



# **SOUTHSEA AND NORTH PORTSEA ISLAND COASTAL FLOOD AND EROSION RISK MANAGEMENT SCHEMES**

**SCOPING STAGE REPORT**

**TECHNICAL REPORT 3: ECONOMICS**

**November 2012  
Final Report**

A partnership project by

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## **ANNEX 1: ECONOMICS AND WORKING GROUP WORKSHOP MEETING MINUTES**

## **ANNEX 2: JOHN CHATTERTON ASSOCIATES REVIEW OF STRATEGY ECONOMICS**

## **ANNEX 3: PROJECT APPRAISAL REPORT (PAR) STAGE ECONOMICS PROCESS FLOW CHART**



# 1 VISION, AIMS AND OBJECTIVES

## 1.1 The Vision

The vision for this and subsequent phases of the Southsea and North Portsea Island Coastal Flood and Erosion Risk Management Schemes is to:

*“Ensure the sustainable future of the City of Portsmouth by managing coastal flood and erosion risk.”*

## 1.2 The Aims

We will achieve this vision by:

1. Working together with our partners;
2. Providing cost effective methods for adapting to climate change;
3. Recognising the importance of communities, cultural heritage and the environment;
4. Maximising funding and contributions.

We will use this opportunity to explore and deliver broader benefits to shape the future of Portsmouth

## 1.3 The Objectives

The objectives of the next phase of the project are to:

- Manage the risk of flooding and coastal erosion to people and their property, now and in the future;
- Develop and prepare an adaptable flood and coastal risk management scheme to provide a safe standard of protection;
- Develop a robust business case to deliver the scheme;
- Obtain the necessary licenses, consents and approvals to deliver and manage the scheme;
- Provide a clear action and implementation plan for scheme delivery.

## 2 INTRODUCTION

### 2.1 Background to the Scoping Study

In accordance with Defra and the Environment Agency's guidance on coastal and flood risk management, the Eastern Solent Coastal Partnership completed a Strategy Appraisal Report (StAR) in 2011. The StAR identifies that the City is at significant risk of flooding with 4,211 residential, 364 commercial and 48 Ministry of Defence (MoD) properties currently at risk from a 0.5% annual exceedance probability of flooding (AEP) due to breaching of the existing coastal defences.

The StAR described the proposals for a 100 year flood and coastal erosion risk management strategy for Portsea Island, Portsmouth, Hampshire. In 2012, the Eastern Solent Coastal Partnership, in collaboration with the Environment Agency, gained formal approval to proceed with the Project Appraisal Report (PAR) development for Cells 1 and 4 of the StAR (Southsea and North Portsea Island respectively).

The coverage of Flood Cells 1 and 4 is shown in [Figure 2.1](#) and can be described as follows:

- Flood Cell 1: Southsea (Portsmouth Harbour Railway Station to the Royal Marine Museum);
- Flood Cell 4: North Portsea Island (The Mountbatten Centre to, and including, Milton Common).

In addition, the eastern part of the southern frontage is included within the study area to inform potential future beach management activities.

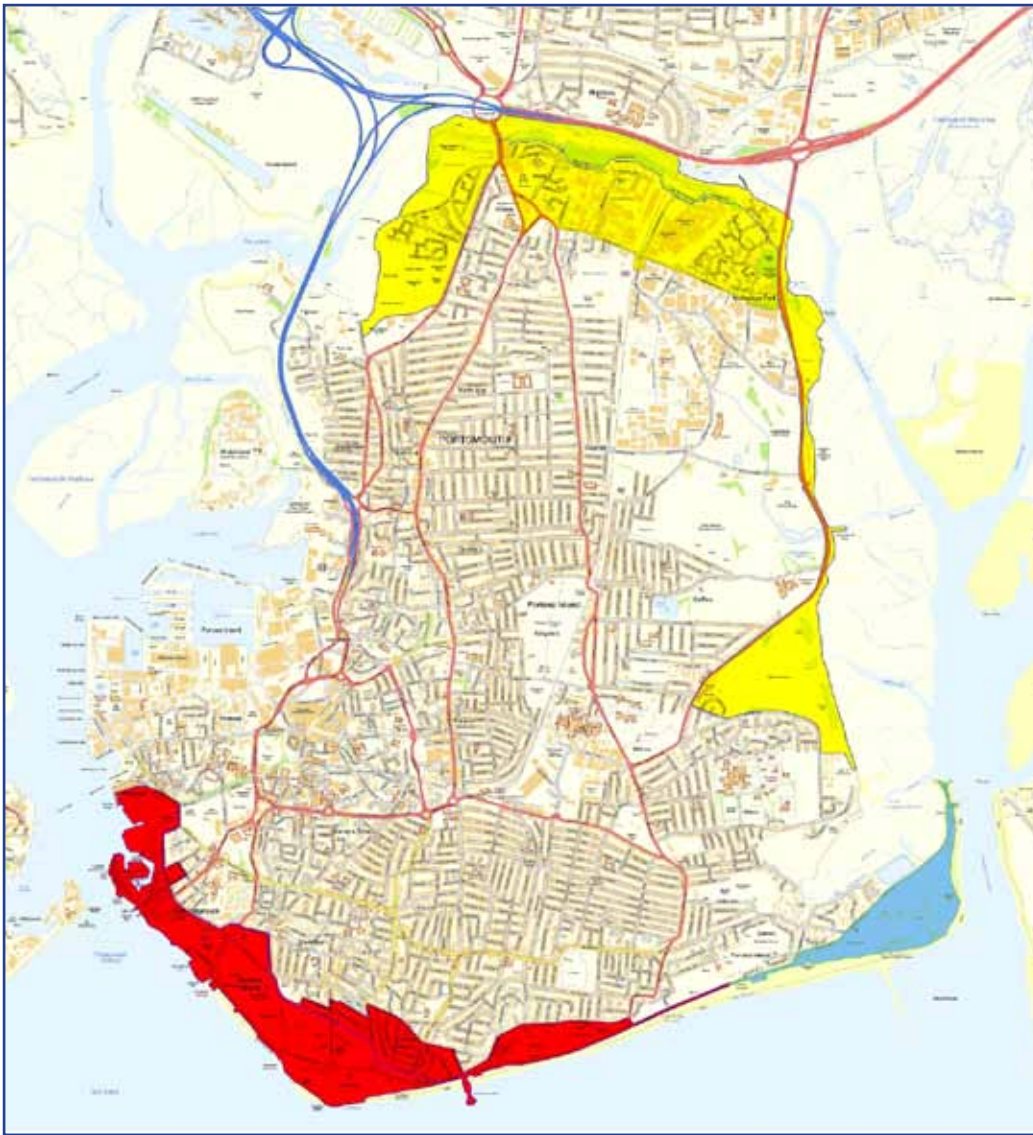
### 2.2 Purpose of the Scoping Study

Due to the importance of reducing flood risk to the City and due to the complexity of developing a robust scheme, that maximises benefits and funding opportunities, the Eastern Solent Coastal Partnership has scoped the work required to deliver the Southsea and North Portsea Island Coastal Flood and Erosion Risk Management Schemes (the Schemes).

This Scoping Stage guides all subsequent work towards the realisation of the Schemes, and is focused toward the next stage; the development of the PARs.

The purpose of the Scoping study is, therefore, to:

- Document the role and requirements of the PAR Stage to inform any future schemes' technical content and future approval processes such as;
  - PAR for Large Project Review Group (LPRG) approval;
  - Planning Permissions and other approvals for the Schemes by the Local Planning Authority (LPA) and other statutory regulators and/or consultees;
  - Preparation, completion and submission of an Environmental Impact Assessment (EIA) for any Schemes to support any approval processes.



**Figure 2.1:** Flood Cell 1: Southsea (shown in Red) and Flood Cell 4: North Portsea (shown in Yellow). The blue zone is included to inform potential future beach management activities.

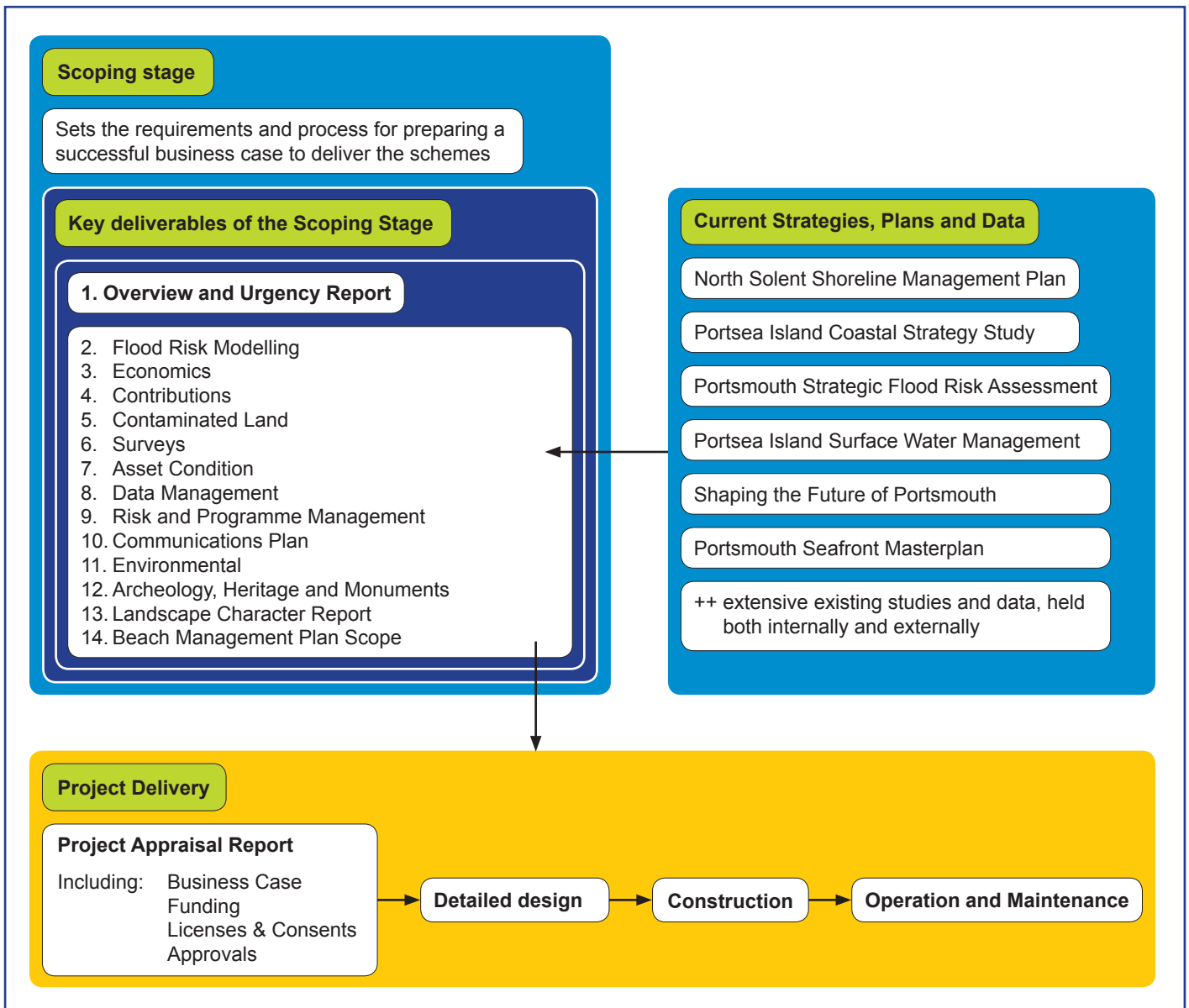
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- Understand and identify the suitability and limitations of the existing Portsea Island Coastal Strategy Study (2002-2012) (PICSS);
- Identify the data requirements to support any scheme approval, design and construction process, including the sourcing of existing data and the identification, commissioning and collation of additional data;
- Identify a robust and resilient approach for managing data through the Scoping Stage and future scheme stages;
- Identify an engaging and proactive approach to communication within the project team, Council Members and influential internal and external stakeholders;
- Identify, share, allocate and cost project risks for managing and monitoring throughout the project;
- Generate a Project Implementation Plan;
- Produce a methodology for undertaking the PAR, and summarise this methodology in an Overview and Urgency Report.

