4 Residential Properties

4 Residential Properties

OVERVIEW

Residential flood damage is significant in almost all cases of serious flooding in the UK, and remains an area of public and government concern. This damage includes both direct damages and indirect losses, measured as the tangible and intangible impacts of flooding on residential properties and householders.

This chapter addresses the appraisal of the direct damages and tangible impacts of flood waters on household inventory and building fabric items and on domestic vehicles. In addition, information is provided for the cost of evacuation, and for incorporating government guidance on the appraisal of the indirect and intangible impacts of flooding. Information and data are also provided to allow the damage-reducing effects of property-level resistance and resilience measures.

The assessment of direct residential property flood damage potential should utilise the depth/damage data within the Chapter 4 section of MCM-Online. The most detailed standard data provided is for:

- Five house types;
- Six building ages; and
- Four different social grades of the dwellings' occupants.

Data are provided for various water types (see Table 4.1: *Categories of flood water* in the 'Tables & Figures' spreadsheet on MCM-Online), saltwater flooding, wave damage and also reductions following the issuing of a flood warning. We also provide a method for calculating likely vehicles damages and a comprehensive set of flood evacuation costs. Data and methods allowing the estimation of the beneficial effects of property-level resistance and resilience measures are also provided.

Since 2013 most damages have been inflated using an appropriate index (CPI, GDP deflator). In the 2021/22 version a major revision of the damages has been completed, which included cost reviews by flood damage experts and updates to ownership and inventory item price values. Additionally, In the 2022/23 version, the data source for inventory item prices was were revised to include values from price quotes of items in the standardised shopping basket published by the Office for National Statistics (ONS, 2022). The standardized shopping basket provides large samples of item prices collected in all regions of the UK on a monthly basis. However, not all inventory items relevant to flood damage estimation in the MCM are included in the standardised shopping basket. Item prices are therefore determined through online surveys of major retailers, as in previous MCM versions, combined with statistical analysis of price quotes form the standardised shopping basket. The changes to the methodology may have a small impact on values and will ensure more statistically robust annual price updates for future MCM versions.

For the 2023/24 version, damages have been inflated using the appropriate indices.

LESSONS FROM EXPERIENCE

- Residential flood damage data may be used in as detailed or generalised a way as required for the purpose of the benefit assessment. Dwellings and their occupants can be noted without reference to age or type or property or the social grade of resident;
- Whatever level of aggregation is chosen, there will be errors traceable to the original data sources. It is almost impossible to quantify these errors but every attempt has been made to minimise them;
- Damage susceptibility estimates: professional opinion varies on the precise effect of flood water on inventory and building fabric items. Susceptibility must be continually up-dated as more information becomes available;
- Inventory and building fabric data: standard checklists have been devised which are not exhaustive;
- Secondary data sources: applying nationally based data to small areas locally may lead to errors;
- Ground floor plans: individual properties will vary from these specifications to some degree.

UNDERLYING ASSUMPTIONS

The residential potential flood damage data for household inventory and building fabric items is based on economic values not financial values (see Chapter 3, Table 3.2). Financial datasets are provided separately on the MCM-Online.

Flood impacts on households are classified as direct tangible, intangible and indirect (Table 4.2). In compiling the standard flood damage data, the total inventory damage is dependent on the average remaining values (ARV - to depreciate prices), the house type, the social grade and the ownership of household items for each social group (Table 4.3: *Social grade categorisation by occupation*).

Table 4.2: The range of possible flood impacts on households (not exhaustive or necessarily mutually exclusive)

Direct Tangible Losses For Flooded Households	Intangible Losses On Flooded Households	Indirect Losses On Flooded Households	Indirect Losses For Non-Flooded Households
➢ Damage to building fabric ➢ Damage to household inventory items ➢ Clean-up costs	➢ Worry about future flooding ➢ Loss of memorabilia and irreplaceable items and pets ➢ Damage to physical and/or mental health, death or injury ➢ Loss of community ➢ Loss of confidence in authorities and services	➢ Permanent evacuation from area ➢ Disruption to household due to flood damage ➢ Temporary evacuation costs ➢ Disruption due to flood warnings or alarms ➢ Loss of utility services ➢ Loss of income/earnings ➢ Loss of leisure and recreational opportunities ➢ Additional communication costs ➢ Loss of services ➢ Increased travel costs ➢ Increased cost of shopping and recreational opportunities	➢ Increased travel costs ➢ Loss of income/earnings ➢ Loss of utility services ➢ Loss of other services ➢ Loss of leisure and recreational opportunities ➢ Increased cost of shopping and recreational opportunities

