Joint Defra/EA Flood and Coastal Erosion
Risk Management R&D Programme

The Appraisal of Human related Intangible Impacts of Flooding

R&D Technical Report FD2005/TR

Environment Agency

defra
Department for Environment
Food and Rural Affairs

Defra/Environment Agency
Flood and Coastal Defence R&D Programme

The Appraisal of Human-Related Intangible Impacts of Flooding

R&D Technical Report FD2005/TR

Publishing organisation
Defra Flood Management Division
Ergon House
17 Smith Square
London SW1P 3JR
Tel: 020 7238 6178
Fax: 020 7238 6187
www.defra.gov.uk/environ/fcd

Dissemination Status
Internal: Released Internally.
External: Released to Public Domain.

Statement of use - this report is intended to assist in the valuation of the health impacts of flooding on residents in England and Wales. The project report provides full details of the development of the survey methodology and analysis of the survey results. It also provides a detailed methodology for using the results to estimate the economic impact of these health effects in project appraisal. A simplified version of this methodology has now been circulated to all operating authorities in England and is available as supplementary project appraisal guidance at: http://www.defra.gov.uk/environ/fcd/pubs/pagn/fcdpag3/pag3suppjuly04.pdf.

Keywords - flooding, health, valuation, impacts, health measures, stress, willingness to pay, survey, at risk

Research contractor
Lead contractor: Risk & Policy Analysts Ltd (RPA), 1 Beccles Road, Loddon, Norfolk, NR14 6LT (Tel: 01508 528465; Fax: 01508 520758; www.rpaltd.co.uk). RPA was responsible for the overall management of the project and participated in all aspects of the work. The project director was Pete Floyd with research support provided by Carolyn George and other members of RPA staff.

The research team included: Flood Hazard Research Centre, Middlesex University (principally Sylvia Tunstall, Sue Tapsell and Colin Green), EFTEC (led by Ece Ozdemiroglu) and CASPAR, University of Newcastle (Michael Jones-Lee, Hugh Metcalf and Sue Chilton).

Defra Project Officer - David Richardson, Defra Flood Management Division,
Ergon House, Horseferry Road, London SW1P 2AL.(David.Richardson@defra.gsi.gov.uk)

The above outputs may be downloaded from the Defra/EA R&D Programme website (http://www.defra.gov.uk/environ/fcd/research), use the search tool located on the project information and publications page. Copies are held by all EA Regional Information Centres, contact The Environment Agency's National Customer Contact Centre by emailing enquiries@environment-agency.gov.uk or by telephoning 08708 506506.

FOREWORD

This report presents the results of a major research project. We would like to take this opportunity to thank all those who contributed to the study including members of the research team, the market research interviewers, staff from the Environment Agency and Defra Flood Management Division, members of the Project Advisory Group and, especially, members of the public.

In the course of identifying locations for focus groups and survey interviews, the researchers spoke to many residents to determine the nature and extent of recent flooding events. Without this information, which was always forthcoming, the researchers would not have been able to locate those households that had been flooded - which was critical to the success of this study.

During the course of this project, the researchers (and interviewers) have spoken to well over 2,000 members of the public who have either been flooded or are at risk of flooding in England and Wales. We are indebted to the numerous people who took the time (sometimes an hour or more) to tell of their experiences of being flooded - which, in some cases, was clearly distressing. Our gratitude also extends to those who had not experienced recent flooding but assisted us with their views on what it means to be at risk of flooding.

We hope that, as a result of this help, future decisions on flood and coastal defence will take greater account of the adverse impacts of flooding on human health.

Peter Floyd
Project Director

EXECUTIVE SUMMARY

Background

There are perhaps two million properties at risk of flooding in England and Wales. Flood and coastal defence projects are orientated towards the protection of 'tangible' assets (such as property, agricultural land, infrastructure, services, roads, etc.). Although recreational impacts are sometimes accounted for in the associated economic appraisals, environmental and health impacts (including loss of life) are rarely included.

Main aims

The aim of this major Defra/Environment Agency funded research project was to develop a robust, yet simple-to-use, methodology so that the impacts on human health and well-being can be accounted for in assessing the benefits of flood alleviation measures.

It is intended that the methodology will be applicable to all levels of appraisal from policy and programme evaluation to the appraisal of individual flood alleviation schemes. Furthermore, it is likely to be incorporated into Defra's Project Appraisal Guidance documents (such as FCDPAG3 on economics).

Results

The work was carried out in two phases:

- Phase 1 - to develop and validate survey instruments using focus groups and pilot surveys for i) health impacts; and ii) estimation of WTP (willingness to pay); and
- Phase 2 - to undertake a national survey and, based on the results, develop an economic appraisal methodology.

Two types of questionnaire were developed during Phase 1. The first of these covered the health impacts of flooding as well as the willingness to pay (WTP) to avoid such impacts, and was designed to be answered only by those who had experienced flooding within their house since January 1998. The second questionnaire was designed to explore the WTP of those who had not been flooded but were at risk of being flooded.

The initial development of the questionnaires involved nine focus groups and a set of one-to-one interviews which were held at various locations in England during autumn 2001. This was followed by a pilot survey (with 162 face-to-face interviews) which was carried out during spring 2002 in six locations. However, it was determined, in consultation with the Project Advisory Group, that further development work was required if the survey instruments were to be reliably used in the planned main survey. Following a series of trial interviews in August 2002, the revised questionnaires were piloted (with 53 face-to-face interviews) in two locations during October 2002.

Overall, it was found that the use of the revised questionnaires worked successfully under 'field conditions' (i.e. when administered by a market research company) and it was decided that the study could proceed to the main survey work (Phase 2).

The main survey (Phase 2) involved 1,510 face-to-face interviews (983 flooded and 527 at risk respondents) in 30 locations across England and Wales in autumn 2002. All 30 locations had suffered fluvial or surface water flooding to varying degrees since January 1998.

The results demonstrate that flooding causes short-term physical effects and, more significantly, short- and long-term psychological effects. In this study, a wide variety of health measures were used including the General Health Questionnaire (GHQ-12) and the Post Traumatic Stress Scale (PTSS). Overall, it was concluded that the GHQ-12, if applied retrospectively to the 'worst time' following the flood, provided a reasonable measure of the short-term psychological effects whilst the PTSS provided a reasonable measure of the long-term effects. The degree of health impact was associated with a wide range of factors including socio-demographic factors (especially prior health and age), flood characteristics (especially flood depth) and post flood events (especially problems with insurers in settling claims for flood damage which emerged as the most important factor).

More than 60% of flooded and at risk respondents expressed a willingness-to-pay (WTP) to avoid the health impacts associated with flooding. Of those that did not provide a value, some provided genuine zero value bids (for example, on the grounds of not being able to afford to pay extra amounts). When these were accounted for, the overall mean WTP values for flooded and at risk respondents were about £200 and £150 per household per year respectively. On the grounds that those that had been flooded had a better appreciation of what it means to be flooded, the higher value was taken forward. As for the health impacts, the WTP values provided by flooded respondents were associated with a wide range of factors but income and extent of long-term psychological effects (i.e. stress) emerged among the most important influencing factors. However, the most important factor was age with people in their 50s having the highest WTP values. It was also this age group which suffered the greatest short- and long-term psychological effects.

Recommendations

It is recommended that the value of £200 per household per year be taken as representing the benefits of reduced health impacts as a consequence of a significant reduction in the risk of flooding.

A simple methodology for incorporating such benefits into the cost-benefit analysis of flood and coastal defence schemes is recommended and was applied to four case studies. The results from the case studies suggest that although the economic appraisal will tend to be dominated by the much larger 'tangible' losses (damage to property, etc.), the inclusion of health impacts will, in some cases, lead to the selection of options with higher standards of protection.

Finally, it is recommended that consideration be given to the merits of undertaking further work to assess the health impacts on other groups who may be affected by flooding, with particular regard to the impacts on those who run small businesses (such as shopkeepers).

CONTENTS

1. INTRODUCTION

1.1 Background

There are perhaps two million properties at risk of flooding in England and Wales. Flood and coastal defence projects are orientated towards the protection of 'tangible' assets (such as property, agricultural land, infrastructure, services, roads, etc.). Although it is increasingly common for the associated economic appraisals to include recreational impacts, environmental and health effects (including loss of life) are rarely included.