## 2.3 Format of the Scoping Study

The Scoping Study comprises an Overview and Urgency Report and a number of individual assessments, which explore the requirement for delivering the PAR to achieve the necessary consents and funding to deliver an appropriate flood and coastal risk management scheme. These individual assessments are contained in the 14 Technical Reports noted in **Figure 2.2** below, with key aspects highlighted further in *Technical Report 1: Overview and Urgency*.

**Figure 2.2: Format of the Scoping Study**





# 3 OBJECTIVE AND FORMAT OF THIS TECHNICAL REPORT

## 3.1 Technical Report 3: Objective

The objective of this report is to:

- Determine what is known about the current and future economic impacts of flood and coastal risk for Southsea and North Portsea Island;
- Assess the levels and likelihood of external contributions to the project;
- Determine how to obtain any information or data gaps that currently exist regarding economics and contributions;
- Provide clear recommendations and actions for any future FCERM schemes.

## 3.2 Why is this Technical Report Required?

The assessment of the economic impact of flood and coastal risk is an essential factor in demonstrating a robust business case to undertake the FCERM schemes at Southsea and North Portsea Island and is crucial for eligibility for Defra's Flood Defence Grant in Aid (FDGiA).

Although the assessment of economics is heavily reliant on existing modelling assumptions (discussed in [Technical Report 3: Flood Risk Modelling](#)), this report focuses solely on the validity and process of the economic assessment. The objective of this report is to determine and define what is required to present a robust and transparent economic assessment and business case in the PAR.

## 3.3 Technical Report Format

Section 4 'Approach' - describes how we have developed this Technical Report, working in partnership with the Eastern Solent Coastal Partnership and signposts any links to other Technical Reports produced through the wider Scoping Study.

Section 5 'Data' - sets out the data collated through the study which is available through the Eastern Solent Coastal Partnership for future use in related studies.

Section 6 'Economics Review' - describes detailed findings of the John Chatterton Associates independent economics assessment within the context of developing a future PAR.

Section 6 summarises the report's conclusions and recommendations.

## 4 APPROACH

### 4.1 Working in Partnership

This Technical Report has been produced as a partnership between Royal Haskoning and the Eastern Solent Coastal Partnership, with key members of the team as follows ([Table 4.1](#)):

**Table 4.1: Team members**

Team member	Organisation
Hamish Hall (Author)	Royal HaskoningDHV
Chris Smith	Royal HaskoningDHV
Bret Davies	Eastern Solent Coastal Partnership
James Addicott	Eastern Solent Coastal Partnership

In addition to the above team members, an independent assessment of the Strategy economics was undertaken by Dr John Chatterton of John Chatterton Associates (JCA). JCA were sub contracted by Royal Haskoning.

The Eastern Solent Coastal Partnership has led on the Contributions aspect of the report, drawing on the findings of the economics review.

### 4.2 Links to the Wider Scoping Stage

As part of the suite of technical reports produced for this Scoping Stage, the data collated and produced and the findings from this Technical Report will contribute to the wider outputs from the Scoping Stage and will enable opportunities to explore broader outcomes such as linking with other council initiatives. By broadening this study's links with other projects, the opportunities for external contributions is automatically increased which should have a significant beneficial impact on the benefit cost ratio of any future FCERM schemes.

[Technical Report 3: Economics](#) and [Technical Report 4: Contributions](#) are key to the development of any future business case to promote FCERM schemes across the frontages of Southsea and North Portsea Island. Good benefit cost ratio and Outcome Measure scores derived from undertaking any FCERM schemes are essential to demonstrate that undertaking the works are not only in the public interest but they are also competitive from a national perspective and eligible for central government funding. The Outcome Measures, outlined in Defra's Flood and Coastal Resilience Partnership Funding guide (2011), directly influence the percentage of eligible FDGiA funding for all FCERM studies, strategies and schemes. Any shortfall can be addressed either through reducing costs and/or securing external contributions.

In developing the business case, this report will both draw upon and inform the following reports ([Table 4.2](#).)

**Table 4.2:** *Wider Technical Reports with direct links to this Technical Report*

Report Number	Technical Report
1.	Overview and Urgency
2.	Flood Risk Modelling
9.	Risk and Programme Management

## 5 REVIEW OF EXISTING DATA

### 5.1 Project Planning Phase

The following information was identified during the Scoping Stage Project Planning Phase (November – December 2011) and was used to inform the requirements for this Technical Report.

#### 5.1.1 PICSS Review

This technical report refers to the review of one principal report (shown in bold below), and three related reports. All reports were originally prepared by the Halcrow Group Limited:

- PICSS: Economics Report, June 2009;
- PICSS: Coastal Change Data, June 2009;
- PICSS: Numerical Modelling Report June 2009;
- PICSS: Coastal Defences Report June 2009.

A detailed review of each report was not undertaken during the Project Planning stage; however following a brief review the following initial conclusions were drawn:

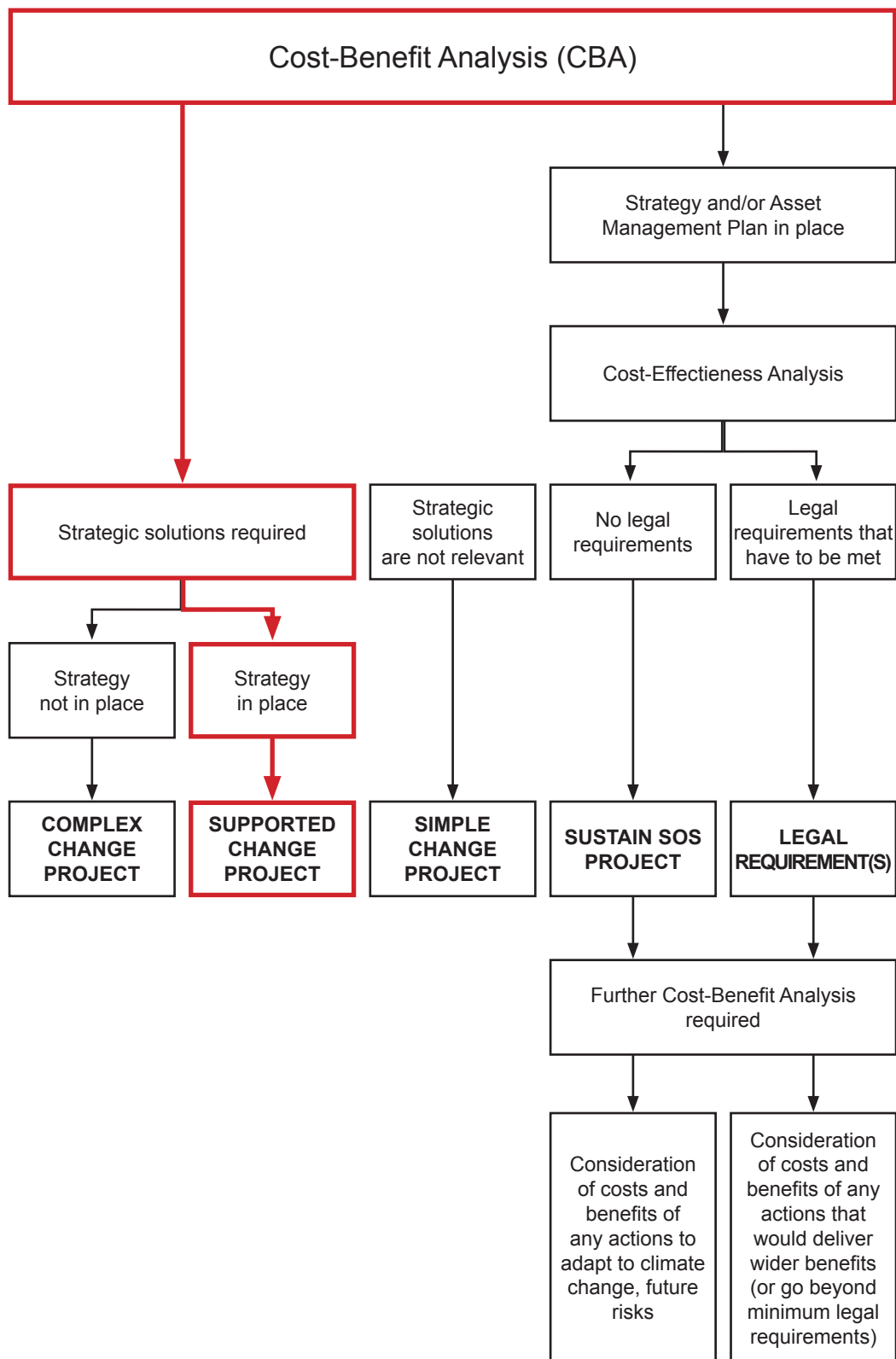
1. There is a degree of uncertainty in the findings of this initial review owing to a lack of evidence available for assessment contained within the available Strategic Appraisal Report (StAR) and appendices (including some missing appendices for the Economics Report);
2. The aim of the scoping stage will remove this element of uncertainty and enable the PAR stage to progress with the minimum of risk.

#### 5.1.2 Flood and Coastal Erosion Risk Management – Appraisal Guidance (FCERM-AG), 2010

FCERM-AG 2010 is the most recent appraisal guidance which has been reviewed and used to guide this Economics review and informs the recommendations of this Technical Report.

In undertaking this technical report it has been noted that the FCERM-AG states that it is an objective for StAR economics to be carried through the PAR stage, as can be illustrated in [Figure 5.1](#) (taken from [Figure 2.3](#) of the FCERM-AG 2010).

It is, therefore, proportionate for the PAR to draw upon the existing StAR economics, making refinements as necessary in the light of the new FCERM-AG, new and refined data and the improved confidence from the flood risk envelopes that will be defined during the PAR (as identified in [Technical Report 2: Flood Risk Modelling](#)).



**Figure 5.1:** The 5 types of appraisal projects; with the route to the Supported Change Project highlighted in Red.

Source: FCERM-AG 2010

## 5.2 Scoping Stage Data Collation and Review

The data presented in [Table 5.1](#) was requested for this Technical Report, with notes to record whether such data was made available to inform this Technical Report and whether it may be available for any further related studies.

**Table 5.1: Data request at Scoping Stage and availability**

Data	Source	Format	Procurement route	Licensing & IPR	Received (date)	Future availability and other comment
Appendices and economic spreadsheets	Halcrow	Digital	N/A	N/A	January 2012	Electronic copies of reports received, plus clarification with Halcrow following meeting of 5/1/12
Obtain new guidance	internet	Digital	N/A	N/A	January 2012	Both the FCERM-AG and the Resilience Partnership Funding are subject to revision, which may affect the development of the PAR.
Rateable Value data (commercial and resi')	PCC	Digital	N/A	N/A	2nd May 2012	This is located on the Box system.
PCC Local Land and Property Gazetteer	PCC	Digital	N/A	N/A	12th April 2012	GIS data available on Box. Check for frequency of updated undertaken by PCC.

