

Project:	<b>River Avon Tidal Flood Risk Management Strategy</b>	Job No: <b>60478613</b>
Subject:	<b>Testing the potential impact of an alternative baseline for scheme financing (CEE010)</b>	
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## 1.0 Overview and Scope

This Technical Note has been prepared to summarise the findings of additional economic testing and Partnership Funding Assessment for the River Avon Tidal Flood Risk Management Strategy. The scope is defined in compensation event CEE010, accepted 18 September 2017, and this note covers the following:

- The background and context for this additional piece of work.
- A summary of the economic appraisal and the financing baseline currently used in the Strategy and in the Partnership Funding assessment of Phase 1 works.
- The definition and rationale for developing and appraising an alternative financing baseline (for sensitivity testing impacts on scheme financing).
- A summary of the economic case for the preferred option (and initial scheme) adopting the alternative baseline which are compared to the current FCERM compliant Strategy appraisal.
- Presentation of the PF score and funding shortfalls required to make the adjusted PF score 100% using the alternative financing baseline and comparison against the current Do Nothing baseline adopted in the Strategy.
- A discussion of the results and a recommendation for next steps and actions including the need to liaise with and confirm the financing baseline with LPRG prior to engaging in further activities on the project.

## 2.0 Background and Context

### Strategy development and preferred option selection

Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG, chapter 5) describes the Do-Nothing ('walkaway') option as:

*"the option used in appraisal to act as a baseline against which all other options are tested. It assumes that no action whatsoever is taken. In the case of existing works, it assumes for the purposes of appraisal that operating authorities cease all maintenance, repairs and other activities immediately. In the case of new works, it assumes that there is no intervention, and natural and other external processes are allowed to take their course".*

FCERM-AG (chapter 5) also provides the following guidance relating to the baseline assumptions for barriers and sluices:

**Failing closed or open (such as barriers, sluices).** *"It is often not known whether an asset that is not at the end of its operational life will fail open or closed. It is often pragmatic to assume they would be left open, giving a worst case scenario. In situations where the effect of the fail position is*

*significant, you can test the impact on the appraisal outcome during sensitivity testing. Alternatively, you can assign probabilities to each condition". **Main guidance:** "define the baseline (open/closed) and assess the impacts under each scenario. You can combine scenarios using the probabilities assigned or assess the scenarios separately during the appraisal....The overriding rule is to think through the real consequences and to think through the probability of these consequences happening".*

The do-minimum ('status-quo') option is an option where an operating authority takes the minimum amount of action necessary to maintain an asset but not significant capital investment.

Key assumptions for the Strategy relate to the operation of the Floating Harbour tidal stop gates at Junction Lock (ordinarily open and with no navigation function) and Netham (ordinarily closed and navigation function). As per FCERM-AG the Do-Nothing option assumes these gates are not operated (and therefore remain in an open position for potential flood events) from year 0. The gates are open under normal circumstances and leaving them open under a walk away scenario is entirely reasonable as there is a requirement to avoid impedance of navigation, maintain statutory duty for the harbour and avoid impounding fluvial flood waters from upstream.

The Do-Minimum scenario in the Strategy assumes that the floating harbour stop gates continue to be operated throughout the appraisal period during all return periods of flood events. The Do Minimum scenario also assumes continued serviceability of the limited raised defences (at St Phillips comprising EA embankment and third-party structures, and at Cumberland Road wall) whilst the Do-Nothing assumes these raised assets fail at the end of their estimated residual life. Further details and information on the assumptions of these scenarios is set out in the River Avon TFRMS – Baseline Scenarios Note (AECOM, March 2016) which was approved by the BCC and EA Project Team and the Project Board on 14<sup>th</sup> March 2016.

These scenarios have also been used as a basis to assess the merits of do something options (e.g. improve the Standard of Protection) and to demonstrate compliance against the FCERM decision rules (see Appendix 1). This has led to the recommendation of the preferred strategy option which involves constructing a series of raised defences along the New Cut and entry points to the Floating Harbour in three phases (Phase 1, 2 & 3).

