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Flood and Water Management Bill

Impact Assessment - Designation of Third Party Flood and Coastal Risk Management Assets (Features)

Last updated: 26 September 2009

Summary: Intervention & Options

Department /Agency: Defra and Environment Agency	Title: Impact Assessment on Designation of Third Party Flood and Coastal Risk Management Assets (Features)	
Stage: Bill	Version: 2.0 (BILL)	Date: 25 September 2009
Related Publications: Floods and Water Management Bill, Explanatory Memorandum and related consultation document(s), and the consultation stage Impact Assessment of Designation of Third Party Flood and Coastal Erosion Risk Management Assets		

Available to view or download at: <http://www.defra.gov.uk/>

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What is the problem under consideration? Why is government intervention necessary?

Government intervention is necessary to overcome market failures that result in too much flooding, too little prevention and inefficiency. Individuals' actions may be based on pure self-interest or incomplete appreciation of flood risk, potentially placing themselves and others at greater risk of flooding. Government intervention is delivered on the ground by operating authorities, which includes the Environment Agency, Internal Drainage Boards and local authorities.

The central concept in this impact assessment is that of a 'feature'. A feature can be anything that forms an integral part of a flood or coastal erosion risk management system. It can be something that is man-made, or a natural feature of the environment. Some 65% of features relied upon for flood and coastal erosion risk management in medium or high consequence systems are not maintained by operating authorities. Features such as these are also known as 'third party assets'. It is relatively rare that these features lead to flooding (Northampton 1998, Mytholmroyd 2000 are known cases) but when they do, the effects can be devastating. The problem is that, excepting a few localised exceptions, there is nothing currently in Law to prevent someone from removing a feature that is privately owned and maintained from their property, regardless of possible detriment to flood defences to their own self and to others.

What are the policy objectives and the intended effects?

The policy objective is to minimise flood risk. The measures seek to achieve that by restricting inappropriate interference with flood and coastal risk management features so that their functions as risk management features are not compromised. The Bill contains measures empowering operating authorities to formally designate features that are integral to flood risk management and that are maintained and / or operated by third parties. Third parties could then not remove, alter or damage these features without prior consent. The consenting process would enable any approved works to be carried out in accordance with any reasonable conditions imposed. Unauthorised works on designated features would constitute an offence. Consent would not be withheld unreasonably. The effect would be fewer uninformed decisions by individuals that would increase risk (and damages) to self and others.

What policy options have been considered? Please justify any preferred option.

1. No changes to the legislation (i.e. do nothing, but which will include non-legislative intervention by operating authorities - see Annex A). 2. Introduce a formal system in primary legislation of designation of features. Option 2 is being taken forward on grounds of increased efficiency, reduced risk and economic grounds.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? Specific designation schemes will be reviewed 12 months after implementation; likely to be led by the Environment Agency. The policy will be evaluated after 5 years.

Ministerial Sign-off For final proposal/implementation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister:

.....Date:

Summary: Analysis & Evidence

Policy Option: Designation of Features	Description: Permissive powers enabling operating authorities to designate flood and coastal erosion risk management features
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COSTS	ANNUAL COSTS		Description and scale of key monetised costs by 'main affected groups' One off cost for operating authorities designating 65% of relevant features and one off cost to owners of features for participating in the designation process. There will not be a charge for a designation, but costs of enquiries and challenge anticipated at £115 (as equivalent of time) each on average.	
	One-off (Transition)	Yrs		
	£ 11 million	5		
	Average Annual Cost (excluding one-off)			
	£ 1.4 million	25	Total Cost (PV)	£ 25 million
Other key non-monetised costs by 'main affected groups' Local Authorities do not charge for process and additional administrative costs unlikely to be significant. Operating authorities will incur some costs associated with designation of additional assets through inspections / scheme development but likely to be met through normal business. Costs of hearing formal appeals. Individuals may experience a restriction on their freedom to make decisions about their features, but only where the benefit of a feature (in flood risk terms) is greater than the cost of the feature.				

BENEFITS	ANNUAL BENEFITS		Description and scale of key monetised benefits by 'main affected groups' Avoidance of flood risk (monetised) because fewer features are compromised (£40m annual average); reduced cost of replacement of compromised features (£7m annual average).	
	One-off	Yrs		
	£ nil	n/a		
	Average Annual Benefit (excluding one-off)			
	£ 46 million	25	Total Benefit (PV)	£ 0.8 billion
Other key non-monetised benefits by 'main affected groups' Designation likely to lead to greater understanding of flood risk by owners of features which may encourage them to plan and prepare for flooding as well as maintain the features, further reducing flood risk and the need for emergency intervention.				

Key Assumptions/Sensitivities/Risks Key assumptions include the number of features that will be designated and the benefits in terms of reduced flood risk that will be realised. These are described along with sensitivity calculations. No allowance has been included for the effects of climate and socio-economic changes which are likely to increase benefits progressively.

Price Base Year 08	Time Period Years 25	Net Benefit Range (NPV) £ 150 million to 3.4 billion	NET BENEFIT (NPV Best estimate) £ 0.8 billion
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What is the geographic coverage of the policy/option?		England	
On what date will the policy be implemented?		April 2011	
Which organisation(s) will enforce the policy?		Operating Authorities	
What is the total annual cost of enforcement for these organisations?		£ 1.2 million (through consenting process)	
Does enforcement comply with Hampton principles?		Yes	
Will implementation go beyond minimum EU requirements?		n/a	
What is the value of the proposed offsetting measure per year?		£	
What is the value of changes in greenhouse gas emissions?		£	
Will the proposal have a significant impact on competition?		No	
Annual cost (£-£) per organisation	Micro	Small	Medium Large
Are any of these organisations exempt?	No	No	No No

Impact on Admin Burdens Baseline (2005 Prices)		(Increase)	
Increase of	£ 0.13 million	Decrease of	
	£ zero	Net Impact	£ 0.13 million

Key:

Annual costs and benefits: Constant Prices

(Net) Present Value

Evidence Base (for summary sheets)

Designation of Features

This impact assessment presents cost benefit analysis for the new system of designating features that the Water and Emergencies Bill will introduce.

A designated feature would be a feature of the environment or a built structure which has an effect on the management of flood risk and will often be relied upon as part of a wider system of defences.

Designations will be administered by the Environment Agency, local authorities and Internal Drainage Boards.

Once a designation is in place owners would require consent before amending, altering or removing the designated feature.

The policy objective is to protect features which provide flood risk management to people.

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1. Background

Operating authorities have permissive powers under existing legislation to build new flood defences and to maintain existing ones. Operating authorities include local authorities, the Environment Agency and Internal Drainage Boards. However, many of the defences or other features (e.g. channels, culverts, sluices, raised ground, etc) that they maintain under these powers are not owned by them. Other flood defences and features exist, that are neither owned nor maintained by operating authorities, often because of historical decisions.

The policy proposals in this impact assessment relate to this second category and in particular to those features that are privately maintained but which operating authorities rely upon to supplement their operations.

The central concept in this impact assessment is that of a 'feature'. A feature can be anything that forms an integral part of a flood or coastal erosion risk management system. It can be something that is man-made, or a natural feature of the environment.

A number of reasons exist for why an operating authority has not chosen to directly maintain a feature even though the feature performs an important role in flood risk management. For example, where a feature is well maintained by a responsible person it is unlikely that intervention is required. Other examples include where a defence is built as part of a building, wall or embankment which means it would be inappropriate or technically challenging to replace it without significant knock-on effect, where there is a low risk of flooding or failure of a defence, or where a defence is part of a flood defence system, but not a critical part of it. Where natural features are providing risk management functions it may have been considered unnecessary to maintain them in the past.

In most cases where a feature is not maintained by an operating authority, the person responsible for the feature maintains it to an acceptable standard. The responsible person means the owner of the land on which the feature is situated, or if different, the person responsible for managing or controlling the feature.

Responsible persons can include –but are not limited to- local authorities, Internal Drainage Boards, railway undertakers, port authorities, factory owners, farmers and individual householders.

If a feature is interfered with, such that it is prevented from fulfilling a flood or coastal risk management function (such as holding back flood waters) then adverse consequences may follow. Though such consequences are relatively rare, they can be devastating when they do occur.

With a few localised exceptions, there is nothing currently in Law to prevent someone from removing a feature that is privately owned and maintained from their property, regardless of possible detriment to flood defences to their own self and to others.

As is the case now, the intent is that operating authorities would only be expected to intervene in the management of a feature where there is a clear need, in line with the five principles of better regulation¹, to safeguard against wilful interference with a feature such that it would put people and property at risk.

¹ <http://www.berr.gov.uk/whatwedo/bre/>

2. Assessment of Consultation-Stage Options

2.1. Policy Position

Following full public consultation, it is proposed that provisions are included in the Bill to enable operating authorities to designate features under new regulatory and enforcement powers. The impact assessment presents the case for Government intervention on the issue, compared to the baseline position.

2.2. Baseline Position

The Environment Agency prioritises its expenditure on maintenance according to the consequences of a flood defence system failing. In assessing the state of a flood defence system, the Environment Agency will inspect features not under its direct ownership or maintenance, at the same frequency as it would for features it maintains directly.

If a feature is in need of maintenance, the Agency encourages the person that owns the feature to take remedial action. If this does not happen, the Agency is empowered to carry out the maintenance itself, if it is in the wider public interests to do so. Similar permissive powers are in place for Internal Drainage Boards and local authorities.

In the shorter term it is neither considered necessary, nor affordable for the Environment Agency to automatically assume responsibility for the maintenance of such features, nor is it reasonable in all circumstances that operating authorities are wholly responsible for features that have been compromised by third parties.

Over time, issues associated with features not directly controlled by operating authorities are expected gradually to diminish. For example, future schemes will, as a last resort only, incorporate features not under direct control of the Agency and only where a maintenance agreement can be put in place. Where features remain in the control of third parties, the Environment Agency is pursuing non-legislative means of encouraging better maintenance, as outlined at **Annex A**.