The Halcrow economics and cost benefit assessment comprised:

- PICSS: Economics Report (June 2009);
- PICSS: Addendum to the Economics Report (April 2010);
- 9 no. Appendices (to the Economics report)
  - A – Flood maps
  - B – Discrete flood map cells
  - C – Defra liaison
  - D – Uplift factors
  - E – Calculation of PV Damages
  - F – Cost estimates and BCR
  - G – Contamination/Remediation
  - H – Sensitivity Analysis
  - I – Outcome Measures

### 5.3 Economics Assessment Method

The following approach has been used to undertake the review of the economic assessment:

- Review the collected StAR economic information (RH and JCA). It was not the intention to review Strategy Benefit Cost spreadsheets in detail, but to review core inputs to the direct and indirect damage data assumptions, identifying any gaps or inconsistencies and developing a methodology to address them;
- Meeting with the Strategy authors, Halcrow, to discuss data supply and approach from the Strategy (whole team 5th January 2012);
- Visit site with ESCP/RH team (whole team 19th January 2012). A site visit was held to ensure familiarity with the study area flood risk cells and the residential and commercial stock present;
- Discuss StAR modelling approach with Royal Haskoning (whole team through working group workshop held 12th March 2012);
- A working group workshop was held on 12th March 2012 to discuss the initial findings of the independent economics review. Minutes of this meeting are presented in Annex 1 and attendance at this workshop comprised the following:
  - Bret Davies (Coastal Partnership),
  - Marc Bryan (Coastal Partnership),
  - Lyall Cairns (Coastal Partnership),
  - Caroline Timlett (Coastal Partnership),
  - Clive Evans (Coastal Partnership)
  - Julie Dunstan (Royal Haskoning),
  - Hamish Hall (Royal Haskoning),
  - John O Flynn (Environment Agency),
  - Dominic Damarell (Minutes), Claire Short (Minutes).
- Review assumptions and base dates (JCA);
- This review of the Strategy assumptions and base dates (including datasets) was undertaken using the Strategy documents identified in Section 4.2);
- RH to feed in implications of sea level rise predictions;
- Using the latest coastal boundary condition dataset and UKCP09 sea level rise guidance, potential extreme water levels at Portsea have been calculated now and over a 100 year economic appraisal period.

This review informs how guidance changes may impact on the Strategy derived economic analysis;

- Assess the breach methods used to derive economic impact (RH and JCA). *Technical Report 2: Flood Risk Modelling* details a review of the Strategy assumptions regarding breach risk, which drive the Do Nothing damage assessment. The findings of the breach review is summarised in this technical report in relation to the potential impact of such assumptions on the economic base case;

Summary of findings including revised Outcome Measure (OM) Score under the Flood and Coastal Resilience Partnership Funding (JCA).

The findings of the Strategy economics analysis undertaken by JCA are summarised in this Technical Report, with the JCA reporting presented in Annex 2.

- Recommendations for the PAR and data collection (RH).

Based on the findings of the independent JCA assessment, Royal Haskoning have written this Technical Report and provide further recommendations for any future economic analysis which would support any PAR for developing any future coastal flood and erosion risk management schemes at Southsea and North Portsea Island.

Baseline - in order to define the study area for the economics review the Do Nothing maximum flood extent (1 in 200 year tidal event in 100 years' time) as derived in the Strategy has been the primary study area, as presented below ([Figure 5.2](#)).

The review of the economics and the recommendations for data collection to develop the PAR Economic Assessment for Southsea and North Portsea Island should be focused to provide the highest economic return on preferred option investment.

Throughout the assessment the team need to be mindful that there is an Environment Agency stated objective within the FCERM Appraisal Guidance for StAR economics to be carried through the PAR stage.





## 6 ECONOMICS REVIEW AND APPROACH TO DEVELOPING THE PAR

JCA were commissioned by Royal Haskoning on behalf of Portsmouth City Council to:

*“undertake an independent assessment and review of the Portsea Island Coastal Strategy Study economics and cost benefit assessment (produced by Halcrow) in the form of a report which can be incorporated in to the suite of documents produced through the Scoping Stage and specifically [Technical Report 3: Economics](#)”.*

Dr Chatterton’s review is included in its entirety in Annex 2 and has been used, alongside Royal Haskoning’s assessment of what is required to complete an Economic Assessment in line with a Supported Change Project PAR.

There are a number of steps required to complete an economic assessment and these have been summarised in the PAR Stage Economics Process Flow Chart presented in Annex 3.

At the time of writing (in 2012) and with the benefit of recently updated guidance and improved datasets, enhancement to the Strategy economics in the following four areas is possible:

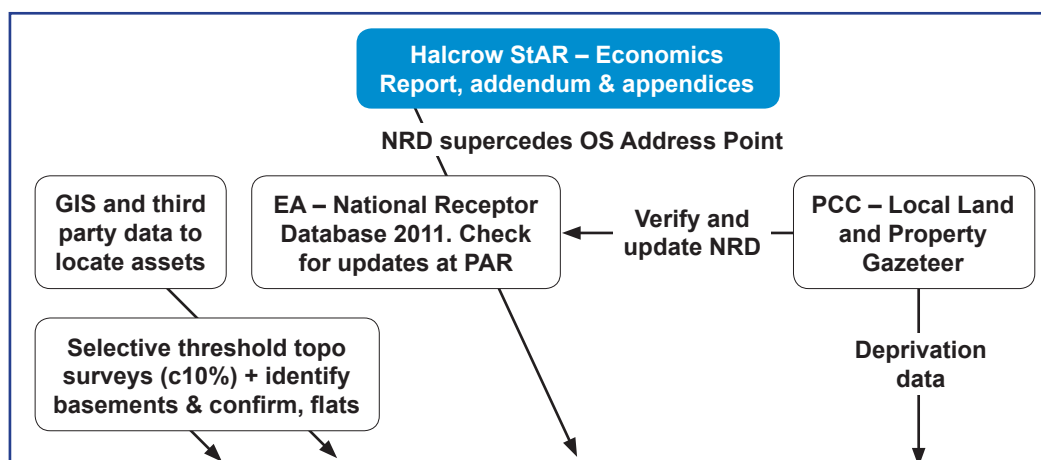
1. Changed Appraisal guidelines and funding protocols;
2. Improved datasets;
3. Economic assumptions;
4. Modelling/flood risk assumptions.

The following sections of this report use the PAR Stage Economics Process Flow Chart, developed during this scoping stage, to expand upon economic assessment where specific guidance is not available to ensure that the correct links are made with current and future scheme development work streams, such as the PAR.

### 6.1 Asset Data

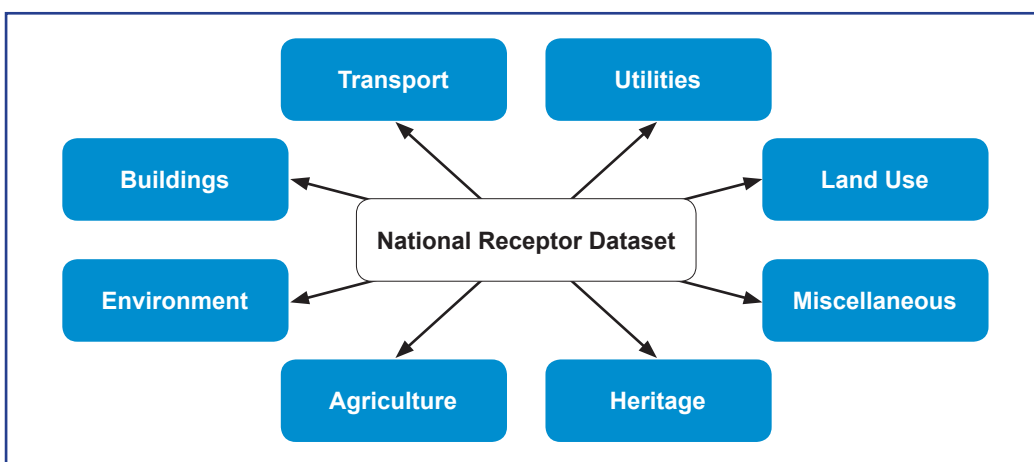
#### 6.1.1 OS AddressPoint (now superseded by National Receptor Dataset)

Figure 6.1: Process



Within the Strategy, OS Addresspoint data was used to establish the location of residential and non-residential properties. Addresspoint can, and has been shown on other projects to, underestimate the number of properties at risk because non addressable properties are not included and, more importantly, commercial properties not receiving post at the identified site (but at a remote HQ, for example) will also not be included.

In 2011 the Environment Agency released the National Receptor Database (NRD), **Figure 6.1** which includes all buildings with a footprint of greater than 25 square metres and also other receptors associated with other than the built environment. These receptor themes are summarised in **Figure 6.2** below:



**Figure 6.2: National Receptor Database Receptor Themes**

Source – Environment Agency Operational Publication No353\_10, Issued 07/09/2010; National Receptor Dataset: what it is, how to access it, and what it can be used for?

Using the NRD, residential property can be separated by type (detached, semi, terraced and flat) and non ground floor flats separated from those at ground floor. Basement properties can also be distinguished which is of particular importance in Southsea where many properties have dwellings in basements.

A comparison of the numbers of properties at risk within the NRD against the property numbers used within the Strategy economics infers that the newer and more appropriate NRD data will give fewer ground floor residential properties flooded and more commercial properties flooded. This is to be expected based on the draw backs of using OS Addresspoint data raised above, however it is not possible to estimate the resulting change to the damages at this stage.

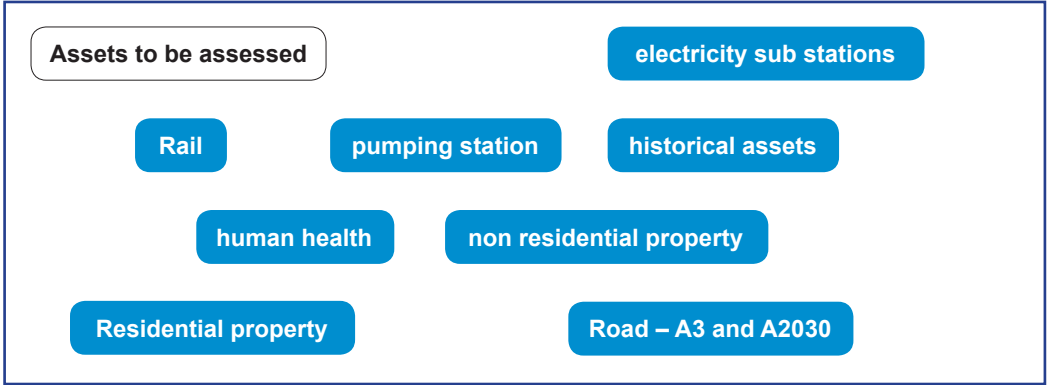
In 2012, PCC made the Local Land and Property Gazetteer available to the project. This dataset is a GIS based property database for Portsmouth. The data contains useful property information i.e. property type (detached, semi-detached, flat etc.) and information on deprivation. The property

information is populated and updated by PCC’s Taxation Office. The NRD is to remain the primary data source for the economic assessment, but should be validated and updated to reflect any improved data (particularly in relation to above ground level flats and basements). This approach is consistent with the appraisal guidance.

6.1.2 Other Third Party Asset Data

In addition to the residential and non-residential property data, information relating to other assets will also be required (Figure 6.3). For the road and rail infrastructure and historical assets the relevant spatial and threshold information can be directly obtained from LiDAR. PCC’s Transport Service should be contacted regarding traffic flow on the two main roads to and from the island to be assessed, and published information can be used for the rail passenger numbers (Network Rail).

Figure 6.3: Assets to be Assessed



Additional information on the importance and location of pumping stations and electricity sub stations should be sought direct from the Utility providers. It is recommended that a meeting is held with Southern Water, Portsmouth Water Ltd. and Scottish and Southern Energy to explain the purpose of the assessment in the context of the wider scheme; not only to obtain data, but also to establish an approach to developing a partnership as the scheme develops to increase the opportunities for working collaboratively. A full service enquiry has been undertaken for this project, which includes locations and providers of services.

