat in front of tidal defences must be avoided or compensated by the creation of habitat elsewhere to offset losses, additionally in relation to impacts on European sites.

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<sup>1</sup> AECOM, 2017. River Avon Tidal Flood Risk Management Strategy; Strategic Environmental Assessment: Environment Report. Bristol City Council, September 2017.

<sup>2</sup> AECOM, 2016. River Avon Tidal Flood Risk Management Strategy; Activity 9B: Options Identification and Environmental Appraisal. Bristol City Council, December 2016.

<sup>3</sup> Severn Estuary Partnership, 2001. Strategy for the Severn Estuary.

<sup>4</sup> Environment Agency, 2105. Severn River Basin District Flood Risk Management Plan 2015-2021. Part A – Background and River Basin District-wide Information. December, 2015.

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The AECOM Environmental Report identified that the detriment mitigation proposed at Bower Ashton<sup>5</sup> could lead to coastal squeeze. However, it is noted that the current approach for the River Avon at Bristol (Policy Unit BRIS5) under the Severn Estuary Shoreline Management Plan Review (SMP2)<sup>6</sup> is to Hold the Line (HTL)<sup>3</sup>, which was agreed across BCC, Environment Agency (EA) and Natural England (NE) as appropriate, subject to the requirement of mitigation and/or compensatory habitat. The original Strategy produced by AECOM is considered to conform with the SMP2.

## 1.2 Site Description

The amended Strategy is proposed primarily along the edges of the tidal River Avon, which runs through Bristol city. The western extent occurs at Shirehampton and Sea Mills, with works then from New Cut upstream to approximately around St. Anne's (Figure 1).

The proposed works occur primarily along the edge of the river channel, both landward and into the river channel itself. Works within the river channel may involve impacts to estuarine habitats including mudflats and saltmarsh. The total length of existing flood defences amended within this amended Strategy is approximately 15.8km; riparian defences amount to approximately 10.3km.

## 1.3 Proposed Works

Following an optioneering stage, Option D1 was reached<sup>7</sup> (Figure 1). Following the inclusion of both fluvial and tidal flows as part of the amended Strategy the flood defences have been identified, and for brevity here, the reader should refer to the supporting Strategic Environmental Assessment Addendum<sup>2</sup>.

The proposed construction works are separate from the proposed maintenance and management works, which are currently unknown at this design stage.

In addition to the construction of phased defences in the core areas, the scheme also includes measures to prevent detriment (an increase in flood risk) to other areas.

It is important to note that proposals in these areas are at an early stage of development, and further investigations and design development on a local level will be required to confirm and refine proposals.

A number of areas have been identified further upstream than St Anne's that may require the implementation of detriment mitigation measures as a result of the Strategy. Due to the reduced modelling certainty and information available regarding these areas, they are included within the amended Strategy for pricing but are not included within the amended Environmental Report at this stage.

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<sup>5</sup> AECOM, 2017. River Avon Tidal Flood Risk Management Strategy. Activity 9C: Pre-scoping Report. September 2017.

<sup>6</sup> <https://www.severnestuarycoastalgroup.org.uk/shoreline-management-plan/> Accessed online 15/04/2020

<sup>7</sup> For further detail on the optioneering stage, refer to: Arup, 2020. Strategic Environmental Assessment Addendum, River Avon Flood Risk Management Strategy. Bristol City Council.