NB. This is Table 4.1 in the MCM 2013

The 'intangible' effects of flooding are recognised as significant. Defra and the Environment Agency have funded research to establish an economic valuation of the intangible health impacts of flooding. This research confirmed the significance of the health impacts of flooding and led to the publication of guidance (Defra, 2004). This has been added to by recent research and guidance considering the impacts of flooding on mental health (Environment Agency 2021a).

Tables 4.3 Social grade categorisation and weighted factor by occupation

Social Group	Description	Weighted Factor
AB	Upper middle and middle class: higher and intermediate managerial, administrative or professional	0.74
C1	Lower middle class: supervisory or clerical and junior managerial, administrative or professional	1.12
C2	Skilled working class: skilled manual workers	1.22
DE	Working class and those at the lowest level of subsistence: semi-skilled and unskilled manual workers. Unemployed and those with no other earnings (e.g. state pensioners)	1.64

NB. This is based on Tables 4.8 and 4.36 in the MCM 2013

DIFFERENT TYPES OF APPRAISAL

The framework presented below is for appraisals of different types, scale and complexity. The framework includes (1) overview appraisals which are less complex and demanding in terms of damage data requirements and which may be undertaken at the meso- or micro-scales, (2) initial appraisals which are more detailed and demanding and more suited to the micro-scale and (3) full-scale appraisals where site-specific damage data are collected. See Chapters 2 and 3 for a more detailed overview of appraisal types.

Table 4.4 Types of project appraisals (2023 value)

Overview, Initial and Full-Scale methods			
Scale of analysis	**Overview**	**Initial**	**Full-Scale**
Guidance	For rapid MDSF and similar desktop type appraisals: first approximations to identify areas where more detailed work is required	For more detailed appraisals where further assessment of household loss potential is warranted	For the detailed study of potential benefits using the most detailed of the standard data sets
Data requirements for the benefitting area	Number of properties at risk	Number, type and age of house at risk	Number, type, age and social class of houses and householders at risk
		Standard of protection (pre and post scheme for intangible values)	Standard of protection (pre and post scheme for intangible values)
			Government Weighting Factors for distributional impact analysis
Direct/ tangible method of assessment	Annual average direct damages: sector average	Generalised standard residential depth/damage data for type and age of houses	Additional data for type, age and social grade of houses and householders
	Vehicle Damages: 42% of total properties damaged x £5,600 (2021 value)	Vehicle Damages: number of properties at risk above 0.39m x £6,944 (2022 value)	Vehicle Damages: number of vehicles at risk above 0.39m x £5,600 (2021 value)
Intangible method of assessment[1]	Health: £279[1] per property per year for intangibles	Health: Defra's intangibles matrix	Health: Defra's intangibles matrix
Indirect method of assessment	Evacuation per household: temporary accommodation costs (£1,370) plus alternative accommodation costs (£3,921) (2023 value)	Evacuation per household: evacuation costs per property type and flood depth	Evacuation per household: survey on percentage of households evacuated and duration of evacuation. Evacuation costs per property type and flood depth
Vulnerability Analysis	Not required	Where feasible	Where feasible
Property-level resistance and resilience damage - saving	Not required	Where such measures exist their impact should be estimated and deducted from damage estimates where feasible	Where such measures exist their impact should be estimated and deducted from damage estimates where feasible

[1] NB: These are the social health costs (i.e. how much a household is willing-to-pay to avoid health impacts). Users are also now directed to guidance about appraising the Mental Health Costs of flooding (Environment Agency, 2021a) and the associated transitional arrangements for its use.