Unless the feature was specifically designed and constructed to be for flood risk management, there is very little to prevent an individual from removing a feature altogether. In such circumstances, although it is rare, the only option usually available to an operating authority is to use its permissive powers to restore the feature or to put a new feature in place of the original. To do so diverts resources from other Flood and Coastal Erosion Risk Management work. It is unlikely that an operating authority will be in a position to compel a landowner to take remedial action.

Historically, interference or removal of a feature tends to occur where the owner is not aware of its significance as a flood defence or coastal erosion asset, and the Environment Agency's non-legislative actions should help educate people. Reasons for interference with, or removal of, a feature can vary, given the diverse range of features that might form part of a flood defence system. It could include activities such as redevelopment, landscaping and replacement of walls.

For example, the replacement of a boundary wall (which happens to be impermeable) with a security fence (which is permeable) might occur for all sorts of perfectly legitimate reasons. However, had that boundary wall also served as a flood defence –regardless of whether that was its original, or primary, function- any benefits accrued by the landowner from making that

change would often be more than offset by the consequential increase in flood risk to the property and neighbouring properties.

Inspections by operating authorities can identify gaps and weaknesses in flood and coastal defence systems, but generally such inspections only occur once every six months on average. Once detected the operating authority is empowered to undertake emergency works but there is a risk that gaps could go undetected for six months or even longer in lower risk systems where the time between inspections is longer. If designations are in place, and enforced, this risk would be reduced significantly. Designation would not in itself prevent such incidents outright but it will formalise the status of the feature which should, along with appropriate awareness raising, promote understanding of its purpose and help deter wilful and unintended interference that otherwise would have a negative effect on its defensive properties. It will also provide an enforcement route which is not available at the present time.

Routine inspections such as those made by the Environment Agency will reveal incidents where features have been “modified” but fortunately these are normally resolved before serious flooding occurs or emergency works are undertaken to prevent such flooding. Consequently there are few examples of incidents which result in major direct damages. Some examples of the type of incident occurring are included as **Annex B** but a comprehensive record of past instances is not available.

Emergency intervention works usually involve the erection of temporary works needed to close the gap while a more permanent solution is designed and constructed. The permanent solution may involve restoring the original feature. More often it will entail replacement with a new feature purpose built for flood or coastal erosion risk management at public expense where this is technically feasible. Such works are by definition unplanned, can be very costly and until completed leave people and property at risk. Funding will be diverted from planned works elsewhere, which may be of equal or higher priority. Consequently, prevention through appropriate regulation rather than to rely solely on the power to carry out remedial works, which is far more expensive, is considered to be a better option for ensuring the integrity of defence systems that include owner maintained features.

2.3. Consideration of Consultation Stage Options

Summary of Options

The consultation for the draft Flood and Water Management Bill included proposals that would enable operating authorities to identify and designate –and so safeguard- things that assist in managing flood and coastal erosion risk. Operating authorities includes the Environment Agency, Internal Drainage Boards and local authorities, each with powers in relation to their areas of expertise and in relation to the scope of permissive powers under existing law (see figure 1).

Figure 1 Operating Authorities' Existing Permissive Powers

Operating Authority	Scope of Permissive Powers
Environment Agency	Main rivers, estuaries and the coast
Internal Drainage Boards	Ordinary watercourses within the Board's boundary
Local authorities	Ordinary watercourses and coastal protection

The draft Flood and Water Management Bill (included in the consultation document) contained draft clauses on new powers to designate features. The accompanying impact assessment presented two policy options:

- The first option was to retain the existing legislative measures without making any amendments to the legislation; and
- The second option was to introduce a formal system that would enable operating authorities to designate a feature where it assists the management of flood and coastal erosion risk.

In practical terms, this would include things such as structures or natural or man-made features of the environment that form part of a flood defence or flood risk management system. The policy intent is not for every possible feature to be designated. Rather the policy intent is that an operating authority should be able to determine which features provide an important role in managing flood and erosion risk –and therefore designate them- and prevent inappropriate interference, and exposure to risk and unanticipated remedial costs.

These will be permissive powers, and so ultimately it will be for operating authorities to determine that which needs to be designated.

A person in receipt of a designation notice would require consent from the designating authority before they can alter, remove or replace a designated feature. The policy is designed to prevent behaviour that could unreasonably increase risk from interference with a flood or coastal defence. This could include features that possess defensive properties even though this may not be their original or primary purpose. The policy intent is not to prevent an individual from utilising the feature for the purpose for which it was originally constructed or making changes to features on their land where to do so would not increase risk to self and others. To this end, the proposals include the right of appeal for people in receipt of a designation notice.

The consultation paper asked whether we should introduce permissive powers for operating authorities to designate features. The consultation-stage impact assessment presented the economic case for Government intervention in this manner. Whilst not a central part of the main policy proposals, the consultation paper also asked two questions on whether there might be a case to go further than the proposed policy on designation (and draft clauses) and whether there should be a duty on a person that is responsible for a feature that has been designated also to maintain it so that it is kept in a good condition².

Consultation Findings

Strong support was received for introducing in the Bill a system of designation of features that affect flooding and coastal erosion risk. The proposal is that an operating authority should be able to designate a feature as being important to a flood defence system, and owners of a designated feature should seek consent before altering, removing or replacing the feature.

Respondents are mostly supportive of owners of features maintaining them to a suitable standard (such that the risk management function is preserved). However it is evident that a duty to maintain features may place an unfair burden on individuals that bear the cost of maintaining something that benefits a number of people within an area or a flood risk management system, especially if they were not previously aware of the importance (or

² An issue highlighted by the Pitt Review on the 2007 Floods and by the National Audit Office in its 2007 publication, 'Building and maintaining river and coastal flood defences in England'.

requirement) to maintain. Respondents also indicated that it may be challenging to get right the definition of the condition to which features must be maintained.

In line with the principles of better regulation, the Environment Agency is pursuing non-legislative actions to encourage better standards of maintenance among owners of features, as summarised in **Annex A**.

Whilst it is clear that maintaining a feature helps to ensure that it continues to affect positively the flood/coastal erosion risk, the very reason for its designation, further detailed economic and policy analysis would be required to assess the appropriateness of legislating on the issue such that we create a new duty on people –which includes members of the public- to maintain their features. It will depend also on the success of the Environment Agency’s non-legislative activity to educate and encourage owners of features to take appropriate steps to secure the future functionality of the feature as a flood defence from which they –and others- will benefit.

An owner of a feature will often benefit directly from the flood or coastal erosion risk management function being performed on their land. This fact should, in theory, incentivise maintenance without recourse to legislation, particularly if that individual is better informed. The owner of a feature is also likely to benefit from a wider flood defence system for which they have no responsibility.

However, the creation of a duty which is to be placed on the owner of a feature, such that they maintain their feature to a certain standard, would extend beyond the equivalent duties placed on operating authorities in respect of their features, and this would require further consideration.

There may also be issues of equity because a structure was not originally intended to serve as a defence, or a natural feature has a coincidental risk management property.

Any subsequent proposals on a duty to maintain designated features would be subject to the opportunity for primary legislation and would be subject to appropriate consultation and impact assessment; it is not the focus of this impact assessment.

The evidence in the consultation stage impact assessment -validated by consultation responses- indicates intervention in terms of designating features, coupled with the non-legislative actions at **Annex A** would be appropriate. It is proposed that legislation on maintenance is considered in the future if it is evident it is necessary to secure effective flood and coastal erosion risk management and non-legislative measures are not sufficiently robust.

3. Measures in the Bill

3.1. Powers to Designate Features

The Bill will empower operating authorities to designate structures or other features which may affect the risk of flooding or coastal erosion. Under a designation, the consent of the designating authority would be required before a feature can be altered, removed or replaced (routine maintenance would not require consent). Consent would not be withheld where there is no detrimental effect on risk management or where an alternative is acceptable in risk management terms. If a designation is no longer required (i.e. there is no longer a need to manage the risk in the same way or another system has come online) then it is expected that the operating authority will cancel the designation and any restriction on the individual will be lifted.

In parallel, the Environment Agency has proposed the process summarised at **Annex A** to help ensure that features are adequately maintained and local authorities would have a duty keep registers of all features (not just those in third party ownership)³.

Operating authorities will be given permissive powers, meaning that the use of the powers would be optional, not mandatory, and would be exercised only where there is justification on flood risk grounds. This means that designation can only apply to features that manage a flooding or coastal erosion risk. Powers conferred on operating authorities would be in respect of their existing flood risk management functions. This means that operating authorities would not exercise powers outside of their areas of expertise and existing general roles and responsibilities for flood risk management (as summarised at figure 1).

Planning permission would not apply in the context of many third party assets (such as boundary walls, natural features) and the power to designate a feature would provide the assurance to the amenity of an area and protection to people and property. Where an individual would require planning permission then this would continue as normal.

The proposals confer new measures of designation, enforcement and appeal, as summarised below.

The main features of the *designation* process are as follows:

- Operating authorities may designate a feature on flood risk grounds:
 - A broad definition is applied to a feature; one can include a structure or a natural or man-made feature of the environment.
 - An operating authority can only designate a feature where it thinks that feature affects a flood or coastal erosion risk.
 - An operating authority can only designate in respect of its own risk management functions (i.e. the Environment Agency could designate in respect of a flood risk from a main river and the coast, and local authorities and Internal Drainage Boards in relation to ordinary watercourses and coastal protection).
 - An operating authority cannot designate a feature if it has been designated by another operating authority, or if it is owned by another operating authority (since that authority will already have risk management responsibilities).