The 'intangible' health effects induced by a disastrous occurrence, such as flooding, can include both physical and stress-related symptoms, for example loss of sleep, anxiety, a reduced immune system response and increased susceptibility to certain illnesses. Current guidance on economic appraisal for flood and coastal defence schemes is provided by FCDPAG3 (MAFF, 1999) which includes a section on the 'non-monetary impact on households', in which it is stated that "...impacts of flooding such as increased stress, health damage and loss of memorabilia can be far more important than the direct material damages to their homes and their contents...". Although this is acknowledged, it is also stated that "...there is currently no agreed method for evaluation of these indirect impacts..."; current methods only extend to the cost of renting alternative accommodation and/or the cost of the drying-out process (usually in the form of the cost of dehumidifiers). Given the possible acute and chronic health effects that can arise from a flooding incident, the costs attributed to these effects could be a major factor in flood risk decision-making[1].

These impacts are not only 'individual' losses but are also 'social' losses that are not currently attributed to flooding, and thus are losses to the national economy which are not being taken fully into account in the decision-making process. They relate to resource costs in terms of lost production and the costs of health care, in addition to the 'willingness to pay' (WTP) of people to avoid such impacts (or to be compensated for the experience). This study aims to assist in the determination of appropriate WTP values to avoid the health effects associated with flooding.

1.2 Study objectives

The aim of this research is to develop a robust, yet simple-to-use, methodology so that the intangible impacts on human health and well-being can be accounted for in assessing the benefits of flood alleviation measures. The specific requirements as stated in the Research Specification are to produce:

- greater understanding of the social issues that underlie the long-term health risks; and
- an easy to use methodology that can be used in economic appraisal to generate robust and defensible valuations for human-related intangible impacts of flooding, which should be based on the improved understanding of the relevant social issues.

[1] It should be noted that treatment of symptoms that are paid for by the health service, private insurance or compensated financially in any other way are not included in the definition of 'intangible' health effects.

It is intended that the methodology will be applicable to all levels of appraisal from policy and programme evaluation to the appraisal of individual flood alleviation schemes. Furthermore, it is likely to be incorporated into Defra's (formerly MAFF's) Project Appraisal Guidance documents (such as FCDPAG3 on economics).

1.3 The approach

The research was originally proposed to be carried out in two phases:

- Phase 1 - to develop and validate survey instruments (using focus groups and pilot surveys for i) health impacts; and ii) estimation of WTP (willingness to pay)); and
- Phase 2 - to undertake national health and WTP surveys and, based on the results, develop an economic appraisal methodology.

As a result of the Phase 1 work, it was agreed (at a Project Advisory Group Meeting held on 18 July 2002) that additional work would be required prior to embarking on the Phase 2 work. The key elements were:

- Phase 1A - to develop and pilot a WTP survey instrument that could be used more reliably in Phase 2 than that used in Phase 1; and
- Pre-screening of Addresses - to review data from the Environment Agency and undertake site visits to each of the 30 proposed Phase 2 survey locations.

1.4 The research team

A team of researchers from different organisations contributed to the overall success of this project.

The research team was led by Risk & Policy Analysts Ltd (RPA). RPA was responsible for the overall management of the project and participated in all aspects of the work. In particular, RPA undertook the literature review on methods of measuring health effects and all the substantial work involved in identifying locations for focus groups and survey interviews. Finally, RPA took overall responsibility for the Phase 2 analysis, the development of the economic methodology and for putting together this report and its appendices.

Flood Hazard Research Centre (FHRC) researchers, drawing on their previous experience, took main responsibility for the development and testing of the survey instruments to measure the health impacts of flooding during Phase 1 and Phase 1A of the research. FHRC also made major contributions to the analysis and reporting of the health impacts for both the Phase 1 and Phase 2 survey work.

EFTEC researchers were responsible for the development and testing (through focus groups, interviews and pilot surveys) of the Phase 1 choice modelling methods and undertook the analysis of the Phase 1 pilot survey WTP results. They also made contributions to the development of the valuation methods tested in Phase 1A.

Researchers at CASPAR (University of Newcastle) reviewed the economic valuation work of Phase 1 and Phase 1A and guided the development of the valuation section of the survey instrument used in the Phase 2 main survey and participated in the analysis of the WTP results.

The pilot surveys (in Phases 1 and 1A) were undertaken by interviewers from Carrick James Market Research and the main survey (Phase 2) was undertaken by interviewers from MORI.

1.5 Organisation of this report

Section 2 provides a review of the approaches to 'measuring' health and WTP, which provides the context within which the research was undertaken.

Section 3 provides an account of the development of the survey instruments used in the main survey work. As such, this covers the work of Phase 1 and Phase 1A.

The focus of this report is the main survey work which is described in Section 4. Section 5 outlines the economic appraisal methodology which is based on the key findings of the main survey.

The overall conclusions and recommendations are presented in Section 6.

2. MEASURING HEALTH AND WTP

2.1 Measuring the health effects of flooding

2.1.1 Introduction

The health effects caused by a flood event may result from: the event itself; the disruption and problems arising from trying to recover; and from the worry or anxiety about the risk of a flood re-occurring.

There are two main types of scales for measuring health effects that are of relevance to this study. The first of these relate to measurements of general health or well-being, whilst the second concentrates on determining the level of stress experienced. It should be noted that there are few studies that specifically focus on the health effects of floods, although much of the research on hurricanes includes some consideration of related flooding. In order to achieve an overview of the methods used to measure health it was considered beneficial to look more widely at literature that covers other natural disasters.

2.1.2 General health measures

Overview

A number of general health measures have been developed in recent years (Sturgis *et al.* 1998) which integrate both objective factors, such as behaviour and mobility, with subjective factors, for example a person's ability to fulfil the roles and expectations they have for themselves, and thus their well-being (Johnson *et al*. 1997). These indices can provide a quantitative measure of different levels of well-being and of people's preferences for various health states, with the advantage that all health states are described using the same standard descriptors. Some of the better known general health measures are the EuroQoL EQ-5D, the Quality of Well-Being Index (QWB), the Health Utilities Index (HUI III), and the Short Form (SF-36 and SF-12 versions). All of these measures are suitable for face to face interviews, or self-administration (for example, postal surveys), and require a very short period of time (i.e. less than 10 minutes) for completion.

QWB and HUI III

The QWB classifies patients according to three attributes, plus an additional attribute consisting of descriptions of symptoms, which may be helpful to identify health effects caused by flooding. Although use of the QWB has been discussed in relation to valuing changes in air quality in work for the Department of Health (1999), it appears to have been mainly used in the US and thus the ranking of health symptoms may not be relevant to UK populations. Similarly, the HUI III has never been used in the UK and, unlike other general health measures, there is no consideration of social role limitations. This scale also appears to be less relevant to the types of ill-health that may occur as a result of flooding.

EQ-5D and SF-36/12

In contrast, the main advantage of both the EQ-5D and the SF-36/12 is that they have previously been used on UK populations. Therefore the wording of the questions, and the rating of different health states, reflect UK preferences. However, the EQ-5D poses questions which are not directly relevant to the injuries/illnesses that would be expected due to flooding and it may not detect low levels of ill-health, which are also likely to be common. Therefore it would have to be used in combination with other scales, and this would increase the respondent burden.

The Short Form 36 (SF-36) was also developed in the US but has since been adapted for use in the UK, and it is suggested to be the most widely used generic health measure currently available (Sturgis *et al.* 1998). It covers a range of health dimensions to produce a health profile rather than an index (i.e. it does not produce a 'one number' summary of general health). The instrument was designed for use with both patient groups and general populations.

The Short Form 12 (SF-12) is made up of 12 items from the SF-36, but only produces scores for the physical and mental health components, rather than the eight dimensions of the SF-36. There is evidence that both the SF-36 and the SF-12 are more sensitive than the EQ-5D for detecting low levels of morbidity (Sturgis *et al.* 1998). Whilst it is perhaps not surprising that the SF-12 provides a less precise measure of health than the SF-36, it is found by many to represent a useful compromise between minimising respondent burden and comprehensiveness and precision of health measurement (Sturgis *et al.* 1998).