OVERVIEW APPRAISALS

Where only the number of properties in the benefit area is known, approximate flood risk management benefits can be derived by making some assumptions about the depth of flooding expected with different return periods.

SECTOR AVERAGE DAMAGES

To provide a more refined estimate of direct damages, the depth of flooding across a range of flood events must be known. The absolute minimum number of flood events that can be considered is three:

- The threshold flood event (the most extreme flood event which does not cause any losses).
- An event larger than the possible design standard of protection.
- An intermediate flood.

With a basic understanding of the depths of flooding, appraisers should use the residential depth/data curves provided within the Chapter 4 'Tables & Figures' spreadsheet on MCM-Online. However, during overview appraisals, only the sector average figures should be used.

To employ both these methods, the appraiser needs to determine the size of the benefit area, the number of properties at risk there and, where available, the depth of potential flooding:

- The size of the benefit area is determined by the flood problem being appraised.
- The number of properties can be obtained from the National Receptor Dataset (NRD), from the Environment Agency.
- The depth of flooding is determined from the ground level data and the results of hydraulic modelling or, more likely at this stage, from field-based assessments or historical records.

WEIGHTED ANNUAL AVERAGE DAMAGES (WAAD)

Where the appraiser has little or no understanding of the potential flood depths and return periods, use the weighted annual average damage (WAAD) approach, broken down by warning lead time and the standard of protection (Table 4.5).

The annual average damage to the average house with no flood warning and no flood protection is £5,269. Table 4.5 gives the reduced values provided by different standards of protection and different levels of flood warning (to which householders are assumed to respond effectively by moving portable property inventory i.e. contents).

However, where this value is used in outline studies, as the weighted annual average damage per residential property within a defined benefit area (say, 1 in 200 year floodplain), the number of properties affected by successively more frequent return period floods should be reduced as in Table 4.6.

Table 4.5 Weighted Annual Average Damages (WAAD) (2023 value) assuming variable threshold Standards of Protection (SoP)

Existing SoP	No warning (£)	<8 hour warning (£)	>8 hour warning (£)
No protection	5,269	5,227	5,215
2 years	5,269	5,227	5,215
5 years	3,163	3,136	3,129
10 years	1,615	1,602	1,597
25 years	772	766	764
50 years	326	324	323
100 years	82	81	81
200 years	41	40	40

NB. This is Table 4.33 in the MCM 2013

Table 4.6 Estimate of the number of properties affected by different floods

Return Period	No. of properties as % of **200 year No. of properties**
100	93
50	80
25	25
10	10
5	5

THE 'INTANGIBLE' EFFECTS OF FLOODING

Research into the valuation of intangible health benefits concludes that the potential value of avoiding such impacts is, on average, £279 per household per year. In addition, this research concluded that the most important factor when calculating potential intangible impacts is the flood risk (Defra/Environment Agency, 2004). At the overview appraisal level only, we recommend using this surrogate value of £279 per household to account for the willingness of households to pay to avoid health impacts. Users are also directed to recent Environment Agency (2021a) supplementary guidance for values associated with the impacts of flooding on mental health. At this level of appraisal it is suggested that an average value (rather than one associated with flood depths) is applied.

VEHICLE DAMAGES

Research for the MCM has ascertained the average value for a typical motor vehicle in the UK to be £5,600. Assessing exactly how many vehicles will be damaged during a flood event is very difficult, not least because vehicles are mobile. A method, which could be used for overview appraisals is based on an average property to vehicle damage ratio for the 2007 and 2012 UK floods (ABI, 2012). This method assumes that the total number of vehicles likely to be damaged during a flood occurring at any time of the day will equate to 42% of the total number of residential *and* commercial properties (see Chapter 5) at risk (from a flood of any depth). Once the number of likely vehicles has been ascertained, appraisers can multiply this by £5,600 (the value per vehicle, not the value of vehicles per household). This method does not require an assumption to be made on the presumed location of vehicles when a flood occurs.

Readers are encouraged to view Chapter 4, section 4.5 of the MCM (Penning-Rowsell et al., 2013) for a full explanation of this method. Please note that the values in this handbook are based on a later update and, therefore, are different from the ones presented in section 4.5 of the MCM.