³ Noting that the Environment Agency already keeps records of existing third party assets in its National Flood and Coastal Defence Database

- If an operating authority identifies a feature that it intends to designate, the owner must be informed in writing using the appropriate notice:
 - An owner is the person that owns the land on which a feature is present, or if different then the person responsible for managing or controlling the feature.
 - An operating authority must give an owner a provisional designation notice which sets out the period of notice, the feature to be designated, the reason for wanting to designate the feature and how the owner can make representations to the operating authority in respect of designation of their feature.
 - An operating authority may then formally designate a feature, but must consider any representations made. The designation notice must set out the feature designated, the reasons for the designation and information about the owner's right to appeal against the designation and the period within which an appeal can be brought.
- An operating authority may cancel a designation, and an owner may apply to an operating authority to seek a cancellation.
- As has been the case until now, the owner of a designated feature would be within their rights, and expected, to maintain the designated feature as previously to a reasonable and appropriate standard, but it will not be a formal duty under the Bill.
- The designation would prohibit alteration, removal or replacement of a feature without the consent of the designating operating authority.
- Consent of the operating authority could not unreasonably be withheld (i.e. if there is no effect on flood risk).
- Enforcement action may be taken by the designating/responsible authority if an owner alters, removes or replaces a feature without the appropriate consent. Failure to comply with an enforcement notice would be an offence.
- The designation would be a local land charge, meaning that the designation would not expire if property ownership changes hands.
- Arrangements for the local land charge would be the responsibility of the operating authority at no expense to the owner of the feature.
- A right of appeal will operate if an application for consent is turned down in respect of any proposed works to alter, remove or replace a feature.

The main features of the *enforcement* process are as follows:

- If someone alters, removes or replaces a designated feature without the consent of the operating authority administering the designation, the authority may issue an enforcement notice.
- An enforcement notice would be issued to the person who contravened the designation, or the landowner.
- An enforcement notice must specify the remedial action expected of the owner and the time period in which it is to be carried out.
- Failure to comply with an enforcement notice would constitute a criminal offence. The Bill stipulates that a fine can be imposed on summary conviction, up to level five on the standard scale.
- In default of an enforcement notice, the responsible authority may enter the land on which the feature is situated and take any steps specified in the enforcement notice. The authority would be entitled to recover costs as a civil debt.
- In the event of an emergency, if a person has breached a designation notice and there is an immediate and material risk of flooding, the authority may enter the land and take remedial action without recourse to an enforcement notice. Reasonable expenses may

be recovered as a civil debt. This is without prejudice to existing powers of operating authorities.

- An offence will be committed by any person that intentionally obstructs a person entitled to enter land under default or emergency powers, and will be subject to up to 2 years imprisonment, a fine or both.

The main features of the *appeals* process are as follows:

- Owners of features will have a wide right to make representations and appeal an operating authority's decisions at all stages of designation:
 - A person in receipt of a provisional designation notice will be entitled to make representations to the operating authority. The authority must consider any representations before taking a decision on confirming the designation.
 - A person in receipt of a designation notice will have a right to appeal the designation, within a certain period of time.
 - A person in receipt of a designation notice may request that it is cancelled, and has a right of appeal if the request is denied.
 - A person in receipt of an enforcement notice may appeal against the notice
- Owners of features will have the right to seek consent to alter, remove or replace their features, and have the right to appeal the decision of the operating authority.
- The Bill includes a clause requiring Ministers to lay secondary legislation in respect of the right of appeal against designations and refusal of consent to alter, remove, replace or cancel a designated feature.

3.2. Costs and Benefits

Costs and benefits are compared to the baseline position (described in section 2.2 of this impact assessment). The baseline position would entail no change from the current legislative measures.

Since operating authorities will not be compelled to designate all features under the new measures, and will only be able to designate something that contributes to flood or coastal erosion risk management, it is assumed that it will only be undertaken in instances where the benefits from protecting against flooding or coastal erosion outweigh the costs of administering and complying with the system of designations.

Costs are expected to be incurred in the system of **registering/designating features**, in **consenting** to changes to designated features and applications for a cancellation of designations, and in **enforcement** activity.

Benefits are expected to arise through **less interference** with flood risk management systems and **less capital investment being needed to remedy compromised features**.

Costs

The costs of designating features would include one-off costs and ongoing costs:

- **One-off costs** would reflect the costs associated with establishing a system of third party assets where operating authorities will have to identify and **designate third party assets**.
- **Ongoing costs** would be associated with **administering consents** where third party assets have been designated, but would be subject to a change, for example if the owner

would like to make a physical alteration to the feature on their land but which might affect the defensive properties of that feature.

The cost calculations, and assumptions that inform them, are explained under the sub-headings that follow.

Supporting Calculations and Assumptions on Costs

Cost Calculations

Four calculations inform the assessment of cost. The calculations cover costs to operating authorities of administering designations and for owners of designated features for their participation in the process and consent applications.

The calculations are set out below:

1. One-off cost to operating authorities

$$= (A + B) \times C$$

Where:

A = Average cost to operating authorities of designating a feature;

B = Average cost to operating authorities of handling enquiries (per designation); and

C = Total number of features to be designated by operating authorities.

This is the cost to operating authorities of designating features and handling associated enquiries and challenges from owners.

2. Ongoing cost to operating authorities

$$= D \times E$$

Where:

D = Average cost to operating authorities of processing each consent; and

E = Total number of designated features that are altered each year (and therefore require consent).

This is the cost to operating authorities of administering consent applications (consents to alter, replace or remove a designated feature).

3. One-off cost to owners of features

$$= F \times C$$

Where:

F = Average cost to owners of making enquiries and representations, per feature being designated; and

C = As above, total number of features to be designated.

This is the cost to owners of features of being subject to designation.

4. Ongoing cost to owners of features

$$= G \times E$$

Where:

G = Average cost to owners of making an application for a consent, per designated feature; and

E = Number of consent applications per year (made by owners, based on the total number of designated features multiplied by the percent of features altered each year).

This is the cost to owners of features of making applications to alter, replace or remove a designated feature.

Assumptions on Costs

This section sets out the key assumptions that inform the cost calculations.

An operating authority would only be able to designate a feature where it is aware of its existence and effect on flood risk management. Operating authorities already monitor the effectiveness of flood defence systems and gather information about the features within a system.

The cost of identifying and registering features on a database is not expected to be significant because operating authorities will either already be collecting information or will do in the future under other proposals in the Bill, primarily the duty on local authorities to keep registers of all features in their area.

For example, the Environment Agency already identifies features as a routine part of its inspections process and writes to landowners to inform them of the status of features on their land with flood risk management properties. It should be noted that the baseline would also reflect the delivery of actions at **Annex A** which are not subject to legislation to establish a system of formal designations and are not attributable –or solely so- to the legislative proposals.

The extent to which other operating authorities (local authorities and Internal Drainage Boards) are reliant on others' features is highly variable, and whilst comprehensive information is not available, anecdotal evidence suggests that many other operating authorities manage their flood defence systems in a manner comparable to the Environment Agency.

Once designations are in place, there are likely to be ongoing costs associated with the administration of consents.

At the time of designation the owner will be advised of the types of activity which will require consents. Many routine maintenance activities which do not significantly alter the feature will be exempt from requiring consent but an owner of a feature will need to seek consent to alter, remove or replace their feature.

Applications are to be made to, and determined by, the operating authority that is responsible for the designation of the feature. Applicants will have a right of appeal if turned down.

Existing legislative measures relate mostly to consents for new structures and works that affect assets maintained by the Environment Agency. They rarely relate to the features of others. It is likely that additional consents will need processing therefore under the Bill proposals.

For the purpose of analysis, the costs of processing additional consents have been based on costs of existing consenting activities carried out by the Environment Agency, and sensitivity analysis included.

The calculations are informed by a number of statistical assumptions. The statistical assumptions relevant to the calculation of costs are explained below, as well as in the tables at **Annex C**:

Average cost to operating authorities of designating a feature:

This is a one-off cost borne by the operating authority for designating a feature. It is expected that a half a full time equivalent day would be required per designation, based on the Environment Agency's experience. This puts the cost at £113 per designation. A breakdown can be found at Annex C.

Average cost to operating authorities of handling enquiries (per designation):

This is part of the one-off cost to an operating authority of designating a feature. The Environment Agency's experience of regulatory processes suggests that 30% additional time would be required for handling challenges and enquiries on average over all designations. That gives an average of £34 per designation based on a £50,000 a year full time equivalent.

Total number of features to be designated by operating authorities / Total number of designated features:

Third Party Assets exist, but will only be designated once the policy is commenced. The Environment Agency's National Flood and Coastal Defence Database (NFCDD) records 96,000 features that are either not owned or not maintained by operating authorities yet are relied on for flood and coastal erosion risk management purposes and will form part of flood defence systems. The database indicates that 65% of the 96,000 features (62,400 features) are both not maintained and are not owned by operating authorities and interference with them -such that they no longer provide risk management functions- would be problematic. These are features we would expect could be designated.

Average cost to operating authorities of processing each consent:

This is a cost to operating authorities borne when the owner of a designated feature applies for consent to vary the feature. Based on a similar consenting process managed by the Environment Agency, the average cost of processing a designation is £462.

Average cost to owners of making enquiries, per feature being designated:

This is a one-off cost to individuals that own a feature. It is assumed that the time cost will be equal to that of the operating authority, on average. Owners of features that are being designated will want to understand the designations and will have a right to appeal against designation. It is not expected that costs will be disproportionately high because the policy is relatively straightforward, rationale for designation should be clear, operating authorities will already be carrying out public engagement, a designation will not require significant

work on the part of an owner, and it is in an owner's best interests in terms of risk management.

Average cost to owners of making an application for consent, per designated feature:

This is a cost borne by the owner of a designated feature if they want to make a change to the feature that would require the consent of the designating authority (which would not include, for example, routine maintenance). For the purpose of calculating costs, it is assumed that the cost to the owner of making an application is a quarter of the equivalent time cost to the operating authority. The average cost is £115 per consent.

Number of consent applications per year (made by owners, based on the total number of designated features multiplied by the percent of features altered each year):

The Environment Agency has estimated, based on its experience, that around 4% of features will be subject to significant change each year. This gives 2,496 (4% of the 62,400 features to designate). With sensitivity tests at 75% and 125% this means that between about 1,900 and 3,100 changes would be made each year with a central case of around 2,500. The NFCDD validates this assumption; it indicates that at any one time between 4 and 5% of features are failing and are in need of replacement, and so the central case has been used in the calculations.