As the economic assessment develops, other financial assets should be considered for inclusion. For example, loss of car park revenue or loss of earnings to visitor attractions should be used to demonstrate the benefits of flood and coastal risk management which will provide opportunities for third party contributions. In some instances loss of earnings can be attributed as economic loss and used in a benefit cost assessment (for example where a council car park is lost due to erosion and there is no alternative asset where business could be transferred). The Multi Coloured Manual should be referred to for a review of what can and cannot be included.

Irrespective of the economic assessment, there remains value in assessing the impact of flood and erosion in financial terms. For example if a private car park were to be lost due to erosion, even if the business can transfer, there will still be a loss of earnings to the private owner. Quantifying this loss could be an opportunity to seek a contribution for the private party to the overall scheme.

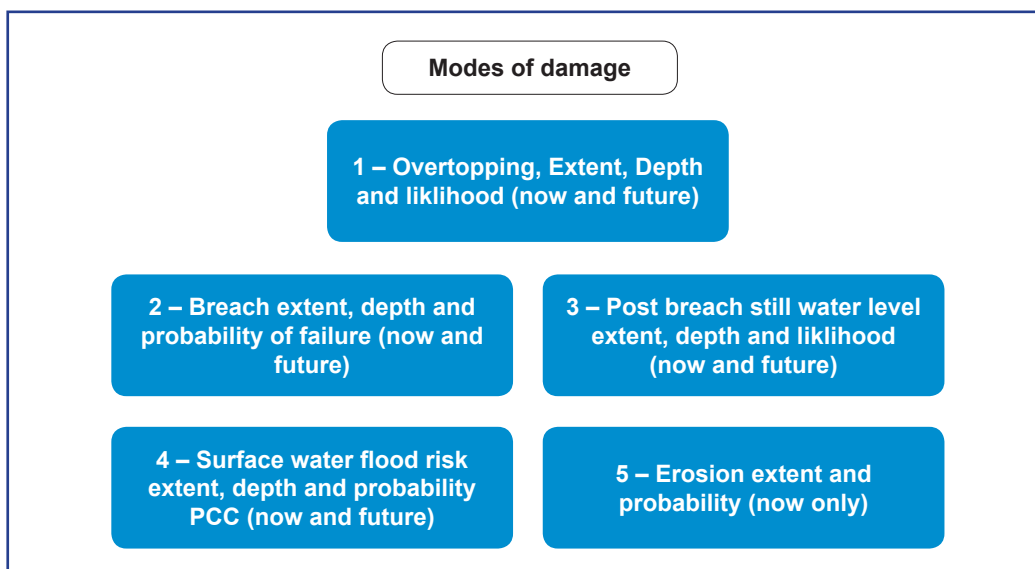
### 6.1.3 Additional Threshold Survey

The threshold data of assets is an important element of achieving a correct and robust economic assessment. The project already benefits from good LiDAR data, but it is still recommended that approximately 10% of properties within the current 0.5% Annual Exceedance Probability (AEP) flood extent should have their thresholds surveyed to gain more accurate threshold elevation data. At the same time as this survey is being undertaken, the threshold data should be reviewed to audit the locations of basements and confirm the data relating to ground floor flats. Threshold data will also be useful for the final auditing of the results, to further demonstrate a robust approach eliminating uncertainty.

**Selective threshold topo surveys (c10%) + identify basements & confirm, flats**

## 6.2 Assessment of Damage

There are five key mechanisms for losses to be incurred in Southsea and North Portsea Island. The modelling will define the impacts of the loss in isolation (depth, duration, extent, likelihood). It is, however, the task of the economic assessment to combine these impacts into likely scenarios, which do not result in any double counting.



**Figure 6.4: Modes of Damage**

The five loss mechanisms are summarised as follows and are shown in **Figure 6.4** as follows;

1. **Overtopping:** Overtopping is a result of a combination of water levels, wave height, defence levels and defence geometry. Overtopping can occur anywhere along a frontage. The impact of overtopping is short duration flooding to low lying hinterland areas and locations where water flows overland to reach these areas. The economic impact from overtopping is derived based on a probability of occurrence. The StAR did not consider the impacts of overtopping.
2. **Breach:** Can occur due to the failure of an asset – whether due to overtopping resulting in asset failure, or simply due to asset failure without the influence of overtopping. The likelihood of failure is therefore dependant on the asset type, geometry, condition and the impacts of waves, water levels and the performance of any beaches. Under a do nothing scenario a breach would not be repaired and areas would be permanently flooded – leading to asset loss (write-off). Over time there is usually a rising probability of breach and once a breach has occurred, it cannot be subject to further losses due to overtopping, erosion or surface water. The StAR considered breach impacts.
3. **Post Breach Extreme water levels.** Although there will be assets written off following a do nothing breach, there will be assets just outside the new, normal flood envelope that flood more infrequently. Using standard approaches to assessment, these properties are not included in the write-off applied in the breach mechanism and can therefore be included as damages. The StAR did not consider the impacts of more extreme events post breach.
4. **Surface Water Flood Risk.** There are areas of Southsea and North Portsea Island that are identified as being susceptible to surface water flood risk. Managing this flood risk is somewhat reliant on gravity through clear outfalls and pumping stations. Since coastal flooding mechanisms could impact on outfalls and pumping stations drainage capabilities, and since there may be options that improve the surface water flood risk, it is recommended that the impacts of surface water flooding are included in the assessment. This will allow further opportunities for increasing benefits and for attracting partnership funding. Care will need to be taken to ensure that once breach has occurred, properties are not double counted. The StAR did not include the impacts of surface water flooding.
5. **Erosion Risk.** With a range of assets in a deteriorated state, and with fluctuating beach levels, there is the certain likelihood of erosion under the do nothing scenario. This erosion will result in the loss (write-off) of assets. Once written off, these assets cannot be counted in the any of the preceding mechanisms. The StAR did not consider the impacts of erosion.



## 6.3 Guidance

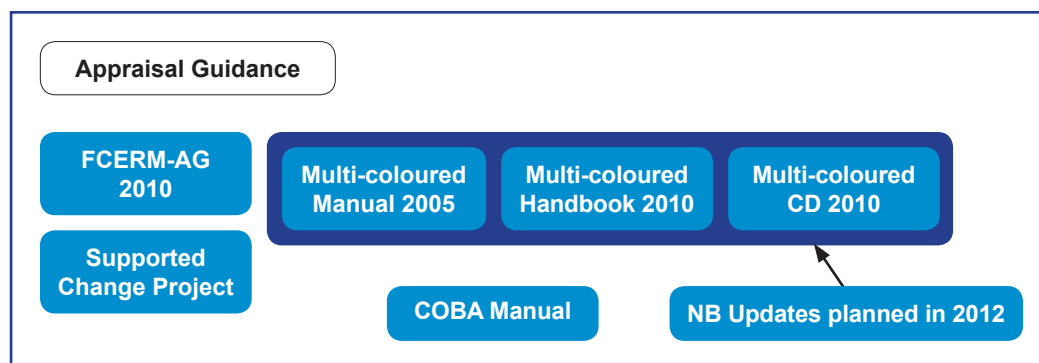


Figure 6.5: Guidance

### 6.3.1 Appraisal Guidance Update

The Strategy economics methodology followed the Defra 'Flood and Coastal Defence Project Appraisal Guidance' (FCDPAG) suite of documents and its supplements as were current at the time of the strategy preparation. These have now been superseded by FCERM Appraisal Guidance (FCERM-AG) published in 2010. This is now the reference document for undertaking the assessment.

### 6.3.2 Benefit-cost Spread Sheet Update

The Benefit cost PAG spreadsheets were changed during the production of FCERM-AG and the Outcome Measures have been revised to reflect Partnership Funding. The latest guidance and tools for estimating outcome measures are collated by the Environment Agency (<http://www.environment-agency.gov.uk/research/planning/122070.aspx>). The Decision Rule to determine which standard of protection is incrementally most cost beneficial has been withdrawn from FCERM-AG approach to appraisal. A similar, but more flexible, decision process has been described in the FCERM-AG (Page 243) and it is recommended that this approach be followed during PAR development, including use of the new FCERM-AG spread sheets with OM scores.

### 6.3.3 Multi-Coloured Manual 2003/5 Superseded by Multi-Coloured Manual 2010

The Strategy economics were based on the MCM 2003/5, which have now been superseded by a significantly revised 2010 edition. The MCM 2010 benefits from recent research regarding calculation of FCERM damages, for example;

- Emergency services revised direct damage costs (emergency services costs should be reduced to 5.6% of direct damage to property (previously this was 10.7%);

- Temporary accommodation costs should be added to residential and non-residential damages to reflect the extended times necessary to dry out and repair flood damaged property;
- Post flood clean-up costs are significant and are now separately appraised in MCM 2010 following research by the Flood Hazard Research Centre (FHRC) in collaboration with the National Floods School. Although these costs are included (increasing by depth) in the MCM datasets, they should also include the substantial costs of electricity to run air movers, air blowers and de-humidifiers around the clock for long periods. These costs could be avoided by implementing flood risk mitigation options and therefore this cost/benefit can be included in the PAR economic assessment;
- Portsea Island could, during an extreme flood, require evacuation either to higher land on the island or to the mainland via the 3 main causeways. The costs of evacuation have been assessed by FHRC in January 2009 and should be applied to the PAR economics as appropriate.

An update to the MCM is planned for 2012, and the FHRC should be contacted to determine any major planned changes anticipated before commencing with the PAR.

#### **6.3.4 Updated Data on Social Deprivation**

Social deprivation data used within the Strategy economics is now redundant as the data has been updated. Lower Level Super Output Area data including the 'Ranking of Index of Multiple Deprivation Score' is available from the Office of National Statistics' website. Another source of deprivation data is PCCs LLP Gazetteer.

The latest available social deprivation data available should be used within the PAR economics as appropriate.

#### **6.3.5 Financial and Economic Benefits**

There is an important distinction between Financial and Economic benefits. Within the Strategy, benefits have been evaluated using MCM (2005) and these are economic benefits, not financial, as indicated in the Strategy Appraisal Report. This distinction is important because the introduction of Partnership Funding allows contributions to be included as a financial benefit rather than a cost to the government.

#### **6.3.6 Inclusion and Exclusion of Indirect Costs of Flooding**

Included:

- Infrastructure at least cost.

Within the Strategy economics, key infrastructure (road and rail links) is included by the assumption that it is to be secured from flooding by designing, at least cost, measures to ensure flood resilience (i.e. raising the roads/railway above flood danger). This approach should also be applied in the PAR to features of historic importance.



Whilst this is an appropriate approach where benefits (especially indirect and intangible) are difficult to assemble, the least cost approach adopted in the Strategy is often an approach to mitigating losses to infrastructure from direct flooding, but excludes the disruption element of flooding, which can extend far beyond the point of severance.

The inclusion of disruption damage to such infrastructure can enhance damages and hence damages avoided by developing more integrated scheme options. Conventional methods of evaluating rail damage and disruption need to be investigated (as Royal Haskoning is currently involved with for Lewisham). Damage and disruption valuation techniques have been developed by Network Rail and were applied for FCRM to PARs (a methodology derived by Royal Haskoning and used by JCA) to evaluate the costs of the 2007 floods. The same principle applies to calculating road traffic damage and disruption, but is restricted to modelling traffic flows on the main arterial roads crossing through Southsea and North Portsea Island Flood Cells, namely the A3 and A2030. These disruption damages should be included in the PAR, applying the method described in the MCM.