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## 2 Coastal Squeeze

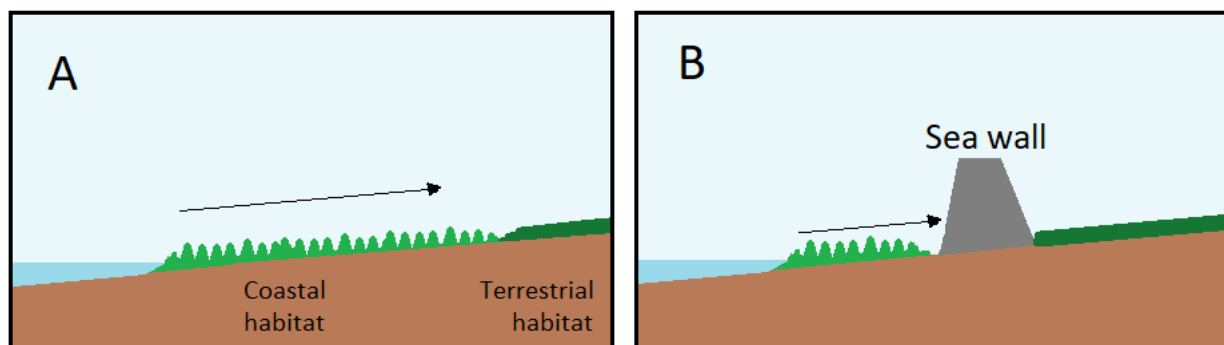
As identified in previous design documents<sup>1, 2, 3</sup>, opportunities should be sought to minimise net loss of intertidal habitats, including saltmarsh and mudflats. Similarly, any proposal should take into account any increased coastal squeeze that may result from new defences and from any increased coastal defence footprint.

In line with more recent policy<sup>8</sup> and emerging legislation<sup>9</sup>, this note considers design of any flood strategy, in relation to *biodiversity net gain* (BNG) of intertidal habitats. Furthermore, as outlined in the Bristol One City Climate Strategy<sup>10</sup>, there is a “*need to build new infrastructure to protect the city from flooding. This will include grey infrastructure, such as flood walls, but [will] also need to take opportunities where natural solutions could be implemented to support flood protection while providing urban cooling, environmental and health and wellbeing benefits.*”

Intertidal mudflats are also considered a priority habitat under Section 41 of the Natural Environment and Rural Communities Act 2006 (NERC Act) and are of material consideration when determining planning applications.

In addition, coastal habitats including the intertidal environment may form a consideration within any Habitats Regulations Assessment (HRA) for potential impacts on nearby European designated sites, e.g. Severn Estuary Special Protection Area (SPA), Special Area of Conservation (SAC) and Ramsar site. Figure 2 outlines the European statutory designated habitats in the vicinity of the site.

For clarity and definition, coastal squeeze (for the purposes of this note) as: the future loss of habitat from sea level rise and the inability for coastal habitats to migrate inland due to the presence of hard sea defences<sup>11</sup> (Drawing 1).



Drawing 1. Representation of coastal squeeze through future loss resulting from placement of hard sea defences. A: Coastal habitats naturally migrate landward with sea level rise, unimpeded by defences. B: With the construction of hard sea defences, coastal habitats are constrained and “squeezed” against defences, ultimately leading to habitat loss if sea level rise (and erosion) is greater than coastal habitat formation. Adapted from Pontee<sup>11</sup>.

<sup>8</sup> National Planning Policy Framework, 2019.

<sup>9</sup> Defra, Environment Bill. Accessed online 24/02/20: <https://www.gov.uk/government/publications/draft-environment-principles-and-governance-bill-2018/environment-bill-summer-policy-statement-july-2019>

<sup>10</sup> Bristol’s One City Environmental Sustainability Board (2020). Bristol One City Climate Strategy; A strategy for a carbon neutral, climate resilient Bristol by 2030. February 2020.

<sup>11</sup> Pontee, N., 2013. Defining coastal squeeze: A discussion. *Ocean & Coastal Management*, **84**, 204-207.

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This note also covers intertidal loss as a result of the proposed intertidal land-take, however this is considered separate to coastal squeeze.

The impact of climate change, and sea level rise, and its in-combination effect on biodiversity are likely to be considered in the Environmental Impact Assessment (Town and Country Planning (Environmental Impact Assessment) Regulations 2017) and in relation to Bristol's Local Plan<sup>12</sup>.

It is important to note that without this amended Strategy the loss of coastal habitats through coastal squeeze is likely to still occur through sea level rise in places where hard defences currently exist, and future assessment should consider appropriate enhancement opportunities.

## 2.1 Design Principles and Habitat Loss

With the current design stage, specific proposals for mitigating any impact of coastal squeeze are excluded, however recommendations are made at the end of this note. This section outlines design principles to be considered as the amended Strategy progresses into detailed design.