Results of Cost Calculations

Costs of registering/designating features

Cost benefit analysis suggests that costs overall will be shared by operating authorities and owners of features, although, as the results indicate, this is likely to be nominal and not unreasonably onerous. These will be 'one off costs' which we anticipate being spread across the first five years from commencement of the relevant Bill provisions. Operating authorities will bear the majority of costs of administering and designating features. Owners of features will bear an amount for responding to and / or challenging designations.

The costs are summarised below:

Activity	Min likely	Most Likely	Max likely	Unit	Bearer of cost
Designating features	5.1	9.1	16.5	£ million	Operating authorities
Participation in designation	1.2	2.1	3.3	£ million	Owners of features
Total one off costs	6.3	11.2	19.7	£ million	

Total each year for five years	1.3	2.2	3.9	£ million per year
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A breakdown of costs, including assumptions and calculations, that have informed the summary table, has been included at **Annex C**.

Costs of consenting

Cost benefit analysis suggests that costs overall will be shared by operating authorities and owners of features. These will be ongoing costs. Costs will be borne by operating authorities with no charges made to those responsible for designated features. There will nevertheless be some cost to owners of features for the time taken in applying for consents.

The costs estimates, including sensitivity analysis, are summarised below.

The costs associated with consents are ongoing, and are presented here as 'annual average costs'.

Activity	Min likely	Most Likely	Max likely	Unit	Bearer of cost
Applying for consents	0.2	0.3	0.5	£ million	Owners of features
Processing consents	0.6	1.2	1.8	£ million	Operating authorities

Total annual costs	0.8	1.4	2.3	£ million
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A breakdown of costs and assumptions that informed this table is included at **Annex C**.

Default enforcement powers will enable an operating authority to take remedial action itself if the owner of an asset has failed to comply with an enforcement/remedial notice. It is not possible to predict how often this will be the case, but it is expected to be cost neutral since operating authorities are expected to recover costs that have been reasonably incurred. Any loss would be at the operating authority's discretion. In an emergency, an operating authority would be able to take action and may require the owner to pay expenses reasonably incurred. There may be circumstances that an operating authority chooses not to recover costs. The Environment Agency already exercises such powers, and by virtue of designation, it is anticipated that the number of instances is reduced and a benefit is realised.

By virtue of a designation, the owner of a designated feature would be restricted from making changes to their feature without the appropriate consent. This could present a cost in terms of loss of liberty but because designating authorities will operate in the public interest it is only going to be the case where the benefit from avoiding risk (in terms of expected annual damages) is significant and outweighs the costs – otherwise the feature in question would not be subject to a designation.

Benefits

The benefits of designating features are expected to come from:

- **Less flood risk damage** because less interference is made with risk management systems; and
- **Less capital investment needed to remedy interference** that has compromised the risk management properties of features.

Actual failure of third party assets is relatively rare, but when it occurs it can be disastrous. Features not owned by operating authorities would normally protect against smaller risks and many of the benefits are likely to accrue to the owners of the features as well as the wider public in the vicinity.

Under a system of designation, owners of features would not be able to make an alteration, removal or replacement without the consent of the operating authority that is responsible for the designation. It is unlikely that all features would be designated unless there is good reason to, and routine maintenance would not require consent.

It is assumed that where a feature has been designated the operating authority would not consent to any change that reduces the standard of defence (or where the benefit of the defence is clearly greater than the cost to the beneficiary). It is possible that operating authorities would consent to a removal or cancellation if there is no longer a need for a defence to be in place. This has been accounted for by including sensitivity tests on the expected lifetime of an asset. Operating authorities should only refuse consent where there is a clear justification in terms of flood/coastal erosion risk.

Benefit will be derived from avoiding loss in protection from flood defence systems and from avoiding expenditure by operating authorities where people have inadvertently, or deliberately, compromised a flood defence system and the operating authority has little choice but to intervene. There may be wider benefit in the event of a flood incident because fully functioning defences will reduce the burden placed on emergency responders and the like.

The benefits are explained under the sub-headings that follow.

Supporting Calculations and Assumptions on Benefits

Benefit Calculations

Two calculations have been used to estimate the likely benefit of the policy, and to test whether benefits are likely to exceed any costs incurred. The first formula calculates the reduction in Estimated Annual Damages because the policy is affording greater protection to flood systems. The second formula calculates the reduction in capital investment that would otherwise be required to remedy interference with third party assets.

The calculations are set out below.

1. Less flood risk damage:

$$\text{Benefit} = \left(\frac{A - B}{C} \times \frac{D}{E} \right) \times \text{Time until compromise is addressed [as \% of year]}$$

Where:

A = Estimated Annual Damages if there were no flood and coastal erosion risk management systems in place;

B = Estimated Annual Damages that occur with flood and coastal erosion risk management systems in place;

C = Number of flood and coastal erosion risk management systems;

D = Number of compromises to systems avoided by the designations being in place; and

E = Effectiveness of the designations policy.

2. Less capital investment needed to remedy interference:

$$\begin{aligned} \text{Benefit} &= \text{Cost to operating authorities per feature remedied} \times \text{number of interventions} \\ &= (A + B) \times (C \times D) \end{aligned}$$

Where:

A = Average replacement cost of a compromised feature;

B = Overheads of operating authority intervention;

C = Number of features that would have failed previously; and

D = Percent of cases of interference in which operating authorities intervene to remedy.

Assumptions on Benefits

This section sets out the basis for the key assumptions that inform the calculations. A breakdown can also be found at **Annex C**:

Estimated Annual Damages:

In order to be recorded on the NFCDD a feature will have flood defence properties. The exact benefit will vary from case to case. The Environment Agency's expert opinion is that on average we would expect the benefit to cost ratio of a feature to be at least 2:1. Any less and it is unlikely to be considered a feature as it doesn't have flood risk management properties. The benefit may be much higher, for example the Environment Agency regularly meets at least 8:1 in its main investment programme.

The National Assessment of Flood Needs and Costs (NADNAC) (2004) puts the estimated annual damages of flooding and coastal erosion at £1 billion. It also puts the equivalent annual damage value if flood systems did not exist at £2.7 billion. This

provides a gross benefit of flood systems of £1.7 billion a year. Adjusted to 2008/09 prices for consistency in the calculations, the gross benefit is £1.9 billion a year.

Number of flood and coastal erosion risk management systems:

Features often form part of a flood defence system, where a number of features work together to provide a standard of protection to a parcel of land, which may cover many different landowners. If one or more features within a system fail (analogous to links in a chain) the effectiveness of the entire system is negated. The Environment Agency records about 3,000 systems in total.

The benefit calculations divide the gross benefit of having flood defence systems by the number of systems to provide an average value of £0.6 million per system per year. Each time a third party asset fails, it can affect the whole system, and the equivalent benefit can be lost.

A typical feature would be expected to last 25 years. Features will have been relied upon for a varying length of time and so this would in reality vary significantly from case to case and from type to type, and depend on how long features have been in place/relied upon at the time of designation. For the purpose of analysis 25 years has been assumed. Sensitivity tests at 75% and 125% provide a range from 19 years to 31 years with 25 years as the central case.

Number of compromises to systems avoided by designations being in place:

It is anticipated that 4% of designated features will require consent each year. With sensitivity tests at 75% and 125% this means that between about 1,900 and 3,100 changes would be made each year with a central case of around 2,500. The NFCDD validates this assumption; it indicates that at any one time between 4 and 5% of features are failing and are in need of replacement, and so the central case has been used in the calculations.

It is assumed that 20% of the alterations, removals or replacements of features carried out by responsible persons would lead to a compromise in a flood defence system. Sensitivity tests at 75% and 125% of the central case provide a range for the percent of changes that can lead to a compromised asset from 15% to 25%. This is based on the Environment Agency's experience of working with features and is an expert opinion where comprehensive data is not held.

This means that without the protection afforded by designations, between about 280 and 780 features would be compromised each year, with a central case of about 500, which again is validated by the NFCDD data.

Effectiveness of designations policy:

There is little readily available information about the likely compliance with the designation process, and it is not easy to disaggregate the effect of the actions proposed at **Annex A** from the designation process. In estimating benefit it has been assumed that the number of failures would be reduced by 50% (with sensitivity tests at 37.5% and 62.5%). This would be brought about by less inappropriate interference with features because people are better informed and educated about the presence, importance and treatment of features. Furthermore, the related offence should provide some disincentive to inappropriate behaviour. People will be better informed and have a direct interest in

securing the functionality of features on their land (because they benefit from it, and anything inappropriate might constitute an offence) the compliance might be considerably higher than the relatively conservative central case of 50% that has been used for calculating expected cost and benefit.

The benefit calculations assume that of the 500 features that are compromised each year, there will be 250 with designation taking effect (within a range of approximately 100 to 500).

Time until compromised is addressed:

Operating authorities carry out routine surveys of features. Ordinarily the inspections regimes would detect a failure within 6 months (this can vary and sensitivity analysis has been set at 50% and 200% which provides a range of 3 and 12 months; variation is often due to the higher priority systems being inspected more frequently than lower priority systems).

Average replacement cost of a compromised feature:

The Environment Agency puts the replacement cost of all such features at £20 billion⁴, based on the average cost of building each of the different defences which has been multiplied by the number of features in the NFCDD. The value represents the capital investment that would be needed to replace all features (at 2008/09 prices). The cost of replacing the 65% of features that could be designated as third party assets is estimated at £10 billion. It is likely to be less than half the total replacement cost because the Environment Agency tends to maintain higher value features. This represents the best estimate but could change over time so sensitivity tests have been set at 75% and 125% which provides a range from £7.5bn to £12.5bn with a central case of £10bn.