2.1.3 Stress related scales

Overview

Where there are longer term impacts on a person's psychological health, these may last beyond the occurrence of physical ailments. Much of the literature reviewed focuses on the occurrence of post traumatic stress disorder (PTSD) among disaster victims. However, the chance of suffering from PTSD is relatively low, and people may suffer from trauma symptoms without experiencing full PTSD (McFarlane *et al.* 1997 and Rick *et al.* 1998). Indeed, some would argue that there is often too much emphasis placed on PTSD when in reality people are experiencing common mental disorders or adjustment disorders.

There is a wide range of questionnaires, interviews and other tools that can be used to directly measure the types of stress effects of concern to this study. However, consideration of a wide range of scales led to the identification of three which were considered in more detail (see Table 2.1) for their possible use in relation to floods in the UK:

- the General Health Questionnaire-12 (GHQ-12);
- the Impacts of Events Scales (IES); and
- the Post-Traumatic Stress Scale (PTSS).

Table 2.1 Summary of stress related scales

Scale	Advantages	Disadvantages
GHQ-12	Commonly used scale Reliable and valid Used in recent annual Health Surveys for England	Does not focus on health impacts arising from a specific event May ignore short-term effects where long delay between event and completing survey
IES	Widely used Reliable and valid Measures stress in relation to a particular event	Considers health during the seven days prior to completing survey To be most useful it requires application over a range of time periods since a flood event
PTSS	Measures stress in relation to a specific event Reliable and valid Does not specify time period for symptoms Provides a continuum of scores, from no symptoms to full PTSD Up to date	Not widely used Developed in Australia, question of relevance to UK

GHQ-12 and IES

The GHQ (Goldberg and Williams, 1988) was designed to be a self-administered screening test aimed at detecting psychiatric disorders among respondents in community and non-psychiatric clinical settings. The questionnaire was designed to be easy to administer, acceptable to respondents (it was developed for and with London respondents), and fairly short, particularly in its 12 question form. It has been widely used in the UK and elsewhere and, in recent years, forms part of the (annual) Health Survey for England.

Although the GHQ has previously been used to measure psychological distress and mental health problems in relation to a variety of natural disasters[2], its weakness is that it is not event specific and thus psychological problems detected may not be related to the flood in question. In addition to this, the GHQ only considers symptoms experienced in the past few weeks, and this may result in the short and medium-term effects not being captured.

The IES (Horowitz *et al.* 1979) is one of the most widely used self-report scales in disaster research[3] and it is designed to measure the impact of a particular traumatic event. However, similar to the GHQ, it also relates to symptoms experienced in the previous seven days.

[2] For example, see Carr *et al.* (1997) for use of the GHQ-12 and McFarlane *et al*. (1997) for use of the GHQ-28.

[3] For example, see Carr *et al.* (1997) for use in relation to the 1989 Newcastle (Australia) earthquake, and Benight *et al.* (1999) for use on survivors of Hurricanes Andrew and Opal.

There are two approaches to overcoming these problems of both the GHQ and the IES. Firstly, it is possible to question people who have experienced flood events over a range of time periods to indicate how stress effects vary over time. However, this would ideally include questioning people immediately after a flood event and, depending on the timing of the survey, this may be difficult. Secondly, it was suggested that the questions could be asked twice, asking respondents to answer for their current health, and then to recall the 'worst' time after the flood and to recall the state of their health then. Within psychiatry, there have been a number of studies examining the possibility of modifying self-report and clinical interview procedures in order to identify worst time or life-time prevalence of mental illness in control groups and in the population in general (Bromet *et al.* 1986, McGuffin *et al.* 1986, Schwartz and Zuroff 1979 and Zuroff 1981). However, most relevant to this study is research by Power (undated and 1988) to develop a 'worst ever episode' version of the GHQ-28 scale. The scale was modified in that only a 'yes' 'no' categorisation was used for responses to each of the symptom items and minor changes to the wording were made so that they were in the past tense rather than present tense. The reliability of the 'worst ever' scale was tested through a six month follow up in which the respondents were asked to rate the same 'worst ever' episode that they had rated in a postal survey in the initial questionnaire. The worst ever version of the GHQ-28 was found to have good overall reliability with a good correlation for the total scores at the two time periods ($r + 0.833$, $p<0.001$) (Power undated). Although there is no example of the GHQ-12 being adapted for use in a 'worst ever' situation, Power's use with the more elaborate GHQ-28 provides a reassuring precedent.

PTSS

The Post Traumatic Stress Scale (PTSS), devised by Scott and Dua (1999), is designed as a diagnostic tool to categorise whether or not subjects are suffering from Post Traumatic Stress Disorder (PTSD). It also provides a measure of the frequency, severity and duration of individual symptoms and symptoms overall. It has three components: five questions concerned with 're-experiencing' the event; seven questions concerned with 'numbing and avoidance' and five concerned with 'hyperarousal'. Each of these can be considered as a separate scale and the data can be used to develop four separate scores. In relation to this study, particular attention was given to the PTSS Intensity score which combines responses to questions on frequency of occurrence with responses on distress caused by symptoms, and is regarded by the scale's innovators as the best method for interpreting the symptoms.

The PTSS includes questions about the duration of the symptoms experienced at the time of the survey. As a consequence, a wider range of (irregular) symptoms may be captured compared to the GHQ-12 and the IES, although it is still possible that short-term effects no longer experienced may be missed. Due to its recent development it has not yet been widely used, but it has been proved to be a valid and reliable tool for the diagnosis of PTSD. However, it is recognised that flood victims are more likely to experience only some PTSD symptoms, rather than full PTSD, and the main advantage of this scale is that it is able to provide a measure of very low levels of stress, giving a continuum of scores through to full PTSD.

2.1.4 Conclusions on the measurement of health impacts

A number of scales have been identified that may be capable of assessing the health effects resulting from flooding in the UK. It appears that there is not any one scale that would adequately capture both physical and mental health impacts. As a result, it has been necessary to use a combination of scales (this appears to be common practice from the literature reviewed).

It is important that the questions asked are applicable to the UK population and, with this in mind, use of the SF-12 was piloted as a general health measure, in preference to the EQ-5D which is unable to detect low levels of ill-health. Given the range of flood events and experiences it is likely that there will be a variety of health impacts, and thus it will be necessary to ensure that minor impacts are accounted for.

The advantages and disadvantages of the stress related scales are less clear cut. In order to measure stress, the most important issue appears to relate to the ability to focus on a single event (i.e. a flood), negating the need to know a person's mental state before that event. On the one hand, the GHQ-12 and IES have been widely used with natural disaster victims, and more generally in the UK. However, as discussed above, their weaknesses may result in identified symptoms unrelated to a flood event and little to no capture of short-term effects. On the other hand, the PTSS appears to ask more relevant questions and includes a measure of the significance and duration of symptoms, resulting in a single value index. Such an index will be useful in comparing flood characteristics with health impacts. However, the PTSS is also viewed with caution due to its relatively new development and lack of UK experience. In view of this, all three instruments were trialled in the subsequent focus groups to consider their inclusion in the survey instruments in more detail.

2.2 Economic valuation of intangible impacts of flooding

2.2.1 Introduction

Some economic costs of flood damage are 'tangible'. These include physical damage to property and possessions, and health impacts due to the flood. These costs can be estimated using data from actual markets. For example, for tangible health impacts, the following data can be used: any expenditures on averting and/or mitigating the effects of the illness (where this includes both private - individual/family and insurance - and public expenditures) and the value of lost earnings because of the illness. Most, if not all, of these tangible damages are already included in the conventional cost-benefit analysis of flood defence investments.

There are also 'intangible' damages caused by flooding. These include stress-related health impacts and loss of, or damage to, irreplaceable personal possessions (e.g. family photos, diaries etc.) and manifest themselves as the value of lost utility because of restricted activities, pain and suffering, anxiety about the future and concern and inconvenience to family members and others. These costs are not reflected in actual markets and hence cannot be estimated using actual market data. Generating evidence that such costs exist and producing initial estimates of their magnitude have been the focus of this study.

2.2.2 Economic valuation techniques

Overview

Economic valuation is concerned with expressing individuals' preferences in monetary units. The preferences can be expressed as willingness to pay (WTP) to secure an improvement or to avoid a degradation and/or willingness to accept compensation (WTA) to forego an improvement or to suffer degradation. Economists use valuation techniques that broadly fall into three categories: actual market data; revealed preference techniques and stated preference techniques, and these are discussed below.