EVACUATION COSTS

Evacuation of flood affected properties is often considered in terms of a short-term emergency response to flooding – to limit loss of life, injury and the stress caused by the flood event - and indeed it is a sensible measure to have in place. In previous versions of the MCM, the costs of emergency response and recovery have been developed to be included in appraisal calculations. In this respect, where properties are affected by flooding, evacuation from the property may also be necessary to allow flood damage to be repaired. In such cases, evacuation requires temporary or alternative accommodation for households affected and this incurs additional costs.

The duration of evacuation has a major impact on total costs, which are accrued over the time period from evacuation to the return to the property. However, to assume that, of the properties originally evacuated, all remain evacuated for the longest duration (i.e. over one year), could result in a greatly overestimated cost figure. Instead, households will return over time and only a small percentage (around 8%), are likely to remain in alternative accommodation over one year.

For overview appraisals only, we recommend using the total average cost of evacuation per household (based on an average evacuation of 23 weeks). The table *'Evacuation Costs – Overview*' on MCM-Online provides the cost for three different scenarios (high, low and average/indicative cost). The total includes average property rents, cost of temporary accommodation, food, additional transport costs and loss of earnings - see MCM, Chapter 4, Section 4.7 (Penning-Rowsell et al., 2013), for the comprehensive method.

INITIAL APPRAISALS

These appraisals require information on flood depths for each flood event being considered, and a more detailed understanding of the properties in the benefit area. In particular, the appraiser will need to know the following:

- The depth of flooding for a range of flood events.
- The type and age of houses in the benefit area, obtained from a more detailed field survey (rather than obtaining the data solely from OS Mastermap/AddressBase, Google 'Street View' and the National Receptor Dataset).

With this information, the appraiser can then evaluate potential direct damages using the residential depth/damage data within Chapter 4 on MCM-Online.

STANDARD RESIDENTIAL DEPTH/DAMAGE DATA

Identifying the variables used to classify dwellings should be a routine procedure in the field. Firstly, identifying the type of dwelling can be done by obtaining the property type from the NRD or, if not available, from direct observation or an online tool such as OS Mastermap/AddressBase or Google 'Street view'. Secondly, by contrast, assessing the age of any dwelling may involve a small degree of subjectivity unless planning departments can provide mapped information. In addition, the ground floor threshold level and the presence of a basement must be clarified using a site survey.

INTANGIBLE BENEFITS AND LEVEL OF RISK

Unlike a strategy study, a more detailed analysis of intangible benefits is required at an outline scale of analysis. Rather than simply applying the weighted average figure of £279 per property per year, the intangible benefits need to be determined using Defra's risk reduction matrix (Defra, 2004), see Table 4.7 *Intangible benefits associated with flood risk management improvements.* Users are also directed to recent Environment Agency (2021) supplementary guidance for values associated with the impacts of flooding on mental health. Flood depth data can be used to assign values at this level of analysis. In addition, it is also recommended that a more detailed vulnerability analysis is conducted (see below).

Government guidance now requires appraisers to consider how the level of exposure to household flood risk varies with and without the proposed scheme. This requires the appraiser to determine the level of risk, such that:

- For areas of uniform risk (such as housing on level ground behind a structural flood defence such as a flood embankment), damages are based on common standards of defence of an area.
- For areas of greatly varying risk (sloping ground away from a river), damages are based on individual levels of property flood risk.

VEHICLE DAMAGES

Research for the MCM has ascertained the average value for a typical motor vehicle in the UK to be £5,600. Based on Department for Transport figures, the average number of vehicles per household is 1.24 (Department for Transport, 2021). We therefore recommend that the average loss value for project appraisals is £6,944 (£5,600 x 1.24 (rounded)) per residential property in the risk area. As vehicles are most likely to be damaged and also written off at flood depths of 0.39m – on health and safety grounds – this only applies to floods greater than 0.39m above ground level (not above property threshold level) at the location of the house in question.

It should be assumed that 25% of the residential properties in the benefit area will not have a vehicle present if a warning has been issued.