The initial Phase 1 scheme recommended by the Strategy is to be undertaken from the present day and involves constructing new defences at Entrance Lock, Cumberland Road underpass, Bathurst Basin, Totterdown and Netham.

### **3.0 Partnership Funding for schemes following from the Strategy**

#### *Basis for assessing scheme financing & partnership funding*

Eligibility for Grant in Aid for schemes is determined using the Environment Agency's Partnership Funding Calculator and calculated Outcome Measures:

- OM1 economic benefits definition notes valuations should be based on FCERM A-G i.e. do-nothing baseline; however, the benefit period is reduced to the duration of benefits. For phase 1 works this is assumed to be 50 years as the delivery of benefits to 2065 does not fundamentally depend on implementation of Phase 2 works.
- OM2 households benefiting. Residential property counts in each risk band (and including level of deprivation) before and after the works (at the end of the claimed duration of benefits period) i.e. initial counts based on the current risk (which can include a near-time failed state). Households must be permanent, direct beneficiaries and built/converted before January 2012.

Currently, Outcome Measures and the Partnership Funding appraisal for the initial £43m Phase 1 scheme have been assessed against a Do Nothing Scenario whereby there is a hypothetical walkaway situation with all flood gates ceasing to be deployed (remain open) from year 0 (Do Nothing); FCERM-AG states that this baseline is appropriate for Cost Benefit Appraisals.

Do Nothing ‘cease to deploy gates’ PF baseline

The economic benefits of the preferred strategic option and the Partnership Funding potential for the Phase 1 scheme are summarised in **Error! Reference source not found.** below (assessed against a Do Nothing scenario with gates open from year 0).

**Table 1. Economic benefits and financial case for preferred strategic option and Phase 1 scheme against walk away (Do Nothing) scenario with gates open from year 0.**

Baseline	Preferred option benefits (100 years)	Phase 1 scheme benefits (50 years)	Phase 1 scheme OM2 properties @ reduced risk	Phase 1 scheme PF score	GiA shortfall
A. Do Nothing (gates fail open from year 0)	£1,531,000k	£1,032,000k	843	135%	£0*

\*EA have advised local contribution will increase national priority.

Discussion and rationale for assessing alternative financing baseline assumptions

By assuming an immediate open position of critical stop gates to the Floating Harbour in Bristol it produces significant immediate tidal flood risk (compared to what is currently experienced and observed on the ground due to harbour maintenance, operations and gate deployment) and this consequently drives large monetary damages (£1.6bn PV over 100 years) as opposed to maintain the status quo ‘Do Minimum’ (£316m PV over 100 years).

This shows that unusually, in this instance, the economic case is highly sensitive to this key parameter regarding gate position. There is a very significant difference in economic impacts between an open and closed position of stop gates to the Floating Harbour (£1.3bn PV difference in damages over the 100 year appraisal period).

Therefore additional economic and partnership funding sensitivity testing of an alternative financing baseline was commissioned to explore the impact on potential funding as a pre-emptive step should LPRG query the PF score sensitivity to assumptions.

**4.0 Sensitivity testing impacts of an Alternative Financing Baseline (CEE010)**

Chapter 7 of The Environment Agency’s Partnership Funding Guidance for risk management authorities (*Calculate Grant in Aid funding for flood and coastal erosion risk management projects*, Version 1 updated February 2014) states:

*“It’s important to understand that the funding is based upon the project scenario data fed into the calculator, including anticipated costs, benefits, OM contributions and risk reduction. It’s usually necessary to enter several scenarios to cover a realistic range of possible combinations, perhaps:*

- *upper and lower estimated costs to deliver the anticipated outcomes to reflect cost uncertainty and risk,*