- Human Health

Human related intangible benefits have been included in the StAR based on Defra supplementary PAG guidance and guidance given in the new FCERM-AG but neither document reflects the true intangible benefits, which, at a maximum £6,000 per property over a 100 year appraisal period, is low. Work published in December 2011 by the Health Protection Agency on the mental health effects of flooding may be considered. During PAR preparation, however, it is not recommended that the benefits deviate from the published guidance so that robustness can be maintained.

- Social equality adjustments

The StAR method allows for social equity adjustments and devotes an appendix to creating precise adjustments for social class distribution. Although the choice of damage sets for residential property is not explicit in the report, it is unlikely that the type/age/social class sets have been used. Social Equity adjustments are therefore irrelevant as the higher level datasets (type or type and age) are normalised to allow for overall parity in social equity.

#### Excluded

The following indirect costs are excluded from the Strategy economics and should be included within any future assessment:

- Electricity supply

There are 89 electricity sub stations in North Portsea Island and 21 in Southsea. As recommended by The Pitt Review (2008) Learning lessons from the 2007 floods, the cost and effectiveness of any resilience measures should be established with the beneficiary [electricity supplier] responsible

for the substations. Where resilience has not been applied, the degree of electrical supply redundancy should be established across the consumer hinterland (wider than the floodplain). The opportunity cost of foregone electricity usage (known as induced benefits) was a significant part of 2007 flood costs to infrastructure.

- Historical assets

Portsmouth is a historic City with a formidable legacy of maritime heritage and historic architecture. The NRD should be used to map this legacy and at least a qualitative assessment made of the effects flooding might have on these structures. This, and the value of ecosystem services, will fall under the environmental assessment remit, but should be discussed in the economic assessment as one of the key intangible benefits of providing protection assessment.

### **6.3.7 Capping and Write-off**

Within the Strategy economics capping was undertaken in a simplistic way when considering breach. Overtopping and coastal erosion damages were ignored and breach capping was undertaken on a generalised basis, using 'reservoirs' of flooded areas from the strategy's numerical model.

The use of reservoirs means that the depth of flooding at each property was also assumed i.e. property thresholds were not surveyed so the actual numbers of properties at risk of flooding (and to what depth) are considered to be highly uncertain.

Grouping flood damages in this way potentially dilutes the accuracy of damage estimates. With GIS damage calculations this is an unnecessary simplification and any PAR developed as part of this project should employ more appropriate, realistic and auditable assessments with regards to write-off and capping.

### **6.3.8 Risk to Life**

Within the strategy economics the risk to life assumptions are methodical and follow the PAG supplementary guidance. However the outcome is highly dependent on the number and lengths of breaching. Sensitivity (as with the main economic report) on numbers, widths and probability of breaching should have been part of the exercise.

The results are unclear in the addendum (April 2010), with no obvious estimate of numbers of lives likely to be lost or an evaluation of the numbers and costs of injuries, which is an additional component of the Risk to Life model. A tabulation of this Risk to Life information would be beneficial.

The Large Project Review Group (LPRG) has been reluctant in the past to change the direction of appraisal as a result of the inclusion of Loss to Life etc, especially when assumptions are based on the arbitrary assumptions on size, location and probability of breaching. It is suggested that LPRG be consulted at the time of PAR preparation on the inclusion (or not) of the benefits of avoiding loss of life.

### **6.3.9 Non-Residential (Commercial) Flood Damages (NRD)**

Whilst the general approach to estimating market values and assigning MCM damages to these properties is sound, the technique to check the quality of the results was not followed. MCM clearly states that Data Quality Scores (DQS) are appropriate to any non-residential properties NRP contributing significantly to the PVd. This test was apparently lacking. The allocation of standard NRP damages per square metre to large properties (especially to MoD and BAe in Portsmouth) using potentially erroneous data (MCM code and therefore data, footprint and threshold of flooding) could change the direction of the appraisal. The general rule is that where a single NRP from the first broad allocation of property attributes contributes significantly to overall Cell Do Nothing PVd (significant may be 10% where overall properties are in the dozens or low hundreds, but less where properties are in the thousands), then a site survey is required following the DQS exercise identifying and correcting potentially erroneous property attributes. This approach should be adopted in the PAR economics and should be linked to the recommended threshold surveys as appropriate.

## **6.4 Clarity of the Assessment**

As has been noted from the review of the Strategy economics, clarity of economic assessment is challenging to achieve.

At the PAR stage, with five flooding mechanisms and three climate change epochs to consider, and multiple factors affecting risk and uncertain asset behaviour, there is the real possibility that the quantitative assessment of impacts will become very complex, requiring multiple spread sheets and linked databases.

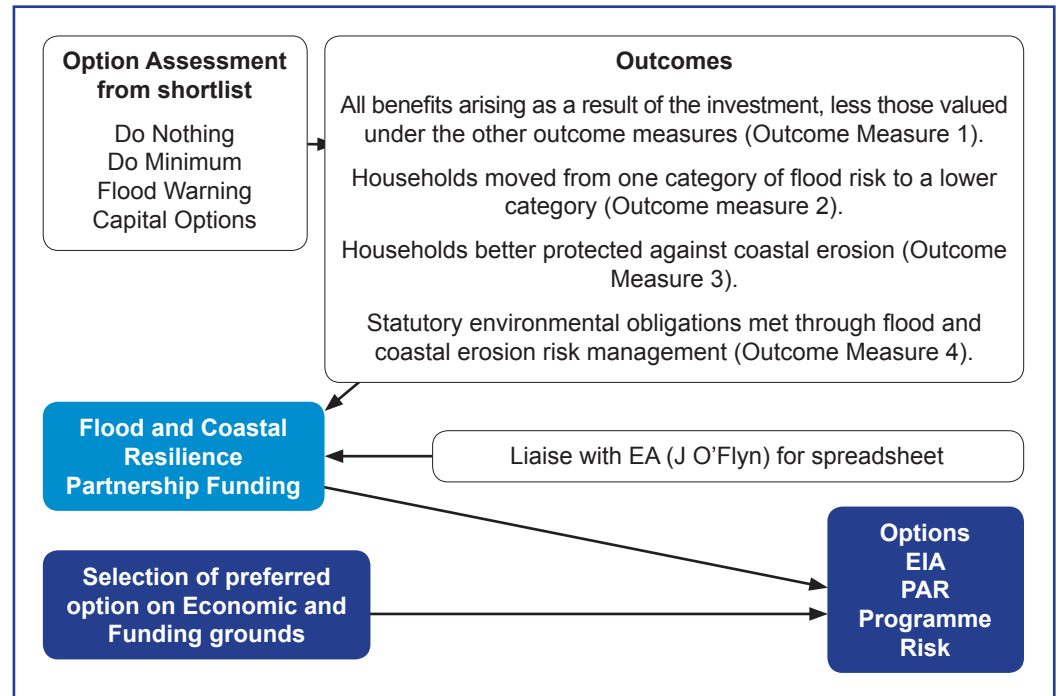
With a project of such strategic importance and with the likelihood of additional scrutiny due to partnership funding, it is imperative that the business case is clearly presented and is as simple as possible to understand, scrutinise, audit and amend.

It is recommended that one of the first PAR activities is to develop, and amend as necessary, the FCERM-AG spreadsheets into a coherent model. This model should be tested to ensure appropriate links with the driving data, to minimise the risk of errors when updating or transferring information. The model should be peer reviewed to further reduce risk.

All assumptions made in preparing these spreadsheets must be recorded in the system.

## 6.5 Option Selection

**Figure 6.6: Option Selection Process**



The assessment of costs (capital and maintenance) has to be undertaken to the same criteria as the assessment of economics. The timing of FCERM interventions (improved or replaced) will be driven by the economic assessment, based on numerical flood modelling and the FCERM asset condition. In refining FCERM options, there will need to be an optimisation of the most beneficial time for intervention, further demonstrating the need for the costs to correspond with the benefits.

For each of the shortlisted options assessed, a corresponding assessment of the benefits will need to be undertaken. This will require a change to the assumptions of the baseline assessment (the Do Nothing Case). These assumptions need to be clearly stated to aid the audit and review process.

The aim of the economic assessment is to support any application for capital grant funding from Defra and any third party contributions. With the emergence of Defra's Flood and Coastal Resilience Partnership Funding, there are several outcomes that need to be derived which link directly to the economic assessment:

- Benefit cost ratio (Outcome Measure (OM) 1);
- Number of properties with reduced flood risk probability (OMs 2 and 2b);
- Number of properties protected from coastal erosion (OM 3 and 3b);
- Impact on 20% most deprived communities at risk from flooding or coastal erosion (OMs 2c and 3c).

It is recommended that the system used to combine costs and benefits also be linked to the Flood and Coastal Resilience Partnership Funding spreadsheet (both data is contained within the economic assessment system) in order that scenarios can be quickly and reliably assessed). It should be noted that this new funding application process will develop so there is the potential for change and the Environment Agency should be constantly engaged in how the process evolves, in order that ESCP can adapt the assessment in a timely manner.

Alongside the Benefit/Cost model there is going to be the need to indicate how and when third party funding is being secured. This funding will inevitably from part of the overall project justification to Defra. It is recommended that a project specific funding strategy/spreadsheet is developed indicating assumptions and conditions. This will benefit any future PAR and the assessment of risk (particularly programme).

The Benefit/Cost model will apply the principles of FCERM-AG so it will be used alongside the technical and environmental assessments to select a preferred option and to select the point at which this option should be implemented.

# 7 RECOMMENDATIONS AND CONCLUSIONS

## 7.1 Future Economic Appraisal

The Strategy Economics should be taken forward using the 2010 FCERM Appraisal Guidance as a Supported Change Project, within the context of the findings of this Technical Report (from the independent economics review Annex 2, Section 5, the Flow Chart in Annex 3 and the 18 recommendations listed below), which offer opportunities for creating an enhanced business case and opportunities for seeking contributions towards future flood and coastal risk management schemes at Southsea and North Portsea Island.

**Recommendation 1:** Using the new appraisal guidance (FCERM-AG) undertake proportionate updates to the strategy economics (including the spreadsheets) in order make any future PAR submission and approval process more efficient.

**Recommendation 2:** The strategy benefit assessment should be replicated using the latest NRD property dataset and the importance of non-building themes should be considered in the wider appraisal.

**Recommendation 3:** Damage data for both residential and non-residential or commercial (NRD) types of property should be updated to reflect the MCM 2010.

**Recommendation 4:** Additional indirect costs of flooding for temporary accommodation, extra electricity costs and evacuation costs should be identified and included in the appraisal along with revision to emergency services costs. Royal HaskoningDHV to discuss the evacuation routes and flood warning in [Technical Report 2: Flood Risk Modelling](#). It is also recommended that early dialogue commences between PCC, the electricity provider and the pumping station owners.

**Recommendation 5:** A proportionate evaluation of transport disruption and infrastructure damage using DfT (CoBA) and Railtrack methods and data should be undertaken and the effect on delayed connections with ferry port departures needs proportionate investigation, as should mapping and the qualitative assessment of flooding on Portsmouth's historic legacy. PCC's Transport team should be contacted for traffic data on main floodable access routes.

**Recommendation 6:** Current and future Do Nothing damages should include separate breaching, erosion and overtopping scenarios and surface water flooding.

**Recommendation 7:** As the NRD is the Environment Agency approved repository for Receptor data for the development of PARs, the discrepancy in property numbers (with that held by PCC and used in the StAR) from a cursory analysis should be investigated. A GIS analysis is required to link NRD commercial (NRP) lists with PCC's lists, which appear more comprehensive than the NRD lists. A geospatial link to PCCs commercial properties is required at PAR stage.