EVACUATION COSTS

The cost of evacuation depends on many variables. However, a direct link between the flood depth inside a property and the evacuation rate and time was established (Table 4.8 *The probability of evacuation and duration in relation to flood depth*). In an initial appraisal where flood depth has been calculated per property type, we recommend to estimate the evacuation costs as a function of the flood depth and property type. The table '*Evacuation Costs – Initial*' on MCM-Online provides the required information to perform the calculation for three different scenarios (high, low and average/indicative cost).

VULNERABILITY ANALYSIS

A vulnerability analysis for households comprises a method indicating the likely impact of floods of different severities on the households affected. Users are recommended to assess the following:

- The number of residents in the flood prone area (disaggregated by flood frequency if possible);
- The approximate proportions of households in each social group (from Small Area Census data), see: www.ons.gov.uk/census;
- The proportion of residences which are bungalows, basement flats or ground floor flats (often occupied by the elderly and infirm);
- Predicted flood depths (depths of over 0.6m can be life threatening);
- Flood warning lead-times;
- Other flood characteristics including the location of residences close to defences which may be over-topped or breached.

In undertaking a vulnerability analysis, it is sensible to concentrate on estimating the number of households who will suffer the most severe conditions and who are the most vulnerable. The variables in the SFVI, as well as those above, offer this potential.

FULL-SCALE APPRAISALS

In full-scale appraisals, it is appropriate to differentiate houses in the benefit area by their type, age and the social group of the occupants. This means that the most detailed direct damage data provided on MCM-Online can be used. In order to reflect socio-economic equity considerations this data should, where it is deemed to be 'necessary' and 'practical' (HM Treasury, 2003), be subjected to a distributional impact analysis. Data required for this analysis includes flood history, depth and duration, small area census data and general information on householders' views on the risk they face.

ADDITIONAL RESIDENTIAL DEPTH/DAMAGE DATA

The additional residential depth/damage data on MCM-Online takes into consideration several types and ages of residential properties, short, long and extra-long flood durations as well as different scenarios; saltwater, wave damage and various categories of water (Table 4.1).

To make full use of the additional residential depth/damage data sets, the social group of the occupants of the houses in the benefit area should be established. Because the social group variable derived from census data relates to the census output area (OA) as a whole, and not to the individual dwelling's occupants, the social group of individual occupants is calculated on the basis of

averages. For example, if 60% of the dwellings in the OA fall into the C2 category and 40% fall into the DE category, the depth/damage data should be weighted accordingly.

DISTRIBUTIONAL IMPACT ANALYSIS

The Treasury Green Book (HM Treasury, 2022) recommends that, where it is 'necessary' or 'practical', potential benefits should account for distributional impacts to incorporate social equity considerations into flood and coastal defence appraisals. Determining if it is 'necessary' or 'practical' then depends on a number of circumstances, including:

- The likely robustness of any calculation of distributional impacts. Whether a community at flood risk can be identified with reliable data and categorised according to their prosperity or social class;
- The type of project being assessed. Whether the assessment will contribute to an appraisal that demonstrates equity and fairness to people;
- The scale of the impact associated with a particular project or proposal. Whether the time and effort in undertaking the assessment is proportional to the scale of the overall appraisal, either at a strategic or feasibility level.

If a distributional analysis is not required, the standard residential depth/damage curves for the property type and age should be used, without accounting for social group. If a distributional analysis is required, total weighted factors should be applied by social group (Table 4.3). However, the total weighted factors for C1 and C2 will generally have a negligible effect. Therefore, use of total weighted factors is only recommended where AB or DE social class groups are predominant. Total weighted factors may then be applied to adjust the standard depth/damage data to obtain potential damages avoided taking account of distributional impacts.

A number of points are important in this government guidance:

- Both weighted and non-weighted results should be presented;
- Where property 'write offs' are considered, average values should be based on average 'no risk' values of properties of similar type and region;
- In areas with a high proportion of rented accommodation the social group of the owner of the property should be taken into account for building fabric damages and that of the occupier applied to content damages.

