

Shortlist Measures Qualitative Appraisal Table¹

Short List Measures	Short List Options	Overview	Technical Assessment	Environmental Assessment	Other Impacts	Qualitative assessment (R/A/G)
Do Minimum	G	Continued operation of the Floating Harbour involving continuation of maintenance to both the Floating Harbour water level control structures and existing raised defences. Like-for-like replacement of mechanical infrastructure e.g. lock gates is undertaken but no improvements in performance to account for sea level rise is assumed.	<p>Technically viable as it represents a continuation of existing activities.</p> <p>Flood risk benefits compared to Do nothing measure but SoP will be reduced due to sea level rise.</p> <p>Lack of information to assess the residual life of existing structures and key harbour assets to act as defences over the appraisal period. The Harbour Asset Management Strategy and the Central Area Flood Risk Assessment (CAFRA) Harbour Resilience Study (2013) highlighted further considerations on the resilience of existing harbour structures.</p>	<p>Minimal environmental impact from construction activities as typically localised patch and repair maintenance or continuation of current operations are expected.</p> <p>Longer term detrimental impacts due to increasing flood risk</p>	<p>Negative socio-economic impact as standards of flood protection will be reduced. The quality of life for residents would be adversely impacted and investment in the city deterred.</p> <p>Positive heritage impacts if existing historic structures are used as defences.</p> <p>Potentially lower cost if existing structures can be used as defences.</p>	<p>Measure to be considered in combination with other measures.</p> <p>This option may result in lower cost if an adaptive approach is adopted, however the residual life of the existing assets is a major risk and providing the required SoP is a major risk</p>

¹ AECOM, "River Avon Tidal Flood Risk Management Strategy - Strategy Technical Report," 2017.

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Property Level Protection (PLP)	A, B and C	<p>Permanent flood defences such as individual property barriers, non-return valves and airbrick/vent covers.</p> <p>Temporary / demountable defences or moveable flood protection systems that are deployed or raised during flooding conditions.</p>	<p>Typically PLP can provide protection against up to approximately 600mm of water. For greater flood depths, PLP is unlikely to form an effective defence. Therefore, PLP can provide only a relatively low standard of protection and the exact standard of protection for large areas is difficult to define.</p> <p>Temporary / demountable defences can be designed to protect large areas or groups of properties.</p> <p>PLP measures would be delivered on a property by property basis and temporary / demountable defences would be delivered on a local scale. On-site storage of the temporary defences and provision of a specialist team for the deployment of the defences would be required.</p>	<p>Minor visual impacts such as appearance of heritage buildings.</p> <p>Longer term detrimental impacts due to increasing flood risk.</p>	<p>Increasing flood risk associated with the deployment of the defences during flood events.</p> <p>Potentially lower cost option.</p>	<p>Not considered a long-term measure to provide the required SoP.</p> <p>May be considered in localised areas or for specific properties.</p>

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Low defence	A, D and E	Defences such as walls or embankments built to provide a 1:200-year (0.5% AEP) standard of protection until 2030. The defences would be designed for short to medium-term sea level rise but will need to be raised further or an alternative measure implemented to provide the SoP for the appraisal period.	<p>An outline design of the low defences has been undertaken at the shortlist stage and has shown that the low defences are technically viable. These includes walls and embankments as well as new tidal stop gates and supporting infrastructure in Bristol City Centre and other areas at the downstream end of River Avon.</p> <p>These measures are to be integrated with the harbour asset management activities, operation of the flood / lock gates at the entry points to the Floating Harbour and the retaining function for Highways along the New Cut.</p>	<p>Landscape and visual impacts which can be mitigated through public realm enhancements.</p> <p>Heritage impacts on existing buildings and historic structures</p> <p>Ecological and environmental impacts during construction and potentially due to permanent works as well.</p> <p>Construction of new structures have higher embodied energy and carbon than other measures.</p>	<p>Positive socio-economic benefit through a reduction in flood risk and economically favourable option.</p> <p>Temporary impact to traffic and transport during construction but less complex construction techniques than tidal barrier.</p> <p>No impact on river navigation</p>	<p>Low Defences represent a more adaptive solution to manage tidal flood risk and sea level rise.</p> <p>However, this measure should be combined with other longer-term measures to provide the required SoP for the appraisal period,</p>