- *different outcomes in terms of risk management (varying numbers of properties in After and Before risks bands) reflecting uncertainties at early stages of development and anticipated risk reduction to understand the implications for funding.*

*For planning purposes a realistic scenario needs to be established but the implications of uncertainty and risk should not be forgotten. Managing expectations - It's important to share the funding and calculator scenarios with key stakeholders in order to manage expectations and avoid future surprises that could undermine success. The calculator can be used at the earliest inception stage of a project to 'test' the funding prospects of different options for managing flood or erosion risks which can prove valuable in setting the initial scope and gaining early support".*

In accordance with this guidance it has been considered prudent to test an alternative baseline scenario for assessing financing and GiA eligibility. This baseline comprises a 'hybrid' of the critical policy surrounding gate deployment scenarios as discussed above.

Under this alternative baseline (Alternative Financing Baseline), gates are assumed to be deployed and closed prior to flood events until they reach the end of their residual life and are then assumed to fail in an open position. The specific point in time that this transition occurs is not currently possible to predict with certainty, especially as a detailed record of asset condition and residual life for key harbour assets is not currently available. A separate commission to provide this key information is planned for 2018 (the Harbour Asset Management Strategy, fully funded by BCC). Once this data is available a more informed assessment of when gates are likely to fail/ no longer be able to be closed can be defined and the estimate of the timing of a likely step change in flood risk associated with this can be refined according to this evidence.

However, the following considerations highlighted by CAFRA Harbour Resilience Study (2013) are relevant when assessing future plausibility of maintaining gate deployment and harbour operations with minimal investment:

- No recent extreme tidal event has been recorded. Tidal stop gates have only been operated during events up to 1 in 20 annual chance.
- There is a high likelihood and catastrophic consequence of debris on the operation of the Floating Harbour.
- Recent investment has increased the resilience at Junction Lock, Entrance Lock and Nova Dam but damage to Underfall Yard and Brunel Dam would hinder the Harbour's operation following or during a flood.
- Netham Lock was considered resilient from a mechanical perspective but the BCC Harbour Master has noted the assets are manually operated and remote from the wider harbour operation.
- The Harbour's vulnerability increases significantly during more extreme events, (especially as it relies on human intervention which may be hindered during a flood) and it will continue to increase in vulnerability as the impact of sea level rise is realised.

Therefore, until the Harbour Asset Management Strategy data relating to asset and infrastructure condition and residual life is available, for the purposes testing an Alternative Financing Baseline it has been assumed that stop gates will remain operable and are closed in advance of tidal events until 2030 before a switch to gates failing (in an open position) with raised defence assets also deteriorating from this point forward.

This assumption for the 'switch' to occur in 2030 fits within the epoch constraints of the Strategy economic assessment for which the numerical modelling is available (modelling only available for the following time periods; 2015, 2030, 2065 and 2115). Also, based on the information on the existing knowledge of asset condition and resilience it is considered more likely that key harbour assets will reach the end of their residual life closer to 2030 than to 2065. Therefore the former has been

adopted as the point at which the ‘switch’ between status quo (gates closed) and system failure (gates fail open). This assumption should be revisited and confirmed if required following the findings of the Harbour Asset Management Strategy (due 2018).

Alternative Financing Baseline

The economic damages, and benefits of the preferred strategic option, have been recalculated by adopting this Alternative Financing Baseline. As shown in Table 2 below (compared against Table 1 for Do Nothing), adopting this alternative baseline reduces the benefits of the preferred strategic option over the next 100 years, and also reduces the PF score of the Phase 1 scheme to below 100%.

A major reason for the reduction in benefits for this Alternative Financing Baseline compared to the Do Nothing baseline is a decrease in the annual average damages (AAD) accrued over epoch 1. This initial time period has the lowest discounting over the next 100 years and therefore changing the gate deployment assumptions for this first period has a comparatively greater impact than it would compared to later on. In addition, a large percentage of the properties which are written off in year 0 with the Do Nothing ‘gates open’ baseline are not written off until year 15 under the Alternative Financing Baseline scenario. This means that a discount rate of 0.59 is applied to the large lump sum value for the property write off which reduces the economic damages / benefits significantly.