Actual market data

As mentioned above, in the context of this study, actual market data are already used to estimate the cost of tangible impacts of flooding. The assumption behind this approach is that individuals' behaviour in actual markets and the prices they pay for goods and services are at least a minimum reflection of their preferences or willingness to pay. The proof is complex but the concept is simple: people would not be purchasing a good or service at a given price unless they thought it was worth at least as much as its price.

Revealed preference techniques

Revealed preference techniques analyse data from actual markets that are somehow linked to or reflect people's preferences for goods and services that do not have markets of their own. In the context of this study, the most relevant revealed preference technique is hedonic property pricing. Hedonic property pricing seeks to estimate an implicit price for environmental goods and services by analysing time series data on property transactions. This technique is based on the assumption that property prices are determined not only by the structural characteristics of the property (e.g. number of rooms) and the access to public services (e.g. schools) but also environmental characteristics (e.g. clean air, peace and quiet, pleasant views etc.).

The flood risk to a property can also be a variable influencing the price of property. Despite this, there are three reasons why hedonic property pricing has not been used in this study. The first is that hedonic property pricing is applicable only when people perceive the existence of an issue, such as flood risk, sufficiently for it to feature in property values. It is not always the case that such risks are known by potential buyers. The second is that even if such awareness is reflected in property prices, the resulting implicit price would include tangible and intangible flood damage rather than the intangible damage alone, which is the focus of this study. Finally, when the flood risk is known, its effect is not just a marginal decrease in the property price but may in fact render the property impossible to sell, effectively reducing the price to zero. This change is not conducive for hedonic property pricing.

Stated preference techniques

Stated preference techniques use carefully structured questionnaires to elicit respondents' preferences for a given non-market intangible effect. The techniques use structured questionnaires containing questions on attitudes, opinions, experiences, valuation scenario(s) and socio-economic characteristics. These questions have four purposes:

- to gather qualitative information about attitudes, opinions and experiences;
- to encourage respondents to think about the different aspects of the issue of concern;
- to estimate average WTP or WTA (valuation section); and
- to be able to explain this average amount by econometric modelling that creates a WTP function consisting of a number of variables such as attitudes, experiences and socio-economic characteristics.

Stated preference techniques were used in this study to elicit a 'value' for the health-related impacts of flooding.

2.2.3 Techniques used in this study

Overview

There are two variants of stated preference techniques: contingent valuation and choice modelling (DTLR, 2002). Both variants use similarly structured questionnaires but differ in the way they define the non-market effect of concern.

Contingent valuation

Contingent valuation is concerned with the non-market effect as a bundle of different attributes or characteristics. It estimates WTP (or WTA) for this bundle as a whole by asking respondents:

- open-ended questions (e.g. how much are you willing to pay to avoid flood x?);
- dichotomous choice questions (e.g. are you willing to pay £y to avoid flood x?); or
- payment card based questions (e.g. looking at a card listing a series of amounts, respondents are asked to choose the amount that corresponds to the maximum they would be willing to pay to avoid flood x).

In the context of this study, a contingent valuation survey would be used to estimate WTP to avoid a number of different floods described in terms of their attributes and impacts.

Flood defence investments affect individual attributes of flood events differently depending on the location, the severity of the flood event the defence is built against and the currently available defences. In order to produce a robust WTP value, the combination of flood characteristics valued by the individual must be the same as that for the flood defence it is being applied to. Therefore, the number of flood scenarios that could potentially be appraised is too large for a single contingent valuation survey (since each scenario would need to be tailored to the individual being questioned).

Choice modelling

The alternative, which can cater for a much larger number of flood scenarios, is to use choice modelling. Choice modelling is concerned with the individual attributes of, say, a flood and estimates WTP for these individual attributes.

Use of choice modelling in the context of this study would aim to:

- estimate how much people are willing to pay for a marginal improvement in each attribute of a flood;
- determine the implied ranking of these attributes;
- estimate the value of changing more than one of the attributes at a time; and
- estimate how much people are willing to pay to avoid a given flood so long as this flood is within the range of scenarios presented to the respondent.

The respondents are given current and potential future scenarios of, say, different floods which are explicitly defined in terms of their attributes. One of the attributes is always price or cost so that WTP can be inferred through econometric analysis of trade offs people make between other attributes and cost. There are a number of variants to choice modelling which differ in the way they present the respondent with the choice task. Only two of these comply with the requirements of economic theory: choice experiments and contingent ranking. Choice experiments require the respondents to choose their most preferred scenario. Contingent ranking requires the respondents to rank the given scenarios according to their preference.

The *choice experiment* variant of the *choice modelling* approach was trialled in this study as it was considered to be more robust in terms of compliance with economic theory than other variants of choice modelling.

Choice modelling in the literature

In undertaking the literature review, no economic valuation studies were found that covered exactly the same ground as this one is intended to, although the Department of Health (1999) cites two examples of choice modelling which have interesting parallels with flooding. The first of these was undertaken by Viscusi *et al*. (1991) in which a total of 389 respondents in North Carolina, USA, were asked to choose, if they had to move home, between different (fictitious) locations with differing risks of chronic bronchitis and death in a road accident. They were also told how the locations differed in the cost of living. From the expressed preferences between the locations, the researchers were able to infer people's willingness to trade an increased cost of living for a reduced risk of chronic bronchitis, and other trade-offs such as risk of chronic bronchitis for road fatality risk[4]. Another study by Diener *et al*. (1997) explored the values attached to a range of outcomes for air pollution in southern Ontario. Again the alternatives presented were based on variations in property rent and the health effects of air pollution. However, rather than assess individual WTP for a reduction in personal

4 Prof. Jones-Lee has commented that whilst he has had some success with using Viscusi *et al*.'s approach in a road safety study, the method was less successful when considering pollution, due to respondents reading additional disadvantages, not specified in the question, into an area with higher levels of pollution, e.g. it would be dirtier, less attractive etc.

exposure to risk, the questions were framed in terms of reductions across the region so that individuals had to make their own assessment of how much more or less their own household would suffer.

3. DEVELOPMENT OF THE QUESTIONNAIRES

3.1 Overview of Phase 1 work

During Phase 1, two types of questionnaire were developed. The first of these covered the health effects of flooding, and was designed to be answered only by those who had experienced flooding within their house (since January 1998). In its original form, this consisted of four components:

- information on person (age, sex and other socio-economic data);
- information on recent flooding event(s) (since January 1998);
- some broad questioning on health and well-being including three health check-lists[5]; and
- health scales as discussed in Section 2 (i.e. the SF-12, GHQ-12, and the IES or PTSS).

The second questionnaire, based on a choice modelling approach, aimed to explore the willingness to pay of people to mitigate the given attributes of a flood event. The survey was designed so that the amount respondents were prepared to pay includes only the intangible effects of flooding.

Unlike the health impacts questionnaire, the choice modelling questionnaire had to be asked to both those whose properties have been flooded and those whose properties had not been flooded but are located in 'flood risk' areas. Flood defence investments are made to benefit not only those who have already been flooded but also those who are at risk. This will continue to be the case in the future when the information from this study will feed into the appraisal of those investments. Therefore, it was necessary to capture the views of both those who have been flooded and those who are 'at risk'. Both versions of the questionnaires follow the same format:

- attitudes and opinions about flood attributes such as depth, duration, and dirtiness; and views about how to reduce flood risk or help those who suffer flooding (asked to all);
- valuation scenario: which explained the attributes of flooding used (asked to all);
- questions about the characteristics of the property at risk (asked to all) and, for those that had been flooded, further questions on their experience (e.g. height of water in the house; financial damage; loss of personal items; preventative actions; warning times; and experience of physical health impacts and stress suffered); and
- socio-economic characteristics such as gender, age, education, occupation, income, newspaper readership and so on (asked to all).

In order to assist with the development of the two questionnaires, nine focus groups and one set of one-to-one interviews were held at a number of locations. The following sections discuss the locations and findings of these focus groups, together with the subsequent development of the questionnaires in view of these findings.

---

5 These scales were previously developed and used by FHRC and cover: physical health effects during or immediately after flooding; physical health effects in the weeks or months after the flooding; and psychological health (see Tapsell *et al.* 1999; Tapsell and Tunstall, 2001).

3.2 Health focus groups

3.2.1 Locations and socio-demographics of focus groups

The five health focus groups were held between 26 July and 27 November 2001, comprising a total of 34 people who had experienced flooding. Participants in the groups were aged between 32 and 80 and comprised 17 women and 17 men of varying backgrounds and income. On the whole, people responded very positively to participating in the focus groups and took time in considering their responses to the various survey instruments they were asked to complete.