INTANGIBLE BENEFITS AND LEVEL OF RISK

At the full-scale level of analysis, the intangible benefits need to be determined using Defra's risk reduction matrix (Defra, 2004), see Table 4.7 *Intangible benefits associated with flood risk management improvements.* Users are also directed to recent Environment Agency (2021a) supplementary guidance for values associated with the impacts of flooding on mental health. Flood depth data can be used to assign values at this level of analysis. In addition, it is also recommended that a more detailed vulnerability analysis is conducted (see below).

Government guidance now requires appraisers to consider how the level of exposure to household flood risk varies with and without the proposed scheme. This requires the appraiser to determine the level of risk, such that:

- For areas of uniform risk (such as housing on level ground behind a structural flood defence such as a flood embankment), damages are based on common standards of defence of an area;

- For areas of greatly varying risk (sloping ground away from a river), damages are based on individual levels of property flood risk.

VEHICLE DAMAGES

For full-scale appraisals it is necessary to ascertain the number of vehicles in the risk area. This may be achieved by contacting local authorities or using ONS Census data (https://www.ons.gov.uk/census) which provides detail at various geographical levels. Once the likely number has been ascertained, this figure can be multiplied by £5,600 (the value per vehicle, not the value of vehicles per household, as above).

EVACUATION COSTS

In a full-scale appraisal the appraiser is expected to have a better knowledge of the duration of evacuation and the percentage of evacuation rather than relying on national averages figures. Based on local surveys and research, it is recommended that the appraiser modifies the input values for the percentage evacuated per depth band (cells B3:B9 in the 'Evacuation Cost – Full-Scale' table on MCM-Online) and for the mean duration of evacuation in weeks (cells C3:C9). The appraiser can then use the updated evacuation costs in the same table to perform the calculation for three different scenarios (high, low and average/indicative cost).

VULNERABILITY ANALYSIS

A vulnerability analysis for households comprises a method indicating the likely impact of floods of different severities on the households affected. Users are recommended to assess the following:

- The number of residents in the flood prone area (disaggregated by flood frequency if possible);
- The approximate proportions of households in each social group (from Small Area Census data), see: https://www.ons.gov.uk/census;
- The proportion of residences which are bungalows, basement flats or ground floor flats (often occupied by the elderly and infirm);
- Predicted flood depths (depths of over 0.6m can be life threatening);
- Flood warning lead-times;
- Other flood characteristics including the location of residences close to defences which may be over-topped or breached.

In undertaking a vulnerability analysis, it is sensible to concentrate on estimating the number of households who will suffer the most severe conditions and who are the most vulnerable. The variables in the SFVI, as well as those above, offer this potential.

"CAPPING" ANNUAL AVERAGE DAMAGE (AAD) VALUES

The capital sum worth investing to reduce the risk of flooding to any residential property should be "capped" at its market value. This is ideally done for all levels of project appraisal but certainly at the most detailed level.

The benefit calculation results should therefore be scanned for such cases, and their values reduced accordingly. The market values used should be the average for each property type for the Region involved, obtainable from the Land Registry. The UK House Price Index (UKHPI) uses house sales data from HM Land Registry, Registers of Scotland, and Land and Property Services Northern Ireland

and is calculated by the Office for National Statistics. Valuation data for England, Wales, Scotland and Northern Ireland and the English regions for all property, detached, semi-detached, terrace and flats is available at: https://landregistry.data.gov.uk/app/ukhpi/

Indicative property valuations for higher level geographic regions of the UK are given in Table 4.9 for information and comparison. The Environment Agency advises users to utilise these values (at International Territorial Level 1 (ITL1)) when undertaking appraisals in England.

The cap should be applied to each property that makes up the PVd (i.e. all properties that are directly affected). Other damages are calculated related to property damages (i.e. health costs, emergency services uplift, evacuation costs, vehicle damages). In these cases, their PVd values should be calculated separately. In England, if the capped value is reached no subsequent damages are added as it is assumed that the property is abandoned or made resilient (see Environment Agency (2022) and Environment Agency (2021b) for specific guidance). However, appraisers should consult the relevant guidance to check the rules on when damages should be capped as there may be some variations between nations.