**Table 2. Economic benefits and financial case for the preferred strategic option and Phase 1 scheme against ‘hybrid’ alternative baseline**

Baseline	Preferred option benefits (100 years)	Phase 1 scheme benefits (50 years)	Phase 1 scheme OM2 properties @ reduced risk	Phase 1 scheme PF score	GiA shortfall	GiA funding should score reach 100%
B. Do Nothing ‘hybrid’ - Gates closed epoch 1, fail open epoch 2&3	£1,136,000k	£659,000k	52	80%	£8.6m	£34.7m

As part of CEE010, BCC also requested that a partnership funding calculation was undertaken using the Do Nothing baseline as the basis for the OM1 benefits but the Alternative Financing Baseline as the basis for the OM2 property counts (before & after the scheme).

This combination of baseline assumptions for Outcome Measures within the partnership funding calculator produces a PF score of 125%, as shown in Table 3. This provides an interesting test and demonstrates that OM2 provides a limited influence over the overall PF score and OM1 is the dominant contribution to the score. However, we do not recommend a mixing and matching of baseline assumptions for different OMs within the same PF calculation as a consistent basis for appraisal should be adopted.

**Table 3. Economic benefits and financial case for the preferred strategic option and Phase 1 scheme against ‘hybrid’ alternative baseline**

Baseline	Preferred option benefits (100 years)	Phase 1 scheme benefits (50 years)	Phase 1 scheme OM2 properties @ reduced risk	Phase 1 scheme PF score	GiA shortfall
C. Do Nothing as OM1 baseline. Alternative ‘hybrid’ as OM2 baseline	£1,531,000k	£1,032,000k	52	125%	£0*

\*EA have advised local contribution will increase national priority.

### 5.0 Discussion and Recommendations for planning scheme financing requirements

From the sensitivity testing undertaken it seems reasonable to assume a potential range of FCERM GiA funding for the £43.3m Phase 1 scheme of £34.7m - £43.3m (subject to the required shortfall being met by other funding sources). Therefore, based on the current cost estimate, an anticipated reasonable ‘worst case’ funding shortfall of £8.6m results (based on the Alternative Financing Baseline tested in CEE010), as shown in Table 4. This shortfall could reduce to approximately £3.6m if the LEP grant of £5m (2023/24 allocation) was secured towards the scheme.

More generally, given the profile and magnitude of the scheme, it is not unreasonable to expect that a financial contribution would be required from BCC towards the scheme (even with a PF score of above 100%) and this would also help meet Defra targets for external scheme contributions of 15% or more for large schemes.

**Table 4. Estimated funding shortfalls for a range of sensitivity tests**

Baseline	PF score	GiA shortfall
A. Do Nothing (gates fail open from year 0)	135%	£0
B. Alternative Financing Baseline (gates deployed and closed epoch 1, gates fail open from year 15)	80%	£8.6m
B. Alternative Financing Baseline Sensitivity 1 - 25% increase in capital cost	65%	£18.9m
B. Alternative Financing Baseline. Sensitivity 2 – increase duration of benefits by 25%	80%	£8.5m
B. Alternative Financing Baseline. Sensitivity 3 – 50% of OM2 properties in Very Significant Risk (before) in Significant risk	80%	£8.6m
C. Do Nothing as OM1 baseline. Alternative ‘hybrid’ as OM2 baseline	125%	£0

As in line with the FCERM guidance, it is recommended that the Do Nothing baseline including ‘cease to deploy gates from year 0’ is adopted for PF calculations of the initial Phase 1 Scheme and presented to LPRG for approval. It is recommended that the business case is put forward on this basis with reasoned and justified evidence along with the demonstration of compliance with the guidance. This will demonstrate that the decision rules have been met and that valid and justifiable baseline assumptions around gate deployment have been made.