An overview of the nature of the focus groups and their participants is presented in Table 3.1.

Table 3.1 Details of focus group attendants

Location (date)	Last flood	Number of attendants	Age range	Male/female	Instruments tested
Yalding (27 July)	Autumn 2000	6	30s-70s	2:4	GHQ-12, SF-12, IES
Weybridge (13 Sept)	Autumn 2000	9	30s-80s	5:4	GHQ-12, SF-12, PTSS
Todmorden (19 Sept)	Autumn 2000	7	30s-60s	2:5	GHQ-12, SF-12, PTSS
Ruthin (1 Oct)	Autumn 2000	6	30s-60s	3:3	GHQ-12, SF-12, IES
Alconbury (27 Nov)	Easter 1998	6	39-63	5:1	GHQ-12, SF-12, PTSS

3.2.2 Purpose of focus groups

The main aims of conducting the focus groups were to test the applicability and usefulness of the various questions and health measures. It should be noted that many of the questions and check-lists have been used by FHRC in previous studies and the ‘new’ items focused on the use of the formal health scale questionnaires.

The location for the last trial of the questionnaires was Alconbury (and Alconbury Weston) in Cambridgeshire. The prime purpose of this group was to trial a modified version of the PTSS within the questionnaire. In addition, it was considered desirable to test the questionnaire in an area affected by floods some time ago (Easter 1998 as opposed to the more recent floods of Autumn 2000 as experienced in other focus group areas).

3.2.3 Key findings and implications

Discussions during the focus groups, and analysis of the results from the survey instruments, proved to be very useful in informing the research project and in helping to identify problems and issues that needed to be addressed when finalising the main survey instrument. A number of conclusions can be drawn and points raised.

Some problems of definition arose during the focus groups, leading to refinement of the questionnaires. For example, it was questioned whether ‘flood’ implied flooding anywhere on the property including gardens, below ground floor flooding, or only that above ground-floor level. Given that, in the majority of cases, health effects from flooding would most likely be expected from floodwaters entering the living areas of a house, this was used as the definition of a ‘flood’ for this study. A further question arose over ‘flood warning’, which was subsequently taken to mean any type of warning and not only ‘official’ warnings from the Environment Agency, since any warning is likely to have the same effect.

The health effects checklists worked well and provided a general overview of symptoms experienced by the household immediately after the flood as well as longer term effects. It also proved to be a simple exercise for them to be completed. They were also slightly refined following comments from focus group participants, including extending the questions to cover other members of the household.

From the Alconbury focus group it would appear that people are able to answer questions about flooding even when it happened several years earlier. However, there is always a chance that these recollections may not be as accurate as those from people interviewed sooner following a flood. However, the focus group did demonstrate that people are apparently still experiencing psychological effects from the flooding three and a half years after the event.

The survey instruments tested in the focus groups were all demonstrated to work well. The GHQ-12 and SF-12 were both easily administered in the focus groups and provided some interesting results. At the time, it was considered that use of these instruments in the main survey would allow a comparison with the general population, using results from the Health Survey for England. With regard to the IES and PTSS, it was felt that only one should be used in the main survey, due to the overlap between the two scales. Although the PTSS encountered some teething problems, subsequent revisions appear to have solved these problems[6]. In view of this, the PTSS was preferred to the IES as a result of its ability to provide a continuum of scores, from ‘no effect’ to a diagnosis of PTSD. Although there is some question over the relevance of the PTSS for UK populations, use of the GHQ-12 and SF-12, in conjunction with the PTSS, should provide support for the results.

A further point arising from the focus groups is that all the survey instrument scales used are designed to measure the effects on adult individuals. However, flooding is generally experienced within a broader context e.g. the family, household, and community. Evidence indicates that this social context is important in influencing the effects of flooding, and that the sum of the individual impacts will not necessarily be the same as that of the whole. The PTSS covers some key social issues which are not covered by the GHQ-12, SF-12, and IES.

[6] In particular, the phrase ‘the traumatic event’ was replaced with ‘the flood’ to ensure that respondents focused on the impacts of the flood event in addressing such issues as ‘I have recurring dreams of the flood’. This minor change was not considered to invalidate the questionnaire.

The experiment of administering the GHQ-12 and SF-12 instruments twice (to account for current and most severe health effects) also worked well and provided additional information. However, given that this approach has not been taken before, there was uncertainty as to whether repeating the survey instruments is a valid method to use in the main survey. The evidence from the focus groups supported the use of this approach in the pilot survey, but the results should be viewed with caution.

A further methodological question to consider when repeating the health questionnaires, and one which was not (in hindsight) adequately addressed in the focus groups, is the *order* of doing this, so as not to 'contaminate' the response. The consensus was that it is better to ask people to complete all three questionnaires (i.e. GHQ-12, SF-12 and PTSS) relating to their recent health first and then to repeat them (GHQ-12 and SF-12 only) for when the effects were at their most severe.

3.3 Choice modelling focus groups

3.3.1 Locations and socio-demographics of focus groups

Four choice modelling focus groups were held at two locations, with separate groups testing the 'at risk' questions and the 'flooded' questions at each location. These were London Colney, Hertfordshire and Lamberhurst, Kent. Twenty-nine participants attended these focus groups, comprising of 14 men and 15 women aged between 30 and 80.

As a result of these focus groups it was felt that further work was required to refine some of the key parameters used in the various scenarios (with particular regard to the use of 'risk' terms and the range of monetary values to be employed). In this respect six one-to-one home interviews were held in Alconbury, Cambridgeshire on 5 December. During the interviews the respondents were asked the reasons behind their answers and were allowed to ask questions for clarification. The reason for choosing this format was twofold:

- it was thought that another focus group would not provide any additional information about the main objectives than the first four had provided; and
- it was considered beneficial to test various versions of the valuation scenario in a setting more similar to an actual survey.

Further details of the focus group attendants/interviewees are given in Table 3.2 (next page).

3.3.2 Purpose of focus groups

The main objectives of the choice modelling focus groups for this study were to:

- gauge the level of interest in and knowledge about the intangible effects of flooding;
- identify the intangible effects of flooding that concern the participants;
- identify the attributes of a flood event that concern the participants;

Table 3.2 Details of focus group attendants and interviewees

Location (date)	Last flood	Number of attendants/ interviewees	Age range	Male/female	Nature of attendants/ interviewees
London Colney (24 Sept)	Autumn 2000	4	40-50	2:2	At Risk
London Colney (25 Sept)	Autumn 2000	10	30-50	5:5	Flooded
Lamberhurst (17 Oct)	Autumn 2000	8	40-80	5:3	At Risk
Lamberhurst (24 Oct)	Autumn 2000	7	30-60	2:5	Flooded
Alconbury (5 Dec)	Easter 1998	3	25-55	2:1	At Risk
Alconbury (5 Dec)	Easter 1998	3	30-44	0:3	Flooded

- identify the preventative measures the participants have taken and/or believe should be taken;
- identify which institutions/people provided the most/least support in the event of the most recent flood;
- test the preliminary designs of the valuation scenario for credibility, and clarity; and
- investigate potential ways of funding the flood defence investments (e.g. via water rates, local taxes etc.) to define the cost attribute.

The focus groups were organised sequentially, with sufficient time between each focus group to allow revision of the questionnaires in the light of the findings of the previous discussions. The revisions after each focus group meant that, at each group, a slightly different set of issues was discussed.

3.3.3 Purpose of Alconbury interviews

The objective of the one-to-one interviews in Alconbury was to test three different versions of the choice modelling questionnaire (flood attributes) and gather further information about potential payment vehicles. There were three versions of the choice modelling, each presenting two scenarios (pre and post policy) and a payment card. The respondents were asked to choose their preferred scenario and then choose the amount that they would be willing to pay to achieve that scenario among those listed on the payment card. Each scenario was defined for the next five years (given that anything less than five years is too short and over 10 years is too long).

3.3.4 Key findings and implications

The focus groups and one-to-one Alconbury interviews had a number of implications for the final questionnaire design, which are summarised below.

The original questionnaire design had two choice modelling questions: (i) flood attributes and (ii) flood consequences (i.e. health impacts) (as tested at London Colney and Lamberhurst). From the focus groups and interviews, it was clear that participants found this double task too confusing and tiring. Given that the first version is the main requirement from this study, it was decided to drop the second choice modelling question.