Average replacement cost of a compromised feature;

Overheads of operating authority intervention; and

Percent of cases of interference in which operating authorities intervene to remedy:

Operating authorities intervene in about 20% of cases of failure of a third party asset, and this would cost the operating authority the equivalent of about 130% of a feature's replacement cost in terms of capital investment (this includes 100% replacement cost and 30% cost for the overheads of an operating authority, which has been based on Environment Agency experience). At present this cost would be met by the operating authority, in the future there would be cost recovery where a person has refused to comply with an enforcement notice. Operating authorities would continue to intervene where necessary in the public interest.

Number of cases of features that would have failed previously:

In the central case, about 2,500 features would be altered each year. 20% of those compromise an asset, which gives about 500 features a year.

⁴ Environment Agency (2009) *Flooding in England: A National Assessment of Flood Risk*

Results of Benefits Calculations

Less flood damage

Taking the assumptions and calculations summarised above, we would expect the owners of designated features and people and property within the surface area of a risk management system to benefit from greater flood and coastal erosion risk management, because the risk of interference with defences is reduced.

The assumptions –in the ‘most likely’ case- are that the system of designations (once in place) would reduce the risk of compromise to risk management systems by 50% and that a failure would go undetected for 6 months. Sensitivity tests have been applied, as set out above, for the ‘min likely’ and ‘max likely’ cases.

The benefits are ongoing, and are presented here as ‘avoided annual average costs’.

The benefits of less flood risk damage (expressed as annual average benefits) are summarised below:

Activity	Min likely	Most Likely	Max likely	Unit	Beneficiary
Avoidance of damages because of the measures on designations	17	79	307	£ million	Owners of features and people within a risk management system

The case studies included at **Annex B** demonstrate that costs incurred during actual flood events, such as the major floods described, can often be attributed to more than one cause. One example of this is where a flood is greater than the standard of defence that a flood defence system is designed to withstand. In such circumstances the systems would overtop even if fully functional and damages would be incurred, but as the examples indicate, third party assets in poor condition can contribute to more extensive and severe flooding. In theory, where the system is in good condition and operating within the tolerances it is designed to withstand, the failure of a third party asset would result in the failure of the system overall. In practice, the state of third party assets may not be the sole contributor, as indicated in the case studies. To account for this, **Annex D** contains the results of additional sensitivity testing of the assumption that the loss of an asset would lead to a breach of the whole system.

The table below summarises the benefit from avoided damage using the central case sensitivity of only 50% of the benefit being attributable to designated features, because there may be other contributory factors to a system failing:

Activity	Min likely	Most Likely	Max likely	Unit	Beneficiary
Avoidance of damages because of the measures on designations (at 50% sensitivity)	9	40	154	£ million	Owners of features and people within a risk management system

The 50% sensitivity is used for subsequent calculations, including for present value benefit, net present value and overall benefit to cost ratio. As such, this forms the central case presented in the impact assessment and “summary: analysis and evidence” sheet at the front.

Less capital investment needed to remedy interference

Operating authorities –and therefore society at large- benefit from the measures because less capital investment needs to be spent on remedying interference with features.

The benefits are ongoing, and are presented here as ‘annual average costs’.

The benefits of less capital investment being needed to replace compromised features is summarised below:

Activity	Min likely	Most Likely	Max likely	Unit	Beneficiary
Avoided cost of not needing to replace features	0.8	6.8	41.3	£ million	Operating authorities

This is a benefit because previously operating authorities were intervening to repair / replace compromised features and bearing the cost. This would be reduced under a system of third party asset designation. Costs to owners would not be affected because they were not bearing the replacement cost previously, and there would be no new cost because designated features would not be removed without consent. Under the enforcement provisions, an individual might be required to bear the cost of repair or replacement if they have breached a designation notice, or the designating authority might choose to bear the cost as now. This would be at the discretion of the designating authority.

By means of further validation, in addition to saving the cost of replacing features, if the equivalent amount of funding to that saved can be put to use in flood and coastal erosion risk management that in itself will carry benefit, because the new capital investment will create new benefit whereas like-for-like replacement of a feature is unlikely to bring additional benefit to that which should already have been secured. For example, the Environment Agency’s return on investment is currently around £8 for every £1 invested. Future funding requirements will be assessed by future funding settlements, so this possible benefit is not included in the totals.

Total Costs and Benefits

The **total one off costs** are summarised in the table below. The table incorporates the costs outlined earlier in the analysis to operating authorities designating features and owners participating in the process.

	Min likely	Most Likely	Max likely	
Total one off costs	6.3	11.2	19.7	£ million
Total each year for five years	1.3	2.2	3.9	£ million per year

A breakdown of the **total ongoing costs and benefits** of designation of features (not including the one off costs) is provided beneath in terms of 'net present values' (the total cost and total benefit of the measures over its lifetime of 25 years at today's prices discounted over time) and 'average annual costs' (the cost and benefit each year not discounted).

Cost / Benefit	Unit	Case		
		Minimum Likely	Most Likely	Maximum Likely
Net Present Value Cost	£ million	14	25	41
Net Present Value Benefit	£ million	163	809	3,405
Net Present Value	£ million	148	784	3,365
Average Annual Cost	£ million	0.8	1.4	2.3
Average Annual Benefit	£ million	9	46	195
Number of Years	Years	25	25	25
Discount Rate	%	3.5	3.5	3.5
Discount Factor	%	17.5	17.5	17.5

Included at **Annex B** are some specific cases identified by the Environment Agency to add contextual information to the analysis. **Annex D** contains additional calculations that incorporate additional sensitivity testing of the assumption that the failure of a feature leads to the failure of its parent system. The results demonstrate that even if the benefit of designating features is greatly reduced the benefit would continue to outweigh the cost⁵.

⁵ Benefit to cost ratio is greater than 1:1 where the share of benefit attributed to the third party asset is 3% or more

Comparison of Costs to Benefits

Case	Min Likely	Most Likely	Max Likely	Unit
Benefit to cost of overall policy	11 : 1	32 : 1	83 : 1	benefit : cost

The central case would bring £46m average annual benefit, at an average annual cost of £1.4m. That represents £32 benefit for every £1 spent.

Of that benefit, almost £40m would be as a result of a reduction in the estimated annual damages to property owners and almost £7m saving to operating authorities because they would need to carry out less intervention as fewer features would be compromised.

The 'minimum' case would bring an estimated £9m in average annual benefit, which is significantly lower than the central case, but with costs at less than £1m average annual cost, the benefits would still exceed costs at a rate of 11:1.

This would assume fewer features are designated than in the central case, that failures are concentrated within fewer systems and compliance with designations is low. Less investment can be put into new and improved defences, meaning that less benefit is derived and the operating authorities would still have to divert funding to remedying inappropriate interference with defences. The benefit is likely to be higher than the worst case because even if compliance is low, operating authorities would be able to recover costs of necessary intervention.

The 'maximum' case would bring £195m in average annual benefit. The maximum case assumes that more features are designated than in the central case, with failures spread evenly across systems and a high rate compliance of compliance with designations. This means that annual flood damages are reduced, and means that operating authorities have to invest less in remedying inappropriate interference with flood defence systems. The maximum case comes at a greater cost, at more than £2m annual average cost, but a rate of return of 83:1.

It is clear that the benefits of the designation system are very likely to significantly outweigh the costs. The calculations suggest a likely benefit to cost ratio of 32:1, within a range 11:1 to 83:1.

If we take the Environment Agency's target of 5:1 (and its current achievement of 8:1) minimum benefit to cost ratio for investment as our benchmark, it suggests that in all cases the measures are worthwhile and have a sufficiently positive effect. In theory, any ratio greater than 1:1 is legitimate in cost benefit terms. Because benefits flow to the individuals that own the features as well as communities within systems, we would want the assurance that the benefits are sufficiently high to not provide a net loss to individuals. The ranges suggest that it is unlikely to be detrimental to individuals in most circumstances.

The calculations are based on certain assumptions which can be read at **Annex C**.

3.3. Admin Burden

Administrative burdens have been calculated and sensitivity tests applied. Costs will be associated with one off costs of understanding consents and making any representations in respect of a designation, as well as ongoing costs in respect of obtaining consents for any alteration, removal or replacement of a designated feature. For the purposes of cost benefit analysis, 50% of designations are assumed to fall on businesses in the central case, within a range of 40% to 60%.

The numbers presented beneath represent the share of the costs included in the analysis in the preceding sections that could fall on businesses.

Variable		Min likely	Most likely	Max likely	Unit
Businesses' share of burden		40	50	60	%
Equivalent number of designations		18,720	31,200	46,800	#
Equivalent number of consents		749	1,248	1,872	#
One off cost	Per year	0.09	0.21	0.39	£ million
	Total	0.47	1.05	1.97	£ million
Annual cost		0.06	0.14	0.32	£ million

The analysis presents a central case of £1m one off costs to businesses over the first five years following commencement of the measures, and £0.14m per year average annual costs borne by 1,248 businesses each year (assuming each consent applies to a separate business).

The results have been adjusted to 2005 prices, as presented in the table below:

Cost	Most likely	Sensitivity range	Unit
One off cost	0.93	0.42 to 1.75	£ million
Annual cost	0.13	0.06 to 0.29	£ million

3.4. Specific Impacts Tests

Competition assessment - The proposals do not change any competition elements for businesses.

Small firms impact - no particular impact. Small firms (as with other parties) will generally only be involved on a one off basis where assets are designated or they propose works that might require consenting. There is no extra regulatory burden on individual firms.

Legal aid – there may be a small impact on legal aid where those responsible for assets dispute the designation or are prosecuted for removing or altering the asset. However it is envisaged that most disputes will be resolved by negotiation with legal action as a last resort and few with responsibilities for third party assets are likely to qualify for legal aid.

Sustainable development – proposals are aimed to help facilitate statutory duty of EA and aims of other organisations to contribute to sustainable development.

Carbon assessment – no implications beyond current position. Large projects by consent applicant will be subject to individual assessment as required under current prevailing legislation.

Other environment – as carbon assessment.

Health impact assessment – this proposal aims to reduce adverse health impact from flooding, or be neutral when looking at other issues such as ecological work.