### 2.1.1 Loss of Intertidal Habitats

Current designs (Figure 1) indicate that loss of intertidal habitats will occur from sheet piling and other hard defences, in front of current hard defences. Flood defence creation in front of existing defences could, cumulatively, result in a significant loss of intertidal habitat.

On a precautionary basis, with current designs and a worst-case scenario, there is estimated to be a loss of 0.47ha of estuarine habitat on a precautionary basis (based on 2024 works, with additional 0.15ha in 2065 works). Currently, without baseline information on habitat definition, it is unknown whether this loss of habitat is comprised of mudflat, saltmarsh or non-tidal terrestrial habitats, e.g. grassland, woodland or scrub.

As outlined within AECOM's HRA<sup>13</sup>, measures will be devised and presented as part of the detail to support a planning application to ensure no net loss of intertidal habitat, and net gain of biodiversity.

### 2.1.2 Future Loss

With the current design proposals, limited to the stretch of River Avon and associated tributaries in relation to detriment mitigation (Figure 1), the flood risk management strategy is to raise and strengthen existing sea defences. With this current proposal, any future increase in sea level rise may lead to the loss of intertidal habitats, if accretion of sediments and formation of coastal habitats, e.g. saltmarsh, cannot be maintained in the tidal range.

Regarding the SMP2<sup>6</sup> the approach for Bristol is to HTL. In agreement with AECOM's former assessment, the proposed works and detriment mitigation under this amended Strategy are to maintain the current flood defences under the existing HTL approach. Consequently, it is considered that this amended Strategy is still in conformity with the SMP2. Furthermore, the loss of

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<sup>12</sup> Bristol City Council, 2011. Bristol Development Framework; Core Strategy. Adopted June, 2011.

<sup>13</sup> AECOM, 2017. River Avon Tidal Flood Risk Management Strategy Report to Inform a Habitats Regulations Assessment: No Likely Significant Effects Report, Bristol City Council. September 2017.

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intertidal habitat from this amended Strategy in locations with existing flood defences is not considered as coastal squeeze in this context.

The proposed designs at this strategic level could cause potential flooding as a result of the design. Consequently, detriment mitigation is required to offset any potential flooding elsewhere along the watercourses. The proposed detriment mitigation at Shirehampton, Pill, Sea Mills, works on the Malago waterbody and Brislington Brook is placed in front of semi-natural habitats. Consequently, there would be future loss of coastal habitat from sea level rise and the inability for coastal habitats to migrate inland due to the presence of hard sea defences

With an assumption that the land behind detriment mitigation, whilst of a semi-natural nature, is still likely to be used for amenity purposes in the future, the presence of flood defences is still likely to be required at these locations due to sea level rise. Notwithstanding their function, it is suggested that detriment mitigation, where possible is set back from the river's edge, in order to allow for some future migration of coastal habitats with sea level rise. This offsetting of flood defences would provide opportunity for coastal habitat succession, whilst still providing a flood defence purpose and maintaining the current purpose of the semi-natural habitats. This principle of future opportunity for coastal expansion with sea-level rise is also applicable to flood defences in front of semi-natural habitats.

If detriment mitigation can be offset as far as possible this would allow for the maximum area of future coastal habitat succession.

## 3 Conclusion and Recommendations

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Construction of flood defences within the river channel will potentially result in intertidal habitat loss. Construction of flood defences, which prevent coastal habitats migrating inland, where semi-natural habitats exist landward, will restrict the creation of future intertidal habitat. Both aspects will result in coastal squeeze, as defined in Section 1.2.

It is important to note that that without this amended Strategy the loss of coastal habitats through coastal squeeze is likely to still occur through sea level rise, and future assessment should consider appropriate enhancement opportunities.

Furthermore, the proposed works should identify options for providing BNG, ideally through the retention, creation, and future expansion of intertidal habitats, in order to mitigate impacts on priority habitats (NERC Act 2006). The loss of coastal habitats may require creation/enhancement of intertidal habitats of a greater area than the area lost. With a potential net loss of coastal habitats, the preferred option at later design stages should account for the requirements of mitigation and/or compensatory habitat cost, including potentially land purchase and/or habitat management, including managed re-alignment. It may be appropriate, through consultation, to contribute to a wider strategic approach across the region for mitigation and/or compensatory measures.