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High Defence	A, B, D, F and G	<p>Raising the defence crest levels or constructing new floodwalls or similar defences (i.e. embankments) where low spots or gaps in existing defences are identified to provide a 1:200 year (0.5% AEP) standard until 2115.</p> <p>The defences would be designed to provide robust long term protection from tidal flood risk by considering sea level rise and climate change projections until 2115.</p>	<p>As with low defences, an outline design of the high defences has been undertaken at the shortlist stage for the same locations and has shown that the low defences are technically viable. Stop gates and operational infrastructure at Entrance Lock and Netham Lock would also be required.</p> <p>Higher defences may have larger footprint and larger foundations which may have associated technical and buildability risks.</p>	<p>Landscape and visual impacts which can be mitigated through public realm enhancements.</p> <p>Heritage impacts on existing buildings and historic structures</p> <p>Ecological and environmental impacts during construction and potentially due to permanent works as well.</p> <p>Construction of new and larger structures have higher embodied energy and carbon than other measures.</p>	<p>Positive socio-economic benefit through a reduction in flood risk and economically favourable option.</p> <p>Temporary impact to traffic and transport during construction but less complex construction techniques than tidal barrier</p> <p>Highest cost and requirement of funding from the start of the appraisal period.</p> <p>Landownership and future development risks due to larger space requirements of high defence structures.</p>	<p>A precautionary management approach to provide the required SoP at the start of the appraisal period.</p> <p>This measure is likely to have the highest cost impact and therefore should be considered where an adaptive approach is not feasible.</p>

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Narrow Barrier	C and E	<p>A tidal flood barrier would stop the highest surge or astronomical tides that would cause flooding in the city centre. The barrier gates would be mostly in the open position, allowing largely unimpeded flow of water in the tidal Avon and normal tidal variation.</p> <p>The proposed barrier location was between the amenity grassland area adjacent to Nibley Road, Shirehampton and the riverbank immediately downstream of the Chapel Pill confluence at Ham Green.</p> <p>This measure would also require flood walls to be constructed upstream of the barrier in central Bristol. These are needed to increase the storage capacity of the upstream channels for periods when the tidal barrier was closed and to stop the stored water from overflowing and flooding the surrounding areas.</p>	<p>An outline design for a tidal barrier at Ham Green – Nibley Road was developed. The design consists of 3 gates, ranging in width from 25 to 40m and in height from 10 to 18m. Construction of a barrier is technically feasible, but there are a number of risks associated with its delivery:</p> <p>Ground conditions – further investigation may impact the location and size of the structure</p> <p>Land acquisition – will require significant construction space and access from both banks.</p> <p>Planning and other consent – will have impact on river navigation and environment/ecology requiring major projects planning process.</p> <p>Lead time – time to secure funding, design and construct may realistically take 10-15 years.</p> <p>Geomorphological impacts - may alter the water flows, disturb sediment and mudbanks in the area.</p> <p>Access – construction and operational constraints to access to/from the left bank may increase costs.</p> <p>Complex construction techniques</p>	<p>Significant temporary and permanent impacts on ecology and nearby sensitive habitats (i.e. SPA, SAC, Ramsar and SSSI sites)</p> <p>Potentially negative visual impacts.</p> <p>Heritage impact to existing buildings and historic structures.</p> <p>Significant impact to geomorphology of the River Avon.</p> <p>Significant structure and would have significantly higher embodied energy and carbon than other measures.</p>	<p>Highest cost measure and therefore has little benefit over the raised defence measures because flood walls would still be constructed throughout the city.</p> <p>Very significant additional maintenance and operational costs.</p> <p>Significant impacts from construction to traffic and transport as well as river navigation.</p> <p>Landmark structure for Bristol having positive economic impacts through local tourism, education, increase in employment and skill level.</p>	<p>Highest cost option with significant environmental impacts and risks</p>