However, should the acceptability of the Do Nothing assumptions be explored from a financing baseline perspective, the additional work carried out under CEE010 provides the required PF assessment and economic case for the alternative baseline and the necessary evidence base.

Next Steps – managing risk / uncertainty

In order to ‘de-risk’ this critical finance related issue prior to seeking approval, it is AECOM’s recommendation that the appropriateness and validity of the key baseline assumptions underpinning the financing assessment are confirmed ‘in principle’ with the Environment Agency’s Large Project Review Group without further delay. Until this is obtained, it is recommended from a risk mitigation and scheme planning perspective that BCC should plan for the ‘reasonable worst case’ of a requirement to provide a financial contribution towards the Phase 1 scheme. Based on the results reported in Table 4 above, this equates to around £9m in the absence of a LEP contribution in 2023/24.

As an aside it is also important to note for the scheme risk register that where the total FCERM Grant in Aid contributions for proposed projects submitted for funding in a single year is greater than total grant available, the EA will use Partnership Funding scores to help prioritise projects. For this reason, promoting Risk Management Authorities will be able to increase confidence in FCERM Grant in Aid

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allocation if they can increase the partnership funding score for a project above 100%. This can be achieved through reducing costs or securing additional contributions.

BCC has stated that the tidal strategy has been identified as a priority by the Wessex Regional FCC and is specifically mentioned in their Strategy as a Priority Place - as Bristol is a thriving city and important to the success of the South West. However, there are relatively fewer residential properties benefiting from the scheme (which are a policy priority for the Environment Agency) and consequently this should also be highlighted in the project risk register as other schemes delivering higher OM2s for a given level of investment, could be prioritised in terms of Grant in Aid Funding.

The Strategy preferred option will also deliver fluvial benefits which have not yet been quantified and are therefore not included in the economic benefits. Inclusion of the fluvial benefits has the potential to increase the PF score of the scheme(s) and it is recommended that this is undertaken during future appraisal work.

**Appendix 1 – Demonstrating compliance with FCERM decision rules**

The initial Phase 1 scheme for the Strategy involves construction of new defences to a >1:200 year standard of protection (SoP). In order to demonstrate that the assigned SoP for this scheme complies with FCERM decision rules the costs and benefits of delivering the scheme to a lower SoP have been derived and then compared using the incremental benefit cost ratio (IBCR) thresholds.

Note that the costs of the lower SoP options have been approximated by scaling the costs of the preferred SoP which were estimated during the preferred option development stage of the Strategy. This approach is considered to be high level and it is therefore recommended that at the OBC stage the costs for lower SoPs are revisited and costed to a higher level of accuracy to confirm FCERM decision rule compliance.

The IBCR assessment suggests that the choice of standard of protection for the scheme is justified because the IBCR of 7 exceeds the required threshold (of 5).

**Phase 1 scheme (Floating Harbour & Totterdown)**

**Do Nothing baseline, 50yr appraisal period**

Option	Cost (PV)	Benefits (PV)	ABCR	IBCR	IBCR threshold required	Leading option
Do Minimum*	£1,850k	£911,000k	492	/	/	
Present day 1:75	£42,850k	£988,000k	23	2	1	
Present day 1:200	£45,000k	£1,024,000k	23	17	3	
Present day >1:200	£46,150k	£1,032,000k	22	7	5	✓

**Alternative Financing Baseline (Gates deployed to 2030, then open), 50yr appraisal period**

Option	Cost (PV)	Benefits (PV)	ABCR	IBCR	IBCR threshold required	Leading option
Do Minimum*	£1,850k	£538,000k	291	/	/	
Present day 1:75	£42,850k	£615,000k	14	2	1	
Present day 1:200	£45,000k	£651,000k	14	17	3	
Present day >1:200	£46,150k	£659,000k	14	7	5	✓