ESTIMATING THE DAMAGE-REDUCING EFFECTS OF PROPERTY-LEVEL RESISTANCE AND RESILIENCE MEASURES

Property-Level Protection (PLP) measures include resistance and resilience measures. Resistance measures (e.g. flood guards) are designed to exclude floodwater from properties whereas resilience measures (e.g. concrete floors instead of timber ones) assume that floodwater will enter a property but internal features are designed to reduce flood damage potential. Both resistance and resilience measures are sometimes used in conjunction with flood warnings (i.e. their implantation is dependent on action being taken once a flood warning is received) but they may also be designed to be effective independent of warnings.

The following are examples of these measures:

- Barriers for doorways and airbrick covers (automatic or manually operated);
- Non-return valves for domestic and foul drainage systems;
- De-watering pumps;
- Waterproofing and sealants;
- Internal rearrangements for electrical outlets and wiring; and
- Replacement of floors and doors with materials, which have a comparatively low damage susceptibility.

The WAAD data for warnings in Table 5.4 must not be used together with estimates of damage-reduction through the use of PLPs. Instead the ‘no warning’ data should be utilised and from estimates of damages using these data, the damage-reducing effects of PLPs should be deducted.

ESTIMATING THE DAMAGE-REDUCING EFFECTS OF RESISTANCE MEASURES

Two approaches for estimating the benefits of resistance measures are available.

APPROACH 1

Step One

Identify residential properties in the benefit area which have resistance measures installed. Where grant schemes have led to PLP measures being installed records may be available which provide this information or alternatively a field survey may need to be undertaken. For an initial study, if the number of properties with resistance measures is small (say 5% of properties or less), it is probably not worth taking account of the effect of resistance measures in an appraisal. Otherwise (e.g. at the project appraisal level) the estimated damage-reducing effect of resistance measures must be taken account of in the appraisal. This is because PLP measures reduce damage at the more frequent flood return periods and will, therefore, have a significant effect on estimated annual average damages.

Step Two

Increase the ground floor residential property threshold level in the benefit area property database by 0.6 metres for those properties known to have resistance measures installed. Because these measures are only likely to be 75% effective the estimated flood damage savings at each flood return period needs to be factored by 0.75.

APPROACH 2

Step One

Calculate the number and then the total ground floor size (m^2) of residential properties at risk at each return period in the benefit area up to the 1.75 year flood probability threshold where flooding is not expected to be greater than 1m (TGA).

Step Two

The following formulae are, to a degree, progressively more reliable if sound local parameter values are substituted for the national average values (e.g. for UP, OP) are included in them below (Clarke et al., 2015).

The formulae may be used to estimate the total £ damage reduction owing to residential property warning-independent resistance measures (WIRB).

Equation 4.1

WIRB (£) = TGA * DR * UP * EF

where:
WIRB (£) is Estimated damage reduction (i.e. benefit) by employing WIRB measures
TGA is Total ground floor area of residential properties located in benefit area within 1:75 flood risk area and where flooding is not likely to be greater than 1m
DR is Damage reduction: £83.58 per m² at 2023 value
UP is Uptake of WIR measures factor: 0.032
EF is Effectiveness factor: 0.75

For warning-dependent resistance measures (WDRB) the equivalent formula is:

Equation 4.2

WDRB (£) = TGA * RA * DR * UP * OP * EF

where:
WIRB (£) is Estimated damage reduction (i.e. benefit) by employing WIRB measures
TGA is Total ground floor area of residential properties located in benefit area within 1:75 flood risk area and where flooding is not likely to be greater than 1m
RA is Reliability and Availability: 0.30
DR is Damage reduction: £43.08 per m² at 2023 value
UP is Uptake of WDR measures factor: 0.048
OP is Operated: 0.63
EF is Effectiveness factor: 0.75

Equations 4.1 and 4.2 are only an indicative guide to the value of residential property damage reduction through use of resistance measures.