**Recommendation 8:** Sample property threshold surveys are required so an appropriate and more accurate flood damage assessment can be made. These field surveys should also confirm basement properties in either residential or commercial use and as flats are a predominant residential type, mostly above flood level, an audit of ground floor flats is essential.

**Recommendation 9:** Presentation of costs and benefits should be updated to reflect third party contributions (Summary PAG sheet) and the new FDGiA calculator applied to calculate Outcome Measure scores. Though the Partnership Funding submission spread sheets prepared by PCC in January are now available, their scrutiny should wait until the revised hydraulic and benefit model is available.

**Recommendation 10:** As FDGiA scores are significantly increased where properties are in the most deprived of the three bandings of multiple deprivation rankings, it is crucial to calculate, with some accuracy, the number of properties in each banding moving between flood risk categories. Flats above the flood levels must not be counted.

**Recommendation 11:** The veracity of property attributes for large non-residential properties needs further testing and decisions taken as to which require further damage assessment in site specific surveys. These surveys should be proportionate to the likely benefits to be derived from their protection.

**Recommendation 12:** The Environment Agency should be involved throughout the development of the benefits and contributions assessment to reduce the risk of LPRG questioning these assessments.

**Recommendation 13:** All published guidance, spreadsheets and toolkits (Environment Agency, FRHC etc.) should be checked to ensure the latest and approved methodology is being used.

**Recommendation 14:** All spreadsheets should be reviewed carefully at test stage to reduce the risk of errors later. Each spreadsheet/system must come with clear guidance and a revisions log.

**Recommendation 15:** The Environment Agency's LPRG should be contacted, prior to commencement of the PAR, regarding the economic valuation of avoiding loss of life.

**Recommendation 16:** The economic spreadsheets and Outcome Measures calculator should be peer reviewed prior to submission.

**Recommendation 17:** To monitor the potential contributions from third parties, it is recommended that a project specific funding strategy/spread sheet is developed indicating assumptions and conditions.

**Recommendation 18:** There are 89 electricity sub stations in North Portsea Island and 21 in Southsea. Once further information is known on the outline design an assessment into likely sub-stations affected should be undertaken as part of the next stage.



## **7.2 Links to the Wider Scoping Stage**

### **7.2.1 Flood Risk Modelling**

#### **Inland flow modelling linked to economics**

Based on the outcome of discussion with the Strategy Client and Consultants, and Dr Chatterton's review of the Strategy economics, we have reviewed the need to link the economics to the overland flow model (discussed in [Technical Report 2: Flood Risk Modelling](#).) From previous projects we have found significant benefits in linking the modelling directly with the assessment of economic impacts:

- This approach saves time when undertaking multiple model runs;
- It is transparent and easily auditable;
- Options can be easily tested and compared;
- Errors in copying and transferring data are reduced due to the automation of the process;
- There is no need to make sweeping assumptions on flood depth and when/where properties are capped or written off.

#### **Implications of sea level rise predictions**

The modelling, and therefore the economics, will need to take note of the change in current and future extreme sea level rise predictions. The modelling proposes wide ranging sensitivity testing to account for possible future revisions to guidance. This means that the economics can similarly be tested for these sensitivities – which should reduce the need for costly and time consuming further updates.

## **7.3 Conclusions**

The work undertaken in assessing economic impacts for the StAR will provide a good basis for developing the economic impacts for the PAR. There are a wide range of updates and improvements that can be made, and the latest information and guidance should be used when the PAR commences.

The economics for areas as large as Portsmouth can be very complex and it is essential that they are easy to understand and audit. There is also the potential for errors and out of date information to corrupt the assessment, and therefore the investment decision. It is therefore recommended that very careful attention is paid to the architecture of the assessment, including simple to follow instruction for audit, and that the process is peer reviewed prior to submission to LPRG.

The severity of flood and coastal erosion risk to Portsea has already been demonstrated, with exposure to erosion, overtopping, breach and pluvial risks plus a combination of these risks. A method is proposed for quantifying these risks, and care must be taken to proportionately value the benefits of protecting against these risks, whilst ensuring that no benefits are double counted.



# **ANNEX 1: ECONOMICS AND WORKING GROUP WORKSHOP MEETING MINUTES**

## Minutes of Meeting

<b>Subject:</b>	<b>Southsea and North Portsea Island Coastal Flood and Erosion Risk Management Schemes:</b> Economics and Contributions Working Group Workshop
<b>Venue:</b>	<b>Conference Room 3</b> , Havant Borough Council, Public Service Plaza, Civic Centre Road, Havant, PO9 2AX
<b>Date:</b>	Monday 12 <sup>th</sup> March 2012
<b>Time:</b>	13.00 – 15.30
<b>Present:</b>	Bret Davies (Coastal Partnership), Marc Bryan (Coastal Partnership), Lyall Cairns (Coastal Partnership), Caroline Timlett (Coastal Partnership), Clive Evans (Coastal Partnership) Julie Dunstan (Royal Haskoning), Hamish Hall (Royal Haskoning), John O Flynn (Environment Agency), Dominic Damarell (Minutes), Claire Short (Minutes).

<b>Item</b>	<b>Minute</b>	<b>Action</b>
<b>1</b>	<b>Welcome and Introductions</b> Introduction. Presentation given by Bret Davies.	
<b>2</b>	<b>Project Benefits</b> LC asked what was found following the economists review by 'John Chatterton Associates'. HH advised that 'Royal Haskoning' commissioned 'JCA' 'to look at the broader economic assessment and how we review the economics'. LC identified the risks associated with revisiting the economics and suggested a sensitivity is undertaken. HH explained that all economics in Portsmouth are done on breach, not overtopping. LC asked is there a problem with the Portsea Island strategy breach scenario? HH hoping to understand this by a simple re-design of the hydraulics modelling using the EA's TuFlow model. Sensitivity in years 10 and 30 to reflect a delay in benefits but propose to better demonstrate a good cost-benefit ratio. The risk of delayed benefits will need to be finalised before completing the technical report. BD presented JCA's recommendations which showed some positive opportunities and recommendations for identifying beneficiaries and demonstrates efficiencies of updating the economics in accordance with FCERM-AG and the latest Multi Coloured Manual. BD to investigate how PCC's SWMP have considered economics and the interrelationship with the coast. BD to obtain and make available SWMP reports to Royal Haskoning.	<b>BD</b>

3	<p>LC said that HH's proposed update to the economics (estimated cost £30k) was reasonable but clarified that any new piece of work must add benefits to the schemes economics.</p> <p>HH to provide the recommendations for this work in the technical report provided it is proportionate, robust and achievable. HH asked by LC to estimate (preferably in hours) how long this might take and how much it might cost.</p> <p>It was also agreed that:</p> <ul style="list-style-type: none"> <li>• If the need arises LPRG could be approached for formal advice which can only support this agreed approach during the later stages of the scheme approval process.</li> <li>• The scheme development stage is what is referred to in FCERM-AG as a "Support Change Project" and that HH proceed with the economic update and refer to it in the report as a: "Support change project with limited additional work"</li> </ul> <p>LC said the reports need to know the areas which will fail first and asked HH to prepare a robust business plan.</p> <p>HH confirmed the report will show individual details to provide to companies i.e Network Rail etc.</p> <p>HH 4 possible scenarios for Portsmouth:</p> <ol style="list-style-type: none"> <li>1) Overtopping to bridge, property damage / written off.</li> <li>2) Robust – overtopping to pier</li> <li>3) Slightly bigger than breach area – reoccurrence to properties.</li> <li>4) Erosion loss: damage to highways (economic problems).</li> </ol> <p>HH Properties will either be 'Written Off' or 'Capped' in the economics.</p> <p>BD the technical report should include the recommendations from JCA's report required for the scoping process.</p> <p><b>Contributions</b></p> <p>HH asked how the Local Enterprise Partnership fits in to this project. LC responded stating that we are currently uncertain but the strategy team within the coastal team are looking at linking with funding opportunities such as the LEP, PUSH, Solent Flood Risk 2026, coastal communities and community infrastructure levy. This work is closely linked and may be led, in the first instance, by the developing work in the Portsea Island Scheme project.</p> <p>Contributions Technical Report to be prepared by CT. This is currently estimated to be drafted by end of April. An External contribution workshop proposed for early April. CT to coordinate this with Chris Smith.</p> <p>LC / JOF discussed the need to maximise contributions and having something robust which will defend the scheme. This would lead to a good opportunity to get funding.</p> <p>JOF Portsmouth to understand who the beneficiaries are for having the defences in place for overtopping.</p> <p>LC referred to a meeting between Ian Miller (EA) and Barry Luck (Southern Water) with PCC's SWMP team. BD to follow up on this and provide any</p>	<p>HH</p> <p>HH</p> <p>HH</p> <p>CT</p> <p>BD</p>
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	<p>findings to HH.</p> <p>JD - the EA have some case studies of projects which have received contributions online "Coastal schemes with multiple beneficiaries" JD to give the web link to CT.</p> <p>HH 'Climate Changing': will do multiple model runs to cover any uncertainty.</p> <p>BD 'Contributions' will look at opportunities outlined in JCA's report in more detail. Who Contributes and how much? Environment Agency Agreement? To add Solent FR 2026 and LEP to list.</p> <p>LC - 'CIL' the best route to get contributions. It is also important to address the need for contributions, irrespective of capital grant, for this scheme to be successful.</p> <p>BD did JCA's report identify contacts at Network Rail, Railtrack, etc? HH no real contacts other than John Dorer at Network Rail. Further contacts to be identified through the contributions workshop.</p> <p>BD any examples or case studies of any recent successful contributions for CFERM schemes? HH 'Home and Community Funding' (example: Western-Super-Mare led by North Somerset Council)</p> <p>JOF advised that forming a 'Flood [Action] Group' works best, rather than approaching individual residents. It also brings the community together. Case example given was West Wittering. CT to liaise with Gavin Holder on this.</p> <p>JOF To find out if the EA have any guidance? HH believes Defra may already be aware.</p>	<p><b>JD</b></p> <p><b>HH</b></p> <p><b>CT</b></p> <p><b>JOF</b></p>
<b>4</b>	<p><b>Any Other Business</b></p> <p>LC confirmed this needs to be a low maintenance scheme.</p>	
<b>5</b>	<p><b>Date of Next Meeting:</b></p> <p>Contributions workshop proposed for early April, exact date to be confirmed.</p>	<b>BD</b>

# **ANNEX 2: JOHN CHATTERTON ASSOCIATES REVIEW OF STRATEGY ECONOMICS**

# **Review of Southsea and North Portsea Island Coastal Flood and Erosion Risk Management Schemes StAR Economics**

## **by John Chatterton Associates**

J Chatterton and associates were commissioned by Haskoning UK Ltd on behalf of Portsmouth City Council to:

*“undertake an independent assessment and review of the Portsea Island Coastal Strategy Study economics and cost benefit assessment (produced by Halcrow) in the form of a report which can be incorporated in to the suite of documents produced through the Scoping Stage and specifically Technical Report 4: Economics and Contributions”.*

A site visit was undertaken on 19th January 2012 with the Haskoning team and Portsmouth City Council’s Coastal project engineer. This was followed by detailed discussion of the tasks in hand to complete the commission.

It is not intended to review Halcrow’s Benefit Cost spreadsheets, but to review core inputs to the direct and indirect damage data assumptions, identifying gaps and inconsistencies and a methodology to address these prior to improved flood modelling to account for combined probabilities of breaching and overtopping both under current and future climate change scenarios. This information will inform a high level re assessment of the likely Flood & Coastal Reliance Partnership Funding potential.