The wording of the attitudes, opinions and experience questions were written in the wording used by the focus group and interview participants. Consequently the wording of some of the questions in the earlier versions was simplified.

Some of the questions contain multiple choices such as the question about flood prevention measures or the questions about why a respondent is or is not willing to pay for flood defence. The full list of these choices for each question and the wording of the individual choices also come from the focus group discussions and one-to-one interviews.

The attributes used in the choice modelling questions are those that participants mentioned as 'most worrying'. A number of different expressions of some of the attributes were tested. The definitions used reflect what the participants found to be the easiest to understand and the most credible.

Finally, the levels each attribute takes are either based on the background research establishing the 'current situation' or from what the participants expressed as credible. Thus, background research, focus groups and interviews resulted in the following selection of attributes, their definitions and the levels prior to the first pilot survey:

- risk of flood expressed as percentage chance of a flood happening in a given area over the next five years. The levels were: 0.5%, 1%, 2.5%, 3%, 5%, 6%, 7%, 10%, and 20%;
- depth of floodwaters inside the property expressed as 'cm' and 'inches'. The levels were (in cm) 10, 25, 50, and 100. These levels were presented both as cm and inches to the respondents;
- warning time before a flood occurs expressed as 'hours'. The levels were (in hours) 0, 3, 7, 12, and 15; and
- annual cost expressed as increase in a locally collected charge for flood defence expressed in £ per year for the next five years. The levels were (in £ per year) 0, 100, 250, 600, and 1500.

The five-year time horizon presented in the valuation scenario is in some ways an arbitrary choice. However, the focus group discussions showed that the participants preferred to think of a limited time period rather than the willingness to pay questions that stretch over a very long time period. Taking this into consideration, 10 years seemed a long time and less than five too short. Therefore, the decision was to use the five-year time horizon and this worked well in the one-to-one interviews.

3.4 Pilot surveys

Following the development and finalisation of the two questionnaires, a pilot survey of approximately 200 questionnaires was planned at various locations.

The pilot surveys were to be undertaken in seven locations (with addresses provided by the National Flood Warning Centre) in two rounds of 100, covering 50 of each questionnaire. This was to facilitate further development of the questionnaires and enable revisions to be incorporated between the first and second rounds. Approximately 1,350 letters were sent to selected addresses in the pilot study areas advising of the possible imminent arrival of interviewers from Carrick James (the market research company appointed to undertake the fieldwork). Environment Agency staff in each of the areas were alerted to the pilot survey, primarily to reassure concerned members of the public.

In three of the pilot areas, problems emerged prior to the commencement of the interviews:

- for Northfield, it transpired that a significant proportion of the addresses provided to the interviewers related to a sheltered housing complex for the elderly - which greatly reduced the number of addresses the interviewers were able to use;
- for Ruthin, the Environment Agency advised that any survey work should be undertaken in both English and Welsh. Since this would have introduced further delays for an area where difficulties had been encountered in obtaining reliable data (on flooded and at risk properties), the proposed use of Ruthin was abandoned; and
- for West Lynn, it was perhaps unfortunate that some residents were trying to oppose a large nearby development in this flood risk area. This may have influenced the manner in which questions were answered.

Further details of the pilot survey areas used and the response rates are given in Table 3.3. Given the practical difficulties that were encountered in some areas, it was found difficult to achieve the initial target quota of 200 responses. In total, 162 responses were received, consisting of:

- 72 responses to the health impacts questionnaire;
- 48 responses to the CM questionnaire (‘at risk’); and
- 42 responses to the CM questionnaire (‘flood victim’).

Table 3.3 Summary of pilot survey

Pilot Area	Addresses Provided	Initial Targets[1]	Round 1 Responses[2]	Round 2 Responses[2]	Further Comment
Leamington Spa	398	20 health 10 CM flooded 10 CM at risk	3 health 7 CM flooded 3 CM at risk	1 health 3 CM flooded 6 CM at risk	Although some addresses were found to be businesses, there was a very low response rate for the health questionnaires for reasons unknown.
Northfield	130	20 health 10 CM flooded	10 health 5 CM flooded	9 health 4 CM flooded	Although a significant number of addresses were found to be an OAP complex, a good response rate was obtained.
Lewes	357	20 health 10 CM flooded 10 CM at risk	8 health 7 CM flooded 5 CM at risk	19 health 5 CM flooded 4 CM at risk	Many refusals in Round 1 and interviewer had difficulty in dealing with flood victims (in terms of time taken and associated distress). In Round 2, a high response rate was achieved (80%) although the contact rate was only 20%.
Ruthin	494	20 health 10 CM flooded	None		Ruthin was not proceeded with.
Waltham Abbey	178	20 health 10 CM flooded	10 health 5 CM flooded	12 health 6 CM flooded	Although the list of 178 properties was reported to cover flooded properties, many of the addresses were found not to have been flooded. However, a 90% response rate was achieved in Round 2.
Derby	98	10 CM at risk	2 CM at risk	8 CM at risk	Many did not believe that they were 'at risk'. Also a significant number of the properties did not have common access. However an 80% response rate was achieved in Round 2 (with a contact rate of 55%)
West Lynn	190	20 CM at risk	11 CM at risk	9 CM at risk	Although an initial high refusal rate, sufficient addresses available to reach quota in Round 1 and a 100% response rate was achieved in Round 2.
Overall		100 health 50 CM flooded 50 CM at risk	31 health 24 CM flooded 21 CM at risk	41 health 18 CM flooded 27 CM at risk	Although the number of CM responses was 90 (out of a target of 100), the number of health responses was below expectations (72 out of a target of 100).
Totals		200	76	86	

Notes: [1] The initial targets represent the overall numbers of responses based on both rounds of the pilot survey and the inclusion of Ruthin.
[2] Ideally, the responses for each round should have been 50% of the 'initial targets' with a few additional responses to make up for the loss of Ruthin.

Before proceeding with a review of the results, it is worth highlighting three key points which emerged from Table 3.3 and which needed to be taken into account in undertaking subsequent survey work:

- properties listed as flooded by the Environment Agency may have suffered flooding in gardens and outbuildings rather than within a living area of the home (which is the threshold for 'flooding' for the purposes of this study as previously discussed);
- to achieve a reasonable success rate, there needs to be a degree of 'on the ground' screening to avoid some of the site-specific problems encountered (difficult access, properties within a sheltered complex, etc.); and
- the overall success rate depends on both the 'contact rate' (i.e. percentage of addresses which result in contact with residents) and the 'response rate' (i.e. percentage of contacts who agree to become respondents).

It appears (with the notable exception of Leamington Spa) that the interviewers were able to achieve a far higher response rate (80% or more) in Round 2 when 'targeting' likely respondents based on their experience from Round 1. This reinforces the second bullet point above.

It would also appear that, in some cases at least, the interviewers tended to make a single pass through a range of addresses to make contacts (resulting in some low 'contact' rates). Clearly, repeat visits would increase the contact rate and, thereby, the overall success rate. It is worth noting that there appeared to be no significant difference between the success rates for those that had been flooded and for those at risk of flooding.

Overall, the results suggested that a success rate of 25% is achievable assuming that the addresses are first screened (remotely) to remove obvious businesses, upper storey flats, etc. The remaining addresses would then be further screened 'on the ground' to remove further site-specific problems where these would include: areas which do not have common access, sheltered housing, and areas which have not flooded (or are not at risk of flooding) contrary to the information supplied by the Environment Agency.

3.5 Analysis of responses to the health impacts questionnaire

3.5.1 Objectives and methods of the pilot survey

The objectives of the pilot survey on the health impacts of flooding were:

- to test the questions and instruments that were selected and used in the qualitative research stage of the project;
- to examine through analysis whether the variables included in the questionnaire include all those that might be relevant, and to test whether the variables are in the most useful form for analysis and modelling purposes;
- to measure the extent of health impacts of flooding using the chosen instruments and questions; and
- to investigate the extent to which health impacts varied according to the characteristics of the flood event (depth, duration, speed of onset, recency of the

event), the characteristics of the respondent (age, gender, social class, income and other vulnerability measures such as having children) and whether or not there was a flood warning.