Race, disability, gender – there are no particular impacts on these issues. Those affected either by applying for consent, or enforcement of unapproved works, are not treated differently according to these provisions. All aspects of this proposal are aimed at the overall management of flood risk and the environment. Disabled provisions such as access are the responsibility of those promoting works or are built into individual projects (for powers of works and entry) to fit with existing legislation. Powers considered here are non site or project specific.

Human Rights – there is, or will be, an appropriate right of appeal built in to provisions on designating features. Where registers or databases are considered, these will be compliant with human rights and data protection.

Rural proofing – legislative changes apply equally to urban and rural areas. Individual cases are considered on their merits.

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	<i>Results in Evidence Base?</i>	<i>Results annexed?</i>
Competition Assessment	Yes	No
Small Firms Impact Test	Yes	No
Legal Aid	Yes	No
Sustainable Development	Yes	No
Carbon Assessment	Yes	No
Other Environment	Yes	No
Health Impact Assessment	Yes	No
Race Equality	Yes	No
Disability Equality	Yes	No
Gender Equality	Yes	No
Human Rights	Yes	No
Rural Proofing	Yes	No

Annexes

Contents:

Annex A - Actions being pursued by the Environment Agency for features not under its direct control

Annex B – Real examples of issues with features

Annex C – Assumptions underpinning cost benefit analysis

Annex D – Additional sensitivity tests

Annex A Actions being pursued by the Environment Agency for features not under its direct control

- Assess the condition of third party assets and record details on a database
- Ensure that all third party asset owners are aware that their asset forms part of a flood defence system
- Assess the owner's capability of maintaining the asset to the appropriate standard
- Advise the owner on what needs to be done to bring the asset up to standard
- Pursue enforcement, where there is legislation, agreement or enforceable contract
- Act in the public interest and where necessary intervene with emergency works or take on the maintenance of the asset
- Follow the policy and process based on risk

Annex B Real examples of issues with features

The information in this Annex has been provided by the Environment Agency to better illustrate issues that can arise in respect of features not owned or maintained by operating authorities.

General Overview

Essential FCRM assets which are not maintained by an operating authority (third party maintained assets) are an ongoing issue from a flood and coastal risk management perspective in all parts of England and Wales, but it is very rare that the issue remains unresolved and directly causes or exacerbates flooding. Even rarer are examples of unexpected physical collapse of third party assets on the main river network during flood events. More common is that following inspection by the Environment Agency, third party maintained assets are classed as being in condition 4 or 5 (on a scale of 1 to 5 where 1 is good). These assets are technically failing and remedial works are needed to avoid physical failure.

Where the Environment Agency finds situations where remedial action is to be recommended and depending upon the perceived risk, the third party maintainer will be informed and often the problem will be resolved by action by the owner. In more critical risk situations permissive powers may be used by the Environment Agency to take direct remedial action.

North East Thames Area for example has been running a letter campaign informing all riparian owners with Condition 4 or 5 assets. This started in 2002 and so far 454 cases have occurred in 7 years - approx 65 per annum. In all cases the area has successfully persuaded the owners to act. However this excludes examples where the issue has been resolved by the EA including appropriate main river works into the capital programme such as culverts in Tottenham (River Moselle culvert) and Edmonton (Saddler's Mill Stream) in North London. North West Region has similarly for several years been informing owners of the results of inspections and has been generally successful in persuading owners to take redial action.

Of particular concern for all regions however is the inability or unwillingness of some owners to undertake either maintenance or repairs. Concerns extend beyond the general public to larger organisations and public bodies where drainage and flood risk management are not their highest priority.

There are many examples of third party maintained retaining walls, channel revetments or other structures that are an issue but culverts present the biggest challenges. In inner city areas it is often difficult to identify who owns a particular feature and in the case of culverts there is often more than one owner. Ownership of a long culvert may extend to many occupiers of property above the culvert, some of which may even be unaware of the existence of the structure or their legal liabilities. Satisfactory resolution of problems where there is multiple or disputed ownership is particularly difficult and there is considerable pressure for direct intervention with the public purse having to pick up at least part of the cost. Owner identification and formal designation if introduced should help to reduce this problem.

1 Northampton – April 1998

The Easter floods of April 1998 were the worst on record at that time across a swathe of central England; an area of some 5,000 square kilometres bounded by Bedford to the east, Evesham to the West, Peterborough to the north and Oxford to the south. April 1998 was exceptionally wet with up to 3.2 times the average monthly rainfall over much of the area. 75mm of rain falling in 36 hours on an already saturated catchment resulted in rapid rises in river levels and serious flooding which started in the early hours of Good Friday 10th April.

Estimates of insured and uninsured losses were in excess of £3,590million, five people lost their lives either directly or indirectly and many people had to make use of temporary accommodation for many months afterwards. Approximately £75million was spent on damage repairs in Northampton alone where some 10,000 people were affected and some 2,000 homes and businesses were inundated.

Northampton lies at the confluence of the River Nene's main tributaries, the Brampton Branch and the Kislingbury branch. Two other tributaries, the Dallington Brook and the West Bridge Dyke, also join the Nene at this point and were major contributors to this flood event. The riverside areas of Far Cotton and St James's were extensively developed in the 19th century with a consequent loss of natural floodplain, and have a long history of flooding. However, flood defences were constructed in the 1940s and model studies in the 1980s and early 1990s had concluded that the residual risk of flooding was low. Prior to 1998 there had been no major flooding in the town since the 1930s.

The exceptional weather conditions were responsible for much of the flooding in the town in 1998 but problems with third party owned and maintained defences were also a contributory factor.

The independent report on the flooding produced shortly after the event (The Bye Report (1999)) states: "Defences have been provided in Northampton by a combination of formal defences, natural features and existing development. As a result, responsibility for flood defence has become fragmented and needs to be clarified. Relevant parties include the Borough Council, the Agency and riparian owners."

More significant, however, is the statement in the report that "Some elements of the defences at Northampton were missing due to actions by others or in poor condition. Flooding would have occurred irrespective of these deficiencies because of the extreme conditions but it may have been less extensive and severe."

The Review team's assessment also states: "It is evident that some lengths of the defence system were missing or in poor condition prior to Easter. The consequence of these defence deficiencies would have been the earlier onset of flooding and, possibly, more extensive and deeper inundation than would otherwise have occurred."

Post event investigations revealed that there were a number of third party structures that contributed to the flooding. One such example was a former factory boundary wall approximately 100 metres long, approximately 1 metre high and originally of

brick construction. This wall was alongside a section of the Grand Union Canal and generally remote from the main channel of the river. Prior to the flood event the landowner had demolished the wall and replaced it with crash resistant “open” fencing. While this was perfectly adequate in terms of security etc from the new landowners’ perspective it presented no barrier to the out of bank flood waters that inundated the floodplain and the canal during this more extreme flood event. Had the old wall still been there it would have protected the site and reduced the volume of flood water which reached very many other properties in the Far Cotton area.

Another example related to the construction of a new road crossing of the River Nene where water escaped around a route which was effectively created during the construction of the new bridge abutments. At a different site in the town a third party maintained trash screen structure on West Bridge Dyke blocked causing water to inundate several dozen houses in the St. James’ End area. At a fourth site further downstream on this watercourse a penstock owned and operated by a different third party may also have been a contributory factor in the flooding.

The “missing” wall above is a rare example of a third party defence structure being removed or modified by the owner out of ignorance of its secondary purpose as a flood defence, and which was undetected by the operating authority until flooding occurred. While examples of failings in the maintenance of third party assets being discovered are common, timely remedial action is usually instigated by the operating authority before flooding takes place.

2. Calder Valley - June 2000

Almost 30 hours of continuous rainfall in early June 2000 caused the River Calder and its tributaries in West Yorkshire to rise very rapidly and flood several towns including Todmorden, Hebdon Bridge and Mytholmroyd.

Approximately 500 homes and business in Todmorden were inundated, with damage estimated at the time to be in excess of £12 million. About 80 families had to be evacuated from their homes and several drivers had to be rescued from stranded cars. A further 120 properties were affected in Hebdon Bridage and Mytholmroyd. Fortunately there were no fatalities.

A notable feature of this event was the failure of riverside and canal side walls at 4 different locations in the valley. In all cases these were walls that were not maintained by any operating authority and which physically collapsed under the weight of water. Emergency repairs were undertaken by the Environment Agency and the local authority at the time. The Agency has more recently progressed a scheme to reduce the risk of flooding to some 750 properties at Walsden and Todmorden.

3. Ashbourne, Derbyshire – September 2008

In September 2008, a short section of a much longer third party owned and maintained riverside brick built boundary wall collapsed during a relatively minor flood event. This resulted in the inundation of three properties immediately adjacent to the Henmore Brook which is a Main river. It was necessary for the Environment Agency to immediately erect a 60 metre length of temporary defences to plug the breach which had put in excess of 200 properties at risk. The emergency repairs

together with the necessary permanent repairs to this short section cost approximately £250,000. The remaining sections of the third party wall will be replaced in due course by a new EA funded scheme for the town due to start in 2010.

References

Northampton:

- i) "The Bye Report" – (EASTER 1998 FLOODS Volumes 1 and 2. Report by the Independent Review Team to the Board of the Environment Agency. Mr Peter Bye, Chairman and Dr Michael Homer, Independent Technical Advisor. 30 September 1998)
- ii) Northampton Chronicle and Echo (April 1998)
- iii) Previously undocumented verbal accounts from Environment Agency Flood Risk Management staff who responded to the events of Easter 1998.