The Halcrow economics and cost benefit assessment comprised:

- **Portsmouth City Council** Portsea Island Coastal Strategy Study Economics Report June 2009
- **Portsmouth City Council** Portsea Island Coastal Strategy Study Addendum to the Economics Report April 2010
- **9 no. Appendices** (to the Economics report)
  - A – Flood maps
  - B – Discrete flood map cells
  - C – Defra liaison
  - D – Uplift factors
  - E – Calculation of PV Damages
  - F – Cost estimates and BCR
  - G – Contamination/Remediation
  - H – Sensitivity Analysis
  - I – Outcome Measures

This review of the economics and the recommendations for the PAR Economic Assessment process and data collection to follow will concentrate wholly on Cells 1 and 4, identified as providing the highest economic return on preferred option investment, and selected by PCC to progress to PAR stage.

**Portsmouth City Council Portsea Island Coastal Strategy Study Economics Report June 2009**

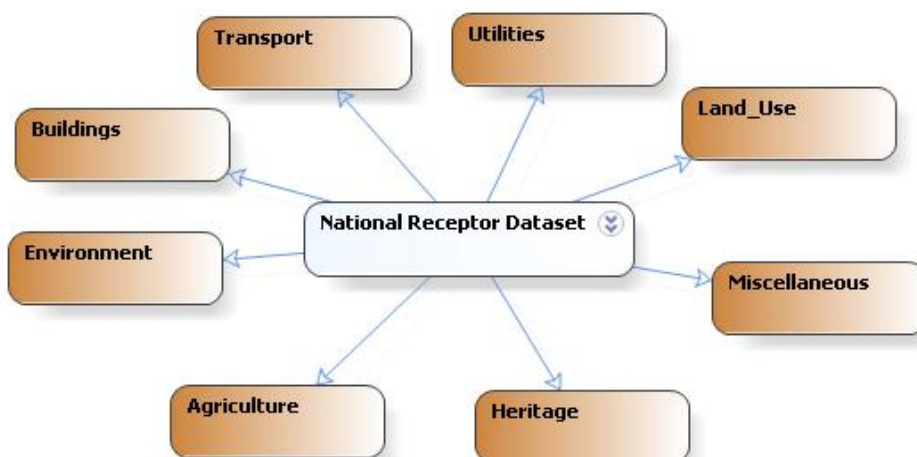
The methodology follows the Defra 'Flood and Coastal Defence Project Appraisal Guidance' (FCDPAG) suite of documents and its supplements. These have now been superseded by FCERM Appraisal Guidance published in 2010.

**Recommendation 1:** To review how the introduction of the new appraisal guidance will affect the strategy and make the PAR process more efficient

- 2.3 There is an important distinction between Financial and Economic benefits. Halcrow's have evaluated benefits using MCM (2005) and these are economic benefits not financial as indicated in the StAR. This is most important as, with introduction of Partnership Funding, local contributions may wish their benefits to be included as financial i.e. benefits to them not resource costs to the nation.

It is also important to stress that only damages from breaching of existing defences have been estimated with no combined breaching/overtopping modelling. The breach assumptions, appear simplistic, based on fixed time intervals, and are not related to any probabilistic assessment. This could result in an skewed assessment of impacts

OS Addresspoint data was used to establish the location of residential and non residential properties. Addresspoint can underestimate the number of properties at risk as non addressable properties are not included and, more importantly, commercial properties not receiving post at the identified site (but at a remote HQ, for example) will also not be included. The Environment Agency released in 2011 the National Receptor Database (NRD) which includes all buildings with a footprint of greater than 25 square metres and also other receptors associated with other than the built environment. These receptor themes are summarised below:



**Recommendation 2:** the benefit assessment should be replicated using NRD property data and the importance of Non-building themes considered in the wider appraisal

Using NRD, residential property can be separated by type (detached, semi, terraced and Flat) and non ground floor flats separated from those at ground floor. Basement properties can also be distinguished.

**Recommendation 3:** Damage data for both Residential and non residential or commercial (NRD) types of property should be updated to reflect the MCM 2010 data, the former datasets having been significantly overhauled since the 2003/2005 data was published.

In dense urban environments evidence from the 2007 floods indicated that, as a result of economies of scale, emergency services costs should be reduced to 5.6% of direct damage to property (not 10.7%) – see Multi Coloured Handbook, 2010. In addition Temporary accommodation costs should be added to residential and non residential damages to reflect the extended times necessary to dry out and repair property. Evidence collected from 5,800 houses flooded in 2007 across England suggested a mean value of £6,695 –ex VAT for residential properties and £5,465 – ex VAT for small commercial properties.

Clean up costs are significant following flooding and have been separately appraised in MCM 2010 following research by FHRC in collaboration with the National Floods School. Though these costs are included (increasing by depth) in the MCM datasets, they should also include the substantial costs of electricity to run air movers, air blowers and de-humidifiers round the clock for long periods. These costs would be avoided by flood mitigation options. An example of these costs is given below for flood depths of 0.6m to 1m:

Clean up component	Unit Cost (£)	No. units	No. days	Other costs (£)	Total (£)
Pressure Washer	50 per day	1	2		100
Aquavac and transformer	34 per day	1	1		34
Decontamination	2 per sq. m	65			130
Skip (6 yd)	185 per week	2	7		370
Storage cabin or off site storage	256 per month	2	56	504	1024
**Blower heater	6 per day	2	36	778	1210
**Air Mover	7 per day	6	36	2333	3845
**Dehumidifier	14 per day	3	21	680	1562
<b>labour Costs</b>				Electricity	
Pressure Washer	126 per day		1		126
Aquavac	126 per day		0.5		63
Decontamination	203 per day		2		406
Carpet Removal	126 per day		2		252
Moving Contents to Storage	126 per day		1		126
Flooring Removal	126 per day		2		252
Skip loading	126 per day		3		378
Dehumidifier maintenance	30 per visit		6		180
<b>Total</b>					10058
<b>CPI Update to November 2011</b>					<b>10656</b>
Storage cabin (£504 delivery and collection)				Storage cabin miscalculated in MCM 2010	
**Use 3kw per hour of electricity usage	3	electricity (£/kw hr)	0.15 ex VAT		



Portsea is an island and as such evacuation during extreme flooding either to the higher centre of the island or to the mainland via the 2 main causeways would be essential. The costs of evaluation have been assessed by FHRC in January 2009.

**Recommendation 4:** Additional Indirect costs of flooding for Temporary accommodation, extra electricity costs, and Evacuation costs should be included in the appraisal along with revision to emergency services costs. RH to discuss the evacuation routes and flood warning in the modelling scope

Key infrastructure (road and Rail links) is assumed to be secured from flooding by designing at least cost, measures to ensure flood resilience. This approach also applies to features of historic importance. Whilst this is an appropriate approach where benefits (especially indirect and intangible) are difficult to assemble, conventional methods of evaluating rail damage and disruption need to be investigated (as RH are currently involved with for Lewisham). Techniques are available, developed by Network Rail and applied in PAR studies by RH and used by JCA to evaluate the costs of the 2007 floods. The same reasoning applies to preventing road traffic disruption, but restricting to modelling traffic on the main arterial roads crossing through cells 1 and 4, namely the A3 and A2030.

There are 89 electricity sub stations in Cell 4 and 21 in Cell 1. Cost and effectiveness of any resilience measures as recommended by the Pitt review should be established with the electricity supplier responsible for the substations. Where resilience has not been applied the degree of redundancy should be established and the effect on the consumer hinterland (wider than the floodplain) established. The opportunity cost of foregone electricity usage (known as induced benefits) was a significant part of 2007 flood costs to infrastructure.

Portsmouth is an historic City with a formidable legacy of heritage architecture. NRD should be used to map this legacy and at least a qualitative assessment made of the effects flooding might have on these structures. This and the value of ecosystem services may fall under the environmental assessment remit as against the economic benefit assessment

**Recommendation 5:** A proportionate evaluation of transport disruption and infrastructure damage using DfT (CoBA) and Railtrack methods and data. Mapping and the qualitative assessment of flooding on Portsmouth's historic legacy. The revised FCERM guidance need to be checked.

3.3.2 The question of capping is often misunderstood. It is often confused with 'write off'. There are three scenarios relevant to Do Nothing damage estimation but the Halcrow modelling only evaluates breaching (to be discussed):

1. Breaching occurs and is not repaired so property rapidly becomes blighted as spring and other high tides persistently envelope the lowest hinterland. It is written off at its market value. Halcrow have modelled this, though as discussed with RH, have potentially exaggerated the number of breaches, their widths and the total and instant dereliction to ground level.

2. Overtopping of the defences affecting properties that would be written off by a breach but until that breach occurs would only incur sporadic losses according to the return period of the event. These damages would be capped if the PVD over 100 years exceeded the market values as obtained from Land Registry data. The two scenarios should be combined in the *probability of breach and no breach* worksheet (*Damage Do Nothing*) of the new PAG spreadsheets. This has not been undertaken by the Halcrow STaR.
3. Some properties would not be written off as a result of breaching neither would they be capped as the low frequency of flooding thresholds means that PVD would never exceed Market values.
4. Some properties would be written off due to erosion. This is not considered in Halcrow's assessment, but is valid for coastal schemes. When erosion takes effect, Scenarios 1 to 3 do not apply further.

With sea level rise write off may increase epoch by epoch and properties affected as in scenario 3 would reduce.

Capping has been done on a reservoir basis rather than an individual property basis. Adopting the three scenario approach will avoid this generalisation. Commercial capping (see 3.3.3) is more difficult than residential capping as NRD no longer gives the rateable value of non residential properties. The rateable value for Large non residential properties (see NRD Significant properties field) can be obtained from the Valuation Office Agency website [www.voa.gov.uk](http://www.voa.gov.uk) . For small commercial properties the rateable values per square metre are available from [www.communities.gov.uk](http://www.communities.gov.uk) for each bulk class (retail, office, industrial and warehouse) e.g. *Table P403 Commercial and industrial property: summary statistics for retail premises, Government Office Regions, 1st April, 1998-2008*

**Recommendation 6:** Revise the Do Nothing damages both now and into the future to address the separate breaching, erosion and overtopping scenarios

- 3.4.1 Assuming fixed interval breaching e.g. year 15 for Do nothing with linear interpolation from year 0 is avoiding an understanding of actual breach probability based on asset condition. The PAG spreadsheet allows for incorporating variable probabilities through time.

Human related intangible benefits have been included based on Defra supplementary PAG guidance and guidance given in the new FCERM-AG but neither documents reflect the true intangible benefits which at a maximum £6,000 per property over a 100 year appraisal period is derisively low. Work published in December 2011 by the Health Protection Agency on the Mental health effects of flooding may be considered.

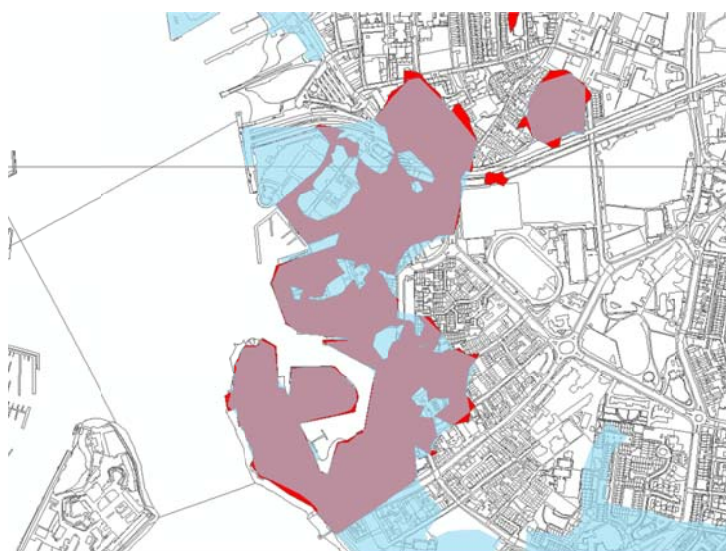
The Halcrow method allows for social equity adjustments and devotes an appendix to creating precise adjustments for social class distribution. Although the choice of damage sets for residential property is not explicit in the report it is unlikely that the type/age/social class

sets have been used. Social Equity adjustments are therefore irrelevant as the higher level datasets (Type or type and age) are normalised to allow for overall parity in social equity.