If the Environment Bill is given Royal Assent, there may be a legal requirement to demonstrate BNG and proposals should consult further on this aspect as design stages progress.

In order to avoid loss of intertidal habitats and deliver BNG, further design is advised to, where possible:

- 1) Avoid or reduce direct loss of intertidal habitat from the work's footprint;

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- 2) Integrate into design the possibility for landward migration of intertidal habitats with sea level rise (as mitigation, compensation and/or enhancement); and
- 3) Where habitat loss is unavoidable, provide compensatory habitat to offset loss of intertidal habitat. This could be achieved within a stretch of the River Avon, or off-site on alternative tidal reaches of the River Avon.

With the above recommendations for reducing intertidal habitat loss and providing scope for landward migration, BNG and retention of intertidal habitats is likely to be feasible.

If possible, it is recommended that BNG calculations are initially undertaken in advance of detailed design, and ideally at an outline business case stage, in order to identify the potential area required for mitigation and compensation, if required, and de-risk the amended Strategy to secure successful delivery.

As design progresses, a Phase 1 habitat survey should be conducted to identify the extent of any potential loss and to identify any areas for landward migration of intertidal habitats, including potential mitigation and compensatory habitat. Further geomorphological and other baseline survey work may be required in creation of off-site habitat.

These recommendations are to be read in conjunction with any HRA on the potential effect of the proposed works on qualifying features of nearby European designated sites, e.g. Severn Estuary SPA, SAC and Ramsar. To conclude no likely significant effect or no adverse effect on the integrity of a European designated site, additional mitigation may be proposed, which could influence the strategy's response to coastal squeeze. Loss of supporting/Annex I habitat within a European site may require mitigation within the European site: consultation is advised with Natural England.

Further options for delivering BNG should be sought through enhancement opportunities. Defra's Biodiversity Metric 2.0 provides an initial framework for calculating biodiversity value and the required net gain<sup>14</sup>. Suitable consultation is advised with relevant stakeholders to ensure feasibility and consideration of projected climate change impacts on tidal flood risk and its impact on intertidal habitats.

With the approach that the SMP2 provides a framework for HTL in Bristol, it is considered that this amended Strategy is still in conformity with the SMP2. Works in relation to the HTL approach will still require mitigation for any loss of habitat.

Further consultation is advised to ensure all relevant stakeholders, e.g. BCC, EA and NE, are still in agreement with the Shoreline Management Plan<sup>6</sup> and the approach to Hold the Line following discussions in 2017<sup>2</sup> on the potential requirement for mitigation and/or compensatory habitat.

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## DOCUMENT CHECKING (not mandatory for File Note)