Calder Valley

- iv) Environment Agency Flood Situation Report, 3-4 June 2000
- v) Upper Calder Improvements Strategy October 2000 (YRFDC/304).
- vi) BBC News website (<http://news.bbc.co.uk/1/hi/uk/776684.stm>) June 2000

Ashbourne:

- vii) Environment Agency: Floodwall Emergency Works, Ashbourne, 16 February 2009. (Ref REMI001009)

Annex C Assumptions underpinning cost benefit analysis**Baseline data used in calculating benefit and cost****Table i. Data on risk management systems and third party assets**

Aspect of policy	Value	Unit	Variables	Basis
Data and assumptions on the status of features	96,000	#	Number of features	The National Flood and Coastal Defence Database records 96,000 features not owned and operated by operating authorities but required for flood and coastal erosion risk management purposes (these are third party assets, which are candidates for designation)
	65	%	Percent of features that might be designated	The National Flood Defence Database indicates that 65% of features relied upon are not maintained by operating authorities are in medium or high consequence systems. The number is the number of features multiplied by the percent that might be designated
	62,400	#	Number of features that could be designated	
	10000	£ million	Replacement cost for all third party assets	The Environment Agency has valued the replacement cost of all third party assets at £20 billion (for 08/09 prices), based on the average cost of replacement. The cost of replacing the 65% of features that may be designated is valued by the Environment Agency as £10 billion (less than half the cost because the Environment Agency tends to maintain higher value features)
	25	Years	Life of a feature / asset	Expected average life of a flood or coastal defence third party asset
	3000	#	Number of flood and coastal erosion risk management systems	Features will often form part of a system managing the risk of flooding or erosion. A compromise to one feature within a system creates a high risk of compromising an entire system. There are about 3,000 systems in total. The value affects the cost benefit because it will reflect the scale of benefit that is lost each time a feature (and therefore a risk management system) is compromised
	2496	#	The number of features that are expected to be altered (i.e. removed, replaced or significantly altered / changed) each year	The Environment Agency has estimated, based on its experience, that around 4% of features will be subject to significant change each year. A proportion of these would compromise the functionality in flood / coastal erosion risk management terms

Aspect of policy	Value	Unit	Variables	Basis
	20	%	Percent of alterations that compromise an asset (i.e. negates its function in respect of risk management)	This is the Environment Agency's best estimate (reflecting the position without a system of designation) of the percentage of alterations that will compromise a feature, such that it no longer performs effectively as a flood or coastal erosion risk management feature. Inspections have not recorded exact data to inform this assumption, so an estimate has been used for the calculations.
	0.5	Years	Time until a compromised defence is addressed	It is assumed that compromises are spread evenly across systems, and each compromise will compromise a system. It is also assumed that a compromised feature would be detected within a period of time and remedied. The 'usual' interval between inspections that would detect any compromised features is six months. This might vary from case to case and is subject to sensitivity analysis. On high risk systems, the maximum time is likely to be six months, but lower risk systems may be subject to less frequent inspection.
	20	%	Percent of compromises to features that operating authorities will carry out works to remedy	Operating authorities will act in the public interest. In all cases it is likely that operating authorities will liaise with those responsible for features that have been compromised. For example, the Environment Agency will detect significant changes to defences as part of its inspections process and will write to owners where necessary. Ordinarily, around 80% of cases will be resolved through correspondence and minor interactions. This is already taking place and is considered part of the baseline activity. About 1 in 5 cases will require physical intervention, involving works of some kind, which would normally be carried out at the expense of the operating authority involved.
	130	%	Cost of remedial works (including overheads) as a percent of the replacement cost value of the feature that has failed and the operating authority decides to repair / replace.	For large schemes, overheads account for about 30% on top of the replacement cost value of the feature in question, but this could be higher in instances of intervention in smaller cases. 30% is taken as the central case, with sensitivity analysis applied to the total. Furthermore, emergency works can include the erection of a temporary structure to close the gap while a more permanent solution is designed and built. In the Environment Agency's experience, the permanent solution may involve restoring the original feature, but more often than not will involve a replacement. It is assumed that operating authorities bear the full cost. The assumptions in on this are based on Environment Agency expert opinion and experience in the absence of comprehensive actual data.

Aspect of policy	Value	Unit	Variables	Basis
	2700	£ million	Estimated Annual Damages (EAD) if there were no flood and coastal erosion risk management systems in place	<p>Data has been drawn from the 2004 National Assessment of Defence Needs and Costs.</p> <p>The Environment Agency is undertaking an analysis of System Asset Management Plans which will help validate the assumption, but these are not yet moderated for national use and the data is therefore unavailable for use in the Impact Assessment.</p>
	1000	£ million	Estimated Annual Damages (EAD) with flood and coastal erosion risk management systems in place	<p>Flooding in England and Wales reports based on the 2009 National Assessment of Flood Risk indicate that with defences in place the present day Estimated Annual Damage (the direct property damages) is £1bn for England, and £1.2bn including Wales. The data does not provide an assessment of expected damages with no defences in place, and so the 2004 data has been used in the Impact Assessment as the best available and comparable data.</p> <p>The Long Term Investment Strategy (2009) indicates that over time the cost associated with 'doing nothing' will increase as climate change takes effect.</p> <p>As part of the future policy review these assumptions should be tested using the latest available data.</p>
	2989	£ million	Estimated Annual Damages (EAD) if there were no flood and coastal erosion risk management systems in place, adjusted to 2008/09 prices	<p>As above, adjusted to 2008/09 prices.</p> <p>Consumer Price Index from: www.statistics.gov.uk</p>
	1107	£ million	Estimated Annual Damages (EAD) with flood and coastal erosion risk management systems in place, adjusted to 2008/09 prices	<p>2004 = 98.0, 2008 = 108.5 (110.7% increase) [2005 = 100]</p> <p>Direct link at time of writing: http://www.statistics.gov.uk/StatBase/tsdataset.asp?vlnk=7174&More=N&All=Y</p>

Table ii. Variables on cost

Aspect of policy	#	Unit	Variables	Cost bearer / beneficiary	Basis
Data and assumptions on designating features	0	£	Identifying a feature and notifying owners	Operating authorities	Nil, there is no cost above the baseline as this activity already occurs, either through existing practices, or under separate provisions to maintain records etc
	0	£	Registering a feature	Operating authorities	
	0.5	FTE day	Staff time of designating a feature	Operating authorities	It is expected that half a full time equivalent (FTE) day would be required per designation, based on the Environment Agency's experience
	225	£ per FTE day	Staff cost	Operating authorities	Environment Agency Staff costs including all overheads and general administrative costs are about £50k per full time equivalent (FTE). It has been assumed that a working year is consists of 220 days, and the salary equates to the mid point of the Environment Agency's Grade 4 (direct report to Team Leader). The FTE value is the annual pay and overheads divided by the number of days, rounded to £225.
	113	£	Cost of designating a feature (to authorities)	Operating authorities	Time Cost * Time Requirement
	0	£	Cost of designating a feature (to owners)	Owners of features	There are no plans to charge owners for a designation. It is not anticipated to cause detrimental effect to property value (flood information will be available already, and the property will receive benefit from features in the locality
	30	%	Staff time to handle enquiries	Operating authorities	Estimate of time requirement informed by Environment Agency experience, as a percent of the time to designate a feature (which will be in addition to the basic cost of the process of designating a feature)

Aspect of policy	#	Unit	Variables	Cost bearer / beneficiary	Basis
	34	£	Cost of handling queries / representations	Operating authorities	Time Cost * Time Requirement, on average
	34	£	Cost of making enquiries / representations	Owners of features	Time Cost * Time Requirement, on average; makes assumption that time consumption and cost to owners is equal to that of the operating authority. Owners of features that are being designated will want to understand the designations and will have a right to appeal against designation. It is not expected that costs will be disproportionately high because the policy is relatively straightforward, rationale for designation should be clear, operating authorities will already be carrying out public engagement, a designation will not require significant work on the part of an owner, and it is in an owner's best interests in terms of risk management. It is not anticipated that costs will fall disproportionately on any particular sector
Data and assumptions on consenting in respect of designated features	4	%	Percent of designated features altered	n/a	An estimate, based on Environment Agency experience of managing assets, of how many designated features would be subject to consent for an alteration, removal or replacement per annum. It is assumed that routine maintenance is not subject to consenting
	462	£	Cost of processing a consent	Operating authorities	Based on actual Environment Agency costs of similar consenting process. The Agency currently processes 6,500 consents a year using the equivalent of 60 full time members of staff. At £50,000 per FTE, the service costs £3m a year, which averages at £462 per application. Consents for designating features are expected to be relatively straightforward compared to existing consents that are processed. It is possible that a consent may cover more than one feature at a time, which could also reduce costs overall.
	25	%	Time to apply for a consent	Owners of features	Estimated to be a quarter of the operating authority time cost. Expected that costs will be relatively low for owners seeking consent because application process should be straightforward and not more than half that of the operating authority (see sensitivity analysis). The cost of an owner's time is assumed to be equal to that of the operating authority. Wider costs such as architect's fees or other planning issues are not included as the owner would be subject to this irrespective of a designation of a feature.
	115	£	Cost of applying for a consent in time		

Aspect of policy	#	Unit	Variables	Cost bearer / beneficiary	Basis
	0	£	Charge for a consent	Owners of features	Operating authorities are not expected to charge an asset owner for making an application or seeking consent for a change to a designation

Table iii. Variables for benefit / cost calculations

#	Unit	Variable	Basis
3.5	%	Discount rate	Standard discount rate for ongoing benefit and cost
25	Years	Discount years	Based on expected life of a 'typical' investment in flood and coastal erosion risk management; for ongoing benefit and cost
17.5	#	25 Years discount factor	Standard discount rate applied over 25 years
5	Years	Time period in which 'one-off' costs are incurred	Period of time over which one-off costs will be borne
50	%	Effectiveness of designations	Estimate of the amount by which designations will decrease compromises to features

Table iv. Ranges for Sensitivity Analysis

Sensitivity ranges are included to allow for variation from the central assumptions and because it is not possible to predict the exact uptake of permissive powers nor the change to flood defence systems over long periods of time. Expert opinion and experience of the Environment Agency suggests that sensitivity ranges would be reasonably set at 75% to 125% of the central case except where greater variation is known to be possible and the limits have been expanded. An upper bound of 150% has been set for time costs in case some cases are more involved than expected in the central case. A range of 50% to 200% has been used where the variation over time is likely to be significant or operating authorities have a large degree of freedom in exercising their powers.