Since only very minor adjustments were made to the survey instruments between rounds 1 and 2, the data from the two phases were combined to create a single pilot data set of 72 responses for the following analysis. It was intended that the interviews would take 45 minutes to complete. In the event, interview durations ranged from 25 to 80 minutes with a mean of 48 minutes.

It must be emphasised that respondents were asked to focus on the effects of the 'worst' (as opposed to the most recent) flood experienced since January 1998. As such all the reported flood characteristics and associated effects relate to this 'worst' flood.

The key findings from the two rounds of the pilot surveys are discussed below with further detail on the responses provided in Annex 1.

3.5.2 Measures of health impacts

Overview

The four main measures of health impacts of flooding (focusing on the impacts of the 'worst' flood) used in the pilot survey were:

- GHQ-12 scale;
- SF-12 scale;
- PTSS scale; and
- Self-reported health effects of flooding.

Three of the four measures for health impacts were analysed but the use of the SF-12 had to be abandoned as it proved not to be possible to obtain the associated formal guidance for its use within the timeframe of the study.

GHQ-12

The GHQ-12 was administered twice: for the respondents' current health 'over the past few weeks' (current) and 'with reference to their health at the time when flooding was most severe for them' (the worst time). In addition, the GHQ was scored by two methods: the GHQ method (scale 0-12) and the Likert method (scale 0-36).

In GHQ Method scoring (0-12 scale), the first two response categories (no symptoms) are both given a zero score and the third and fourth categories (some symptoms) are both given a score of one. This simply differentiates between those with and without symptoms without taking the degree of effect into account.

A GHQ Method score of four is conventionally regarded as 'high' and as a threshold indicative of the presence of some degree of mental health problems (Goldberg and Williams 1988, Erens and Primatesta, 1999). In the pilot survey, 38% of the flood victims (27 respondents) had a current GHQ Method score of four and over and thus could be regarded as potential mental health cases. In the Health Survey for England 1998, the proportions scoring four or more on this scale were 13% for men and 18% for women. This suggests a significantly greater number of 'cases' among the flood victims than among the English population in general.

In the Likert GHQ scoring, the response categories are scored 0,1,2,3 to produce a 'Likert scale' from 0 to 36. The research suggests that 11-12 is the most effective threshold indicating potential mental health cases. Using this scoring method, a markedly higher proportion of the flood victims came into the 'case' category on the basis of their current GHQ Likert score, 71% (50 respondents), partly because there were a large number of respondents (18) with a score of 12, just over the threshold.

Respondents were asked 'at what stage during or after the flooding were the health impacts the most severe or worst for you personally'. From the pilot results, it appears that the worst health effects occurred early on: during the event itself and in the first weeks and up to a month after the event for most of those affected (70%). There were very few respondents for whom the worst time was later on in the recovery period (more than three months after the flood).

The GHQ scores reported were markedly higher for 'the worst time' when effects on health were regarded as most severe. At this time, 85% of flood victims (56 respondents) had scores that put them in the 'case' category using the GHQ Method scoring and, for the Likert scoring, the proportion was 90% (60 cases).

The retrospective use of the GHQ-12 is a novel approach and the associated reliability and validity has not been explored and tested. Therefore, the results of these analyses must be treated with some caution.

Nevertheless, the application of the GHQ-12 to flood victims suggests the presence of substantial mental health problems at the current time and even more severe impacts when the effects of flooding were most severe.

Post Traumatic Stress Scale (PTSS)

Although attention was focused on the PTSS Intensity score, further analysis indicated that six (about 8%) of the pilot flood victims could be classified as suffering from PTSD. It is possible that those most seriously affected were more likely to agree to participate in the survey (or, indeed, that the interviewers were directed by neighbours to such people) and that, therefore, the pilot results are not representative of the health impacts overall and overstate the likely number of PTSD sufferers in the flood victim population.

As the PTSS is a relatively new scale, there are few (and no UK) studies available using the scale with which to compare the pilot results. Therefore, the PTSS Intensity scores of the flood victims interviewed in the pilot study are shown in Table 3.4 for comparison alongside the results obtained by Scott and Dua (1999) in their research to establish the reliability and validity of the scale. The PTSD Group consists of Vietnam war veterans diagnosed by a psychiatrist as suffering from PTSD. The Trauma Group consists of subjects attending professional counselling for a variety of traumas such as bereavement, traffic and work accidents, domestic violence and child abuse. The third, Non-Trauma Group had never been diagnosed as suffering from PTSD and had never received counselling. This group contained some people who worked in trauma related occupations: police, firemen, soldiers and nurses and some people being treated for brain damage and accident related trauma. All were volunteers from New South Wales and Queensland Australia.

As can be seen from Table 3.4, the mean PTSS Intensity score of the pilot study respondents was lower than those of the first two groups but higher than those of the Non-Trauma Group. In the Scott and Dua data none of the Non-Trauma Group were found to have PTSD using the PTSS compared to six (8%) in the pilot sample. Considering that most flood victims were interviewed some months and indeed years after the flood event, the finding indicates that the flood event had a marked impact at least on a small minority of the victims.

Table 3.4 Comparison of PTSS and GHQ scores obtained in the pilot study with scores from Scott and Dua's validation studies

Sample	PTSS Mean Intensity score	Diagnosed as a PTSD sufferer	PTSS Number of subjects	GHQ-12 Likert score mean[1]	GHQ-12 Number of subjects
PTSD group	222.59	50	52	35.59	52
Trauma group	73.14	20	64	31.75	64
Flood victims	*43.36*	*6*	*69*	*14.99*	*70*
Non-trauma group	11.03	0	176	21.08	176

Notes: [1] The GHQ Likert score is based on the results for 'current' health

The results from the PTSS can also be compared with those from the self-reported health scales (discussed below) - and a good correlation was found between the PTSS scores and the number of psychological health symptoms experienced.

Self-reported physical health effects during or immediately after flooding

Most of the respondents, 58 respondents out of 71 (82%) experienced at least one immediate physical health effect from the flooding. Of the 10 listed effects, the most common response was shock experienced by more than half, followed by headaches, colds, coughs and flu. Significant correlations were found between the number of immediate physical health effects reported by a respondent and the GHQ-12 and PTSS health scales used in the survey. As would be expected, these are strongest for associations between the immediate health effects and GHQ scores 'at the worst time'.

Respondents also reported on the immediate health effects on other adults in the household and on effects on children. In total, 47 households contained another adult and 20 contained children aged under 18. Respondents may have hesitated to report on the effects on others and the number of effects reported is lower for others and for children possibly as a result. A third of the respondents reported no effects on other adults in the household. For those reporting effects, the pattern of responses was similar to that for the respondents themselves. Shock was again the most common immediate effect, felt by 25, followed again by headaches (12) and exposure to contaminants (9).

Six out of 20 households containing under 18 year olds indicated that there were no immediate health effects on the children in the household. Shock, exposure to chemicals, and colds, coughs and 'flu were the most common symptoms among children.

Self-reported physical health effects in the weeks or months after the flooding

Fewer respondents reported health effects in the weeks and months after flooding than had felt immediate effects, this is probably because so many experienced shock at the flooding. As many as 26 out of 71 or about a third (36%) reported no physical effects to themselves in the post event period. Of the 16 listed possible health effects, the most common were stiffness in the joints, respiratory illnesses, including asthma and pleurisy, stomach upsets, weight loss, muscle cramps, skin irritations and sprains and strains.

Many respondents experienced only one (25%) or two (14%) of the effects. There was, however, a minority of respondents affected in many ways (5 or more effects: 14% of all respondents). There were again significant correlations between the number of physical health effects in the aftermath of flooding reported by a respondent and the GHQ-12 and PTSS health scales used in the survey. These were strongest for associations between the physical health effects and GHQ scores 'at the worst time'- which was generally considered to be up to 3 months after the flood, thus the GHQ scores 'at the worst time' may, in some cases be referring to the same time that these later health effects were experienced.

There was also an association between the number of physical effects reported in the immediate period of the flooding and the number reported for the weeks and months after the flood. This could be because flood events likely to result in immediate effects are also likely to result in effects in the longer term. Alternatively it could be that individuals susceptible to immediate physical effects are also likely to be susceptible in the weeks and months afterwards.