ESTIMATING THE DAMAGE-REDUCING EFFECTS OF RESILIENCE MEASURES

The formula below may be used to estimate a guide value for the damage reducing effects of resilience measures on residential properties:

Equation 4.3

RISDR (£) = TGA * DR * UP * EF

Where:
RISDR (£) is Estimated damage reduction by employing resilience measures
TGA - Total ground floor area of residential properties located in benefit area within 1:75 flood risk area and where flooding is not likely to be greater than 1m
DR is Damage reduction: £86.16 per m² at 2023 value
UP is Uptake factor: 0.02
EF is Effectiveness factor: 0.50

When undertaking a benefit assessment, a decision will have to be made about a) whether or not to take account of the damage reducing effects of resistance and resilience measures (if they exist and are ignored benefits may be exaggerated) or b) to make allowance for them, possibly by using the above formulae. At the project appraisal level, PLP measures must be taken into account unless the proportion of relevant properties is a very small proportion of the total (i.e. say, less than 1%).

SOME "HEALTH WARNINGS"

- Damage estimates: Professional opinion varies on the precise effect of flood water on some inventory items. Susceptibility must be continually up-dated as more information becomes available;
- Inventory and building fabric data: Standard check-lists have been devised which are not exhaustive;
- Average Remaining Values are not empirically assessed;
- Items are generally assumed to be approximately half way through their lives which may distort downwards the potential damage estimates in some newly established households;
- Applying nationally based data to small areas locally may lead to errors;
- There have been recent cases were additional electricity costs for driers, blowers and dehumidifiers have been incorrectly included in appraisals. These were part of older versions of the Multi Coloured Manual but have been excluded since the 2013 update. The rationale is that the increased costs are offset by reduced electricity consumption due to properties being unoccupied. Environment Agency Economists will be monitoring this during assurance of applications for Defra Grant-in-Aid and we advise that you make sure these values are not included.

REFERENCES

Association of British Insurers (ABI) (2012) Telephone conversation with Matt Cullen, Policy Adviser, Flooding, Association of British Insurers, 19 November 2012

Clarke, J., McConkey, A., Samuel, C., Wicks, J. (2015) Quantifying the benefits of flood risk management actions and advice: flood incident management and property level responses. Report SC0900039/R stage 3, Environment Agency, Bristol, ISBN: 978-1-84911-360-1

Department for Environment, Food and Rural Affairs (Defra) (2004) Flood and Coastal Defence Project Appraisal Guidance, FCDPAG3 Revisions to economic appraisal on reflecting socio-economic equity in appraisal and appraisal of human related intangible impacts of flooding. Supplementary Note to Operating Authorities, July 2004, Revisions to Economic Appraisal, Defra, London

Department for Transport (2022). NTS0205: Household car availability: England. Available at: https://www.gov.uk/government/statistical-data-sets/nts02-driving-licence-holders#table-nts0205 accessed 14 April 2023.

Environment Agency (2021a) Mental Health costs of flooding and erosion. Available at: https://www.gov.uk/government/publications/mental-health-costs-of-flooding-and-erosion accessed 14 April 2023.

Environment Agency (2021b) Guidance Discount rates, price indices and capping: flood defence grant-in-aid. Available at https://www.gov.uk/government/publications/fcerm-grant-in-aid-discount-rates-price-indices-and-capping, accessed 14 April 2023.

Environment Agency (2022) FCERM appraisal guidance (FCERM-AG), (first published 02 September 2021 and last updated 17 May 2022) Environment Agency, Bristol, https://www.gov.uk/guidance/fcerm-appraisal-guidance, accessed 14 April 2023

H.M. Treasury (2022) The 'Green Book': appraisal and evaluation in central government, London, H.M. Treasury, (first published 18 April 2013 and last updated 18 November 2022) https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent accessed 14 April 2023

Office for National Statistics (ONS) (2023) Consumer price inflation item indices and price quotes. Available at https://www.ons.gov.uk/economy/inflationandpriceindices/datasets/consumerpriceindicescpiandretailpricesindexrpiitemindicesandpricequotes. Accessed 14 April 2023

Penning-Rowsell, E.C, Priest, S., Parker, D., Morris, J., Tunstall, S., Viavattene, C., Chatterton, J., Owen, D. (2013) Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal, London and New York, Routledge