Variable	Initial value*	As % of initial value			Variable with sensitivity applied			Unit	Expected bearer of cost (where applicable)
		Min likely	Most Likely	Max likely	Min likely	Most likely	Max likely		
Number of features that could be designated	62,400	75	100	125	46800	62400	78000	#	n/a
Replacement cost for all third party assets	10000	75	100	125	7500	10000	12500	£ million	Operating authorities
Life of a feature / asset	25	75	100	125	19	25	31	Years	n/a
The number of features that are expected to be altered (i.e. removed, replaced or significantly altered / changed) each year	2496	75	100	125	1872	2496	3120	#	n/a
Percent of alterations that compromise an asset (i.e. negates its function in respect of risk management)	20	75	100	125	15	20	25	%	n/a
Effectiveness of designations	50	75	100	125	37.5	50	62.5	%	n/a

Cost of designating a feature (to authorities)	113	75	100	150	84	113	169	£	Operating authorities
Cost of remedial works (including overheads) as a percent of the replacement cost value of the feature that has failed and the operating authority decides to repair / replace.	130	75	100	125	97.5	130	162.5	%	Operating authorities
Percent of compromises to features that operating authorities will carry out works to remedy	20	50	100	200	10	20	40	%	Operating authorities
Time until a compromised defence is addressed	0.5	50	100	200	0.25	0.5	1	Years	n/a
Cost of handling queries / representations	34	75	100	125	25	34	42	£	Operating authorities
Cost of making enquiries / representations	34	75	100	125	25	34	42	£	Asset owners
Cost of processing a consent	462	75	100	125	346	462	577	£	Operating authorities
Cost of applying for a consent in time	115	75	100	150	87	115	173	£	Asset owners (this reflects the cost of time; there will not be a charge)

Breakdown of results of benefits calculations (not shown in main body)**Calculations:**Avoidance of damages formula:

$$\text{Benefit} = \left(\frac{A - B}{C} \times \frac{D}{E} \right) \times \text{Time until compromise is addressed [as \% of year]}$$

Notes:

A = Estimated Annual Damages (EAD) if there were no flood and coastal erosion risk management systems in place

B = EAD with flood and coastal erosion risk management systems in place

[A - B = Damage avoided by the existence of systems]

C = Number of flood and coastal erosion risk management systems

[A - B divided by C = Average damages avoided per system that is in place]

D = Number of compromises to systems that designation avoids (assuming even spread of designated assets across systems; if an asset fails it places the entire system at risk because assets work together in systems)

E = Effectiveness of designations (in terms of percentage of compromises that are avoided)

[D divided by E = Number of compromises avoided by the policy]

Benefit = Damages avoided by the policy because fewer third party assets are compromised.

Variable	Min likely	Most likely	Max likely	Unit	Notes
A	2989			£ million	EAD with no systems
B	1107			£ million	EAD with systems
C	3000			#	Number of systems
[A - B =]	1882			£ million	Benefit of systems
[(A - B) / C =]	0.63			£ million	Average damages avoided per system
[D / E =]	105	250	488	#	Number of compromises avoided
Percent of year until remedied	0.25	0.5	1	Years	Time during which benefit is otherwise lost
Total Benefit	17	79	307	£ million	Damages avoided
Equivalent benefit per feature	0.006	0.026	0.102	£ million	

Variable	Min likely	Most Likely	Max likely	Unit
Number of alterations to third party assets	1872	2496	3120	#
Percent of alterations that compromise the asset	15	20	25	%
Effectiveness of policy (reduction in compromises)	37.5	50	62.5	%
Number of compromises avoided	105	250	488	#



Avoidance of cost of replacement formula:

Benefit = Cost to operating authorities per feature remedied x number of interventions

$$= (A + B) \times (C \times D)$$

Notes:

A = Replacement cost per compromised feature

B = Operating authority overheads (as a % of A)

C = Number of features that would previously have failed

D = Percent of cases of interference in which operating authorities intervene to remedy

Activity	Min likely	Most Likely	Max likely	Unit	Notes
Replacement cost per compromised feature	0.08	0.10	0.13	0	Cost of replacement (from sensitivity range table) divided by number of features (from table i)
Operating authority overheads (as equivalent % of the replacement cost)	98	130	163	%	From sensitivity range table
Number of features that previously would have failed	105	250	488	%	Based on previous calculation
Percent of cases where operating authorities pay to remedy	10	20	40	£ million	From sensitivity range table

Total saving (per year)	0.8	6.8	41.3	£ million	Cost of replacing features that has been avoided
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Annex D Additional sensitivity tests

Additional Sensitivity Tests

The cost and benefit calculations assume that if a feature fails the benefit to the whole system can be lost. In the event of a flood, other factors may influence the amount of damage caused, for example the overall condition of the third party asset, whether the flood event is greater than the design tolerance of the system, a compromise to another category of feature, a lack of general maintenance to features or if the failure of a designated feature would not cause the entire system to fail but only a proportion of it.

The calculations beneath take each of the 'least likely', 'most likely' and maximum likely' scenarios, and apply additional sensitivity analysis that assumes that the third party assets only contribute a certain amount to the overall benefit. The calculations test whether there is a likelihood that the costs of designation exceed the benefits of the system **if the existence of third party assets is not the sole contributor to costs borne in flood events.**

Summary of Results

The additional sensitivity testing indicates that if third party assets only account for 10% of the benefits and all other sensitivities are at the lowest bound used in the calculations, the benefit will exceed costs.

The table below summarises the benefit to cost ratio ranges of this additional sensitivity testing:

Sensitivity Case	Least Likely	Most Likely	Maximum Likely
Benefit : Cost at 10% benefit attributable to third party assets	3 : 1	10 : 1	31 : 1
Benefit : Cost at 50% benefit attributable to third party assets	11 : 1	32 : 1	83 : 1
Benefit : Cost at 100% benefit attributable to third party assets	22 : 1	60 : 1	149 : 1

Detailed Results***Most Likely***

<u>Variable</u>	<u>Sensitivity Test</u>					<u>Unit</u>
Percent benefit attributable to third party assets	10	25	50	75	100	%
Number of Years	25	25	25	25	25	Years
Discount Rate	3.5	3.5	3.5	3.5	3.5	%
Discount Factor	17.5	17.5	17.5	17.5	17.5	#
One-off cost to operating authorities	9.1	9.1	9.1	9.1	9.1	£ million
One-off costs to owners of features	2.1	2.1	2.1	2.1	2.1	£ million
Annual cost to owners of features	0.3	0.3	0.3	0.3	0.3	£ million
Annual cost to operating authorities	1.2	1.2	1.2	1.2	1.2	£ million
Avoidance of damages from designations	8	20	40	59	79	£ million
Avoidance of cost of replacement	6.8	6.8	6.8	6.8	6.8	£ million
Present Value Cost (£m)	25	25	25	25	25	£ million
Present Value Benefit (£m)	256	464	809	1154	1499	£ million
Net Present Value (£m)	231	438	784	1129	1474	£ million
Average Annual Cost (£m)	1.4	1.4	1.4	1.4	1.4	£ million
Average Annual Benefit (£m)	15	27	46	66	86	£ million
Benefit to Cost Ratio	10 : 1	18 : 1	32 : 1	46 : 1	60 : 1	Benefit : Cost

Least Likely

<u>Variable</u>	<u>Sensitivity Test</u>					<u>Unit</u>
Percent benefit attributable to third party assets	10	25	50	75	100	%
Number of Years	25	25	25	25	25	Years
Discount Rate	3.5	3.5	3.5	3.5	3.5	%
Discount Factor	17.5	17.5	17.5	17.5	17.5	#
One-off cost to operating authorities	5.1	5.1	5.1	5.1	5.1	£ million
One-off costs to owners of features	1.2	1.2	1.2	1.2	1.2	£ million
Annual cost to owners of features	0.2	0.2	0.2	0.2	0.2	£ million
Annual cost to operating authorities	0.6	0.6	0.6	0.6	0.6	£ million
Avoidance of damages from designations	2	4	9	13	17	£ million
Avoidance of cost of replacement	0.8	0.8	0.8	0.8	0.8	£ million
Present Value Cost (£m)	14	14	14	14	14	£ million
Present Value Benefit (£m)	44	88	163	237	311	£ million
Net Present Value (£m)	30	74	148	223	297	£ million
Average Annual Cost (£m)	0.8	0.8	0.8	0.8	0.8	£ million
Average Annual Benefit (£m)	2	5	9	14	18	£ million
Benefit to Cost Ratio	3 : 1	6 : 1	11 : 1	17 : 1	22 : 1	Benefit : Cost

Maximum Likely

Variable	Sensitivity Test					Unit
Percent benefit attributable to third party assets	10	25	50	75	100	%
Number of Years	25	25	25	25	25	Years
Discount Rate	3.5	3.5	3.5	3.5	3.5	%
Discount Factor	17.5	17.5	17.5	17.5	17.5	#
One-off cost to operating authorities	16.5	16.5	16.5	16.5	16.5	£ million
One-off costs to owners of features	3.3	3.3	3.3	3.3	3.3	£ million
Annual cost to owners of features	0.5	0.5	0.5	0.5	0.5	£ million
Annual cost to operating authorities	1.8	1.8	1.8	1.8	1.8	£ million
Avoidance of damages from designations	31	77	154	230	307	£ million
Avoidance of cost of replacement	41.3	41.3	41.3	41.3	41.3	£ million
Present Value Cost (£m)	41	41	41	41	25	£ million
Present Value Benefit (£m)	1259	2064	3405	4747	1499	£ million
Net Present Value (£m)	1218	2023	3365	4706	1474	£ million
Average Annual Cost (£m)	2.3	2.3	2.3	2.3	2.3	£ million
Average Annual Benefit (£m)	72	118	195	272	348	£ million
Benefit to Cost Ratio	31 : 1	50 : 1	83 : 1	116 : 1	149 : 1	Benefit : Cost