- 5.2.2 Halcrow calculate [that] Cell 1 (excluding Cell 1a (Old Portsmouth)) has 3,932 residential properties and 377 commercial properties (based on the year 100 flood event with a return period of 1 in 200 years (0.5% APF). NRD suggests between 3,295 and 3,766 residential properties and 676 to 799 commercial (NRD) properties in the coincident area, that is Old Portsmouth. Between 191 and 214 of the NRD properties are 999 MCM codes indicating that their use is unknown and *maybe* relates to non addressable properties with footprints greater than 25 square metres. NRD however counts between 2,672 and 3,062 residential properties as flats with only about one third coded as either definitely or probably ground floor. To compound the reconciliation Portsmouth City Council's lists indicate 687 Non Residential properties in Cell 1.

Row	Property counts in Cell 1	Residential	Flat	Ground Flat	% Ground	commercial	999
1	<b>NRD 2011 counts</b>						
1a	Halcrow Flood cell 1a	1,073	799	185	23%	254	96
1b	Halcrow 0.5% AEP in year 100 - 1a	1,545	1,189	246	21%	337	119
1c	Halcrow Flood cell 1a but outside 2	10	2	1	50%	4	1
1d	All Cell 1	4,839	3,861	1,217	32%	1,033	310
1e	1d-1a	3,766	3,062	1,032	34%	779	214
1f	1d-1b	3,294	2,672	971	36%	696	191
2	<b>Halcrow count excluding 1a</b>	3,932				377	

The reason for the ranges quoted is the non coincidence of the Halcrow defined 0.5% AEP flood zone at year 100 with the Halcrow defined cell boundaries for Cell 1a:



Halcrow calculate Cell 4 has 4,234 residential properties and 490 commercial properties (plus 2 MoD properties (based on the year 100 flood event with a return period of 1 in 200 years (0.5% APF). NRD suggest 4,064 residential properties and 1,233 non residential properties. Some 552 of the NRD non residential properties are 999 MCM codes. NRD however counts 1142 residential properties as flats with only 446 (39%) coded as probably ground floor. Portsmouth City Council's lists indicate 499 Non Residential properties in Cell 4. The discrepancies in residential numbers is further exaggerated by an unknown quantum of non ground floor flats retained in the Halcrow analysis. Including upper storey flats in

both the BCA and Partnership funding calculations, other than through evacuation costs will grossly exaggerate the benefits of the preferred option.

Excluding the already highlighted modelling concerns, this infers that the newer and more appropriate NRD data will give fewer ground floor residential properties flooded and more commercial properties flooded. This is to be expected and it is not possible to estimate changes in damages at this stage.

The Halcrow report does not indicate how property thresholds linking water levels to flood depths were estimated so the discrepancy in properties within the Flood Zone may have another dimension.

**Recommendation 7:** As NRD is the EA approved repository for Receptor data for the development of PARs, the discrepancy in property numbers from a cursory analysis should be investigated. A GIS analysis is required to link NRD commercial (NRP) lists with PCC's lists, which appear more comprehensive than the NRD lists. A geospatial link to PCCs properties is required at PAR stage

**Recommendation 8:** Sample property threshold surveys are required so an appropriate and more accurate flood damage assessment can be made. These field surveys should also confirm basement properties in either residential or commercial use and as flats are a predominant residential type, mostly above flood level, an audit of ground floor flats is essential.

The Benefit cost PAG spread sheets were changed during the production of FCERM-AG and the Outcome measures Spread sheets have been radically changed to reflect Partnership Funding. The Decision Rule to determine which standard of protection is incrementally most cost beneficial has been withdrawn from FCERM-AG approach to appraisal.

**Recommendation 9:** Presentation of costs and benefits should be improved to reflect third party contributions (Summary PAG sheet) and the new FDGiA calculator applied to calculate Outcome Measure scores. Though the Partnership Funding submission spreadsheets prepared by PCC in January are now available their scrutiny should wait until the revised hydraulic and benefit model is available

- 6.1 Sensitivity Tests should not simply 'double' or 'half' costs. There should be logic in the selection of sensitivity variables. Optimism bias is introduced to avoid undervaluing of eventual outturn costs.

- 7 To revise Outcome measures the Lower Level Super Output area data is required for the Halcrow maximum 100 years hence 200 year flood event. Current tables are now redundant.

**Recommendation 10:** As FDGiA scores are significantly increased where properties are in the most deprived of the three bandings of multiple deprivation rankings, it is crucial to calculate with some accuracy the number of properties in each banding moving between flood risk categories. Flats above the flood levels must not be counted.

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**Economics Report April 2010**

This addendum was produced in response to NRGs concern (largely) about potential benefits omitted namely, ***Risk to life in Cell 1 and 4*** where property is adjacent to defences, a clarification of assumptions on the **calculation of commercial damages**; and **damages to road and rail networks**

### ***Risk to life***

The assumptions are methodical and follow in detail the PAG supplementary guidance. However the outcome is highly dependent on the number and lengths of breaching. Sensitivity (as with the main economic report) on numbers, widths and probability of breaching should have been part of the exercise.

The results are not transparent in the addendum, with no obvious estimates of numbers of life likely to be lost nor an evaluation of numbers and costs of injuries, an additional component of the Risk to Life model. A tabulation of this would give a reality check.

NRG have been reluctant in the past to change the direction of appraisal as a result of the inclusion of Loss to Life etc. It could set the political hares racing, especially when assumptions are based on the arbitrary assumptions on size, location and probability of breaching.

### ***Non Domestic (Residential) Flood Damages (NRD)***

Whilst the general approach to estimating market values and assigning MCM damages to these properties is sound, the technique to check the veracity of the results was not followed. MCM clearly states that Data Quality Scores are appropriate to any NRP contributing significantly to the PVD. This test was apparently lacking. The allocation of standard NRP damages per square metre to large properties (especially, MoD and BAe) using potentially erroneous data (MCM code and therefore data, footprint and threshold of flooding) could change the direction of the appraisal. The general rule is where a single NRP from the first broad allocation of property attributes, contributes significantly to overall Cell Do Nothing PVD, (significant may be 10% where overall properties are in the dozens or low hundreds, but less where properties are in the thousands) then a site survey is required following the DQS exercise identifying and correcting potentially erroneous property attributes.

NRP's were grouped in flood reservoirs thus potentially diluting the accuracy of NRP damage estimates. With up to date GIS damage calculations this is an unnecessary simplification.

Some data extracts from NRD illustrate the necessity for data quality checking:  
Ranking for Cell 4, by footprint (area). Eg BAE systems is 15,739m<sup>2</sup>

15739 dG	10143746	Y	211	10143746	B A E SYSTEMS	SHOPPING	CS	PO3 5PQ
9363 dG	10144060	Y	430	10144060	STEVE PORTER TRANS	ROAD HAULIER		PO3 5JT
7742 dG	10144356	Y	410	10144356	BOOKER CASH & CARI	CASH AND CAI	CW	PO3 5SP
7383 dG	10162587	Y	21	10162587	ELMDENE INTERNATI	GENERAL COMMERC		PO3 5QD
6990 pG	30223805	Y	999	30223805				PO3 5LS
6448 dG	2866647	Y	820	2866647		WORKS		PO3 5SA
6291 dG	10162654	Y	21	10162654	H & S AVIATION LTD	GENERAL COMMERC		PO3 5TH
5796 dG	10144202	Y	21	10144202	H & S AVIATION LTD	GENERAL COMMERC		PO3 5PJ
5756 dG	10162197	Y	610	10162197	PORTSMOUTH COLLE	FURTHER EDUC	EL1	PO3 6PZ
5140 dG	10144186	Y	21	10144186	MATRA MARCONI SP	GENERAL COMMERC		PO3 5PU

In Cell 4 40 NRPs have a floor area > 2,500 square metres. An NRD extract for Cell 4 ranks the top NRPs by floor area (Column 1). The inconsistencies in OS class (Column 7) which informs the MCM code (Column 4) will affect the damages calculated for BAe Systems as MCM is allocated the code for a High street Shop. The same false logic is applied to H & S Aviation and Matra Marconi. It would seem logical to conduct site surveys in these properties if exposure to flooding resulted in large Pvd values.

At the opposite end of the floor space estimates in NRD 199 NRPs have zero recorded floor area though most are not property related (eg a substation).

Ranking for Cell 1, by footprint (area). Eg The Pyramids is 4,880m<sup>2</sup>

4880 dG	9678550	Y	21	9678550	THE PYRAMIDS	GENERAL COM	
2985 dG	9673311	Y	511	9673311	HOLIDAY INN	INN	
2624 pG	28309945	Y	999	28309945			
2317 dG	9673594		21	9673594	CATHEDRAL CHURCH	GENERAL COM	
2020 dG	9671675		511	9671675	PREMIER INN	INN	
1669 dG	9678545		910	9678545		PUBLIC CAR PA	
1542 dG	2776411		670	2776411	BLUE REEF AQUARIUM	AQUARIUM	
1526 dG	9677882		213	9677882	WAITROSE LTD	SUPERMARKE	
1451 dG	2776564		640	2776564	D DAY MUSEUM	MUSEUM	
1436 dG	2776242		511	2776242	QUEENS HOTEL	HOTEL	
1434 dG	9676781		610	9676781	ST. SWITHUNS CATHC	PRIMARY SCH	
1211 pG	29184728		999	29184728			
1151 dG	9673451		610	9673451	UNIVERSITY OF PORT	UNIVERSITY	
1058 pG	9678254		211	9678254	SUPERDRUG STORES	F SHOPPING	

Cell 1 in contrast has NRPs with smaller floor areas with 14 only with areas greater than 1,000 square metres. Though the property OS class correlation is poor (cathedral church coded general commercial, reflecting mis-coding of MCM, the impact on overall Pvd is likely to be less than in Cell 4 and site survey are not essential

**Recommendation 11:** The veracity of property attributes for large NRP's needs further testing and decisions taken as to which require further damage assessment in site specific surveys. These surveys should be proportionate to the likely benefits to be derived from their protection

### ***Damages to road and rail***

The 2007 floods provided evidence that Local Authority maintained roads suffer not only disruption due to flooding but serious damages. This is largely because maintenance budgets

have been reduced in cost savings exercises and temporary repairs to metal surfaces will not withstand the rigours of flooding, especially tidal flooding. Damage and disruption to roads was estimated at £191 million in 2007, or almost a third of all national infrastructural damages. Sheffield City Council suffered £2.3 million damage to street furniture alone.

The least cost approach adopted by Halcrow (raising the roads/railway above flood danger) is often an approach to mitigating losses to infrastructure but including disruption to the main roads (A3 and A2023) and damage to these and to other minor roads can enhance damages and hence damages avoided by more integrated scheme options. Disruption to the railway network extends far beyond the point of severance by flooding and in 2007 was much greater than damage to the rail infrastructure.

**Recommendation 12:** (as in main report) A proportionate evaluation of transport disruption and infrastructure damage is required using DfT (CoBA) and Railtrack methods and data. The effect on delayed connections with ferry port departures needs proportionate investigation.

John B. Chatterton  
29<sup>th</sup> February 2012

# **ANNEX 3: PROJECT APPRAISAL REPORT (PAR) STAGE ECONOMICS PROCESS FLOW CHART**



## Annex 3: Project Appraisal Report (PAR) Stage Economics Process Flow Chart