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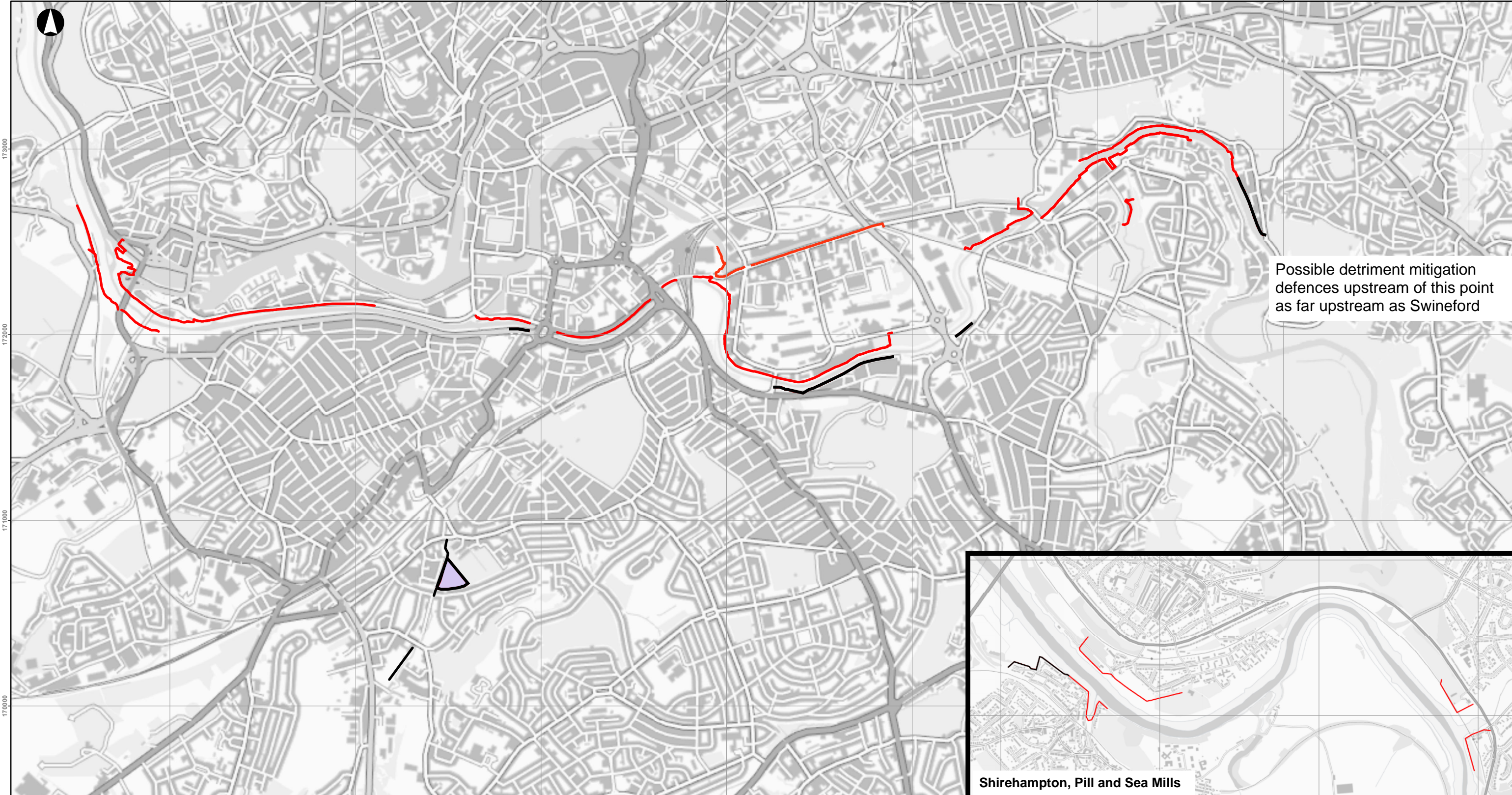
<sup>14</sup> Accessed online 24/02/2020: <http://publications.naturalengland.org.uk/publication/5850908674228224>

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	Prepared by	Checked by	Approved by
Name	Adam Cross	Pippa Wood	Pippa Wood
Signature			



Possible detriment mitigation defences upstream of this point as far upstream as Swineford



**Key**  
 River Avon raised flood defences proposed in 2020s. Most to be raised in 2060s  
 Defences built in 2060s

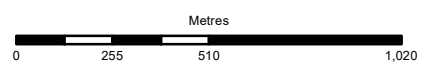


**Note:**  
 - All designs subject to development  
 - Some defences involve raising of existing structures rather than construction of new

PO	2020-03-10	CW		
Issue	Date	By	Chkd	Appd

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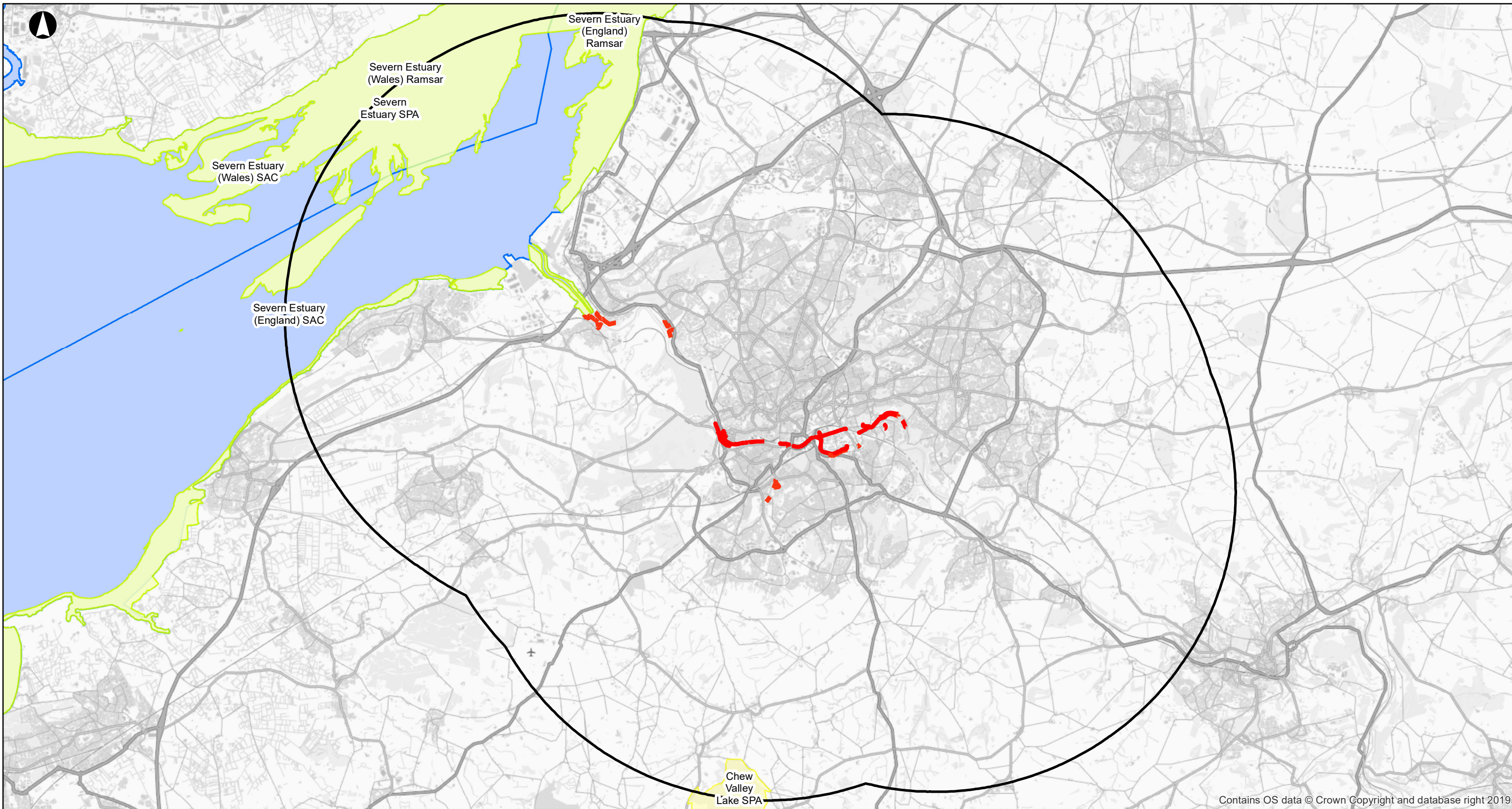
Job Title  
**BRISTOL FLOOD STRATEGY**

**Full Extent  
 2065 Defences**

Scale at A3  
**1:20,000**

Job No <b>260498</b>	Drawing Status <b>Preliminary</b>
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Drawing No <b>002</b>	Issue <b>P0</b>
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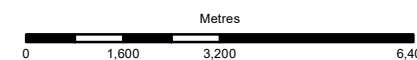
**Legend**

- 10km buffer boundary
- SPA
- Ramsar
- SAC
- Proposed defences

P1	2020-06-23	EB		
Issue	Date	By	Chkd	Appd

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Job Title  
**BRISTOL FLOOD STRATEGY**

**European Sites within  
10km of Proposed Works**

Scale at A3  
**1:125,000**

Job No <b>260498</b>	Drawing Status <b>Preliminary</b>
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Drawing No <b>047</b>	Issue <b>P1</b>
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