Self-reported psychological health

Only four respondents did not report any psychological effects of flooding and the numbers reporting many of the effects were much larger than for the physical effects, as shown in Table 3.5. The most common psychological effect reported was anxiety when it rains which 80% of flood victims experienced, followed by increased stress levels and sleeping problems. Over a third suffered from lethargy or lack of energy, flashbacks to the flood, mood swings or bad moods and difficulty in concentrating on everyday tasks. Mild and moderate to severe depression affected significant minorities of flood victims. Increased tension in relationships and panic attacks were also quite common. A minority (18%) admitted to increased use of alcohol or prescription or other drugs. Six reported that they had had thoughts of suicide.

Many more flood victims suffered from multiple psychological effects. Nearly half (49%) reported that they experienced 5 or more of the 17 possible psychological effects.

Table 3.5 Self-reported psychological effects of the flooding

Psychological effects	Respondent		Other Adults		Children	
Anxiety when it rains	80%	57	65%	30	35%	7
Increased stress levels	65%	46	57%	26	15%	3
Sleeping problems	51%	36	41%	19	15%	3
Lethargy/lack of energy	39%	28	26%	12	10%	2
Flashbacks to the flood	36%	26	22%	10	5%	1
Mood swings/bad moods	35%	25	24%	11	15%	3
Difficulty in concentrating on tasks	35%	25	22%	10	15%	3
Increased tension in relationships	31%	22	28%	13	20%	4
Mild depression	27%	19	15%	7	5%	1
Moderate depression	18%	13	15%	7	5%	1
Severe depression	11%	8	11%	5	-	-
Panic attacks	27%	19	15%	7	5%	1
Anger/tantrums	24%	17	15%	7	15%	3
Increased use of alcohol/drugs	18%	13	15%	7	-	-
Nightmares	18%	13	11%	5	15%	3
Thoughts of suicide	9%	6	4%	2	5%	1
Other	6%	4	4%	2	5%	1
None	6%	4	4%	2	45%	9
Total	71		46		20	

The number of psychological health effects reported was quite strongly correlated with the PTSS Intensity score. This is as expected but does indicate that the PTSS scale is measuring comparable effects to the self-reported effects scale which was developed on the basis of specific symptoms and experiences volunteered by flood victims during qualitative research. This provides an indication that the PTSS is valid for use with flood victims. The correlations with the various GHQ scores were also moderately strong. For the psychological effects, unlike the physical effects, the correlations were as strong with the GHQ scores for the current state as with the 'worst time' scores.

There were links too between reporting physical effects both immediately and in the aftermath of flooding and reporting psychological effects.

The psychological effects reported by the respondents as experienced by other adults and by children in their household were lower than the effects respondents reported for themselves in most cases. This may be because the respondents did not have any way of fully knowing about the psychological state of others as a result of the flooding and therefore these data must be treated with some caution. It is particularly notable that the respondents thought that 45% of the children in their households suffered no psychological effects from the flooding.

3.5.3 Factors affecting health

This section presents an overview of the analysis with a focus on the results of multivariate regression. Further detail on the relationships between individual characteristics and health impacts is to be found in Annex 1.

In its simplest form, multivariate regression analysis involves fitting an equation of the form:

$$y = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + ... a_nx_n + u$$

to a set of observations where y is the dependent variable (i.e. the variable to be explained), the a_i are constants, the x_i are explanatory variables (i.e. the variables that principally determine the level of y), and u is a random error term capturing all other factors (including the pure randomness of human behaviour) that affect y.

The associated 'multiple coefficient of determination', R^2, will lie in the range 0 - 1, or 0% - 100% (where 1 (100%) represents a perfect fit, i.e. y can be completely explained by the variables in the equation). Increasing the number of variables will lead to a better fit (i.e. a higher value of R^2) but, if there are k variables and n observations, n should be greater than 4k to avoid 'overfitting' (i.e. using an excessive number of variables to generate a good fit). This aspect is reflected in the use of R_{adj}^2 which accounts for the numbers of observations (n) and variables (k).

The 'usefulness' of each variable in the analysis is reflected by the t-value (which is simply the ratio of the associated coefficient to the standard error, this ratio being larger, the smaller the probability that the dependent variable is not systematically related to the explanatory variable concerned). As a guide, t-values >2.0[7] suggest significance with a 95% confidence (although the precise values will depend on the number of degrees of freedom = n - (k+1)).

The results of the 72 health questionnaires were subject to various multivariate analyses to explore the dependence of the health impacts on a wide range of factors. These factors fall into four categories:

- factors which relate to the nature of the flooding where these might include flood depth, speed of waters rising, flood warning time, frequency of flooding, recency of flooding, duration of flood, etc.;
- factors which characterise those at risk where these might include age, sex, health, education, employment status, numbers of people in the house, length of residence, social 'grade', etc.;
- factors which relate to the property where these might include type of property (detached, terraced, etc.), number of floors, age of property, whether the property is insured, etc.; and
- post-flood factors where these might include time taken to get house back to normal, provision of advice by authorities, use of support groups, problems with insurers, problems with builders, etc.

[7] Although t-values may be positive or negative depending on whether the coefficient is positive or negative, the standard convention is to report all t-values as positive values.

The analysis is restricted by the number of cases involved (72). Some variables have had to be omitted from the analysis because there were too few cases in certain categories. Furthermore, as the pilot study was only carried out in four areas, clustering may distort and restrict the analysis further. Location variables have been included in the analysis to check whether such area effects are present in some analyses.

The pilot multivariate analyses showed that the health impacts experienced by flood victims will need to be explained by use of most, if not all, of these groups of factors. Table 3.6 lists those found to be the most significant in the various analyses.

Table 3.6 Sample parameters used in multivariate analysis

Variable	Description
maxD	Maximum flood depth (cms) in one or more of the following rooms - kitchen, study, living room, bathroom or bedroom
Speed	Speed at which the floodwaters were observed to rise (1 = quick; 3 = slow; and 2 = in between (and 'don't know'))
WarnT	Flood warning time (minutes)
Age	Age has a quadratic form (see Figure 4.2) and was entered as (a_4 x Age + a_5 x Age^2)
Prior	State of general health prior to (worst) flood event from 1 = poor to 5 = excellent
ResT	Time in residence (years)
ResN	Number of people in residence (i.e. in household)
OutT	Time before getting house 'back to normal' (days with 365 = one year or more)
Ins	Degree of insurance: 0 = no insurance; 1 = buildings or contents insurance; and 2 = buildings and contents insurance
ProbI	Problems with insurers from 0 = none to 10 = extremely serious
ProbB	Problems with builders from 0 = none to 10 = extremely serious

Taking the example of the PTSS values as the dependent variable (and similar results were obtained using the GHQ-12 values and the self-reported health effects - as would be expected given the reasonable correlations amongst the three scales), the use of the variables listed in Table 4.6 provided values for R^2 and R_{adj}^2 of 0.47 and 0.36 respectively. A direct indication of the relative significance of the variables is the t-test. This compares the ratio of the coefficient to the standard error and the probability that such a ratio could arise if there was no relationship between the variable and the PTSS value (the 'nul hypothesis'). Of note is that when the analysis was repeated with the six most significant factors (Speed, WarnT, Age, Prior, ResT and ProbI - for which the probability of the nul hypothesis was less than 7% in each case), there was a correlation of 0.41 (and $R_{adj}^2 = 0.35$) which is only slightly lower than that obtained using all eleven variables listed above.

As indicated above, multivariate analyses were performed on the results of the three health scales (PTSS, GHQ-12 and self-reported effects) and the discussion below summarises the key findings from all the analyses.

In terms of flood event characteristics, warning time, depth of flooding and speed with which floodwaters rose emerged as the most important explanatory factors. The recency of the worst flood, frequency of flooding and the duration of flooding appear to be less important characteristics. However, all these flood characteristics should be considered further as different events may make a difference to the significance of the factors.

We would expect, if the PTSS Intensity score, GHQ-12 Likert[8] score and the number of psychological effects reported are measuring the same thing, that the same variables would explain them and would appear in the 'best fit' models for each of them. This does not appear to be the case based on the data from the pilot surveys. Several, but not all the same, flood characteristics featured as explanatory variables for the PTSS and self-reported psychological effects but only one, depth of living room flooding, was a predictor of the current GHQ-12 Likert score as well. It is perhaps not surprising that the PTSS Intensity score and the self-reported psychological effects appeared more likely to be explained in terms of flood characteristics since these measures were explicitly linked to the flood event in the questionnaire whereas the GHQ-12 questions were not.

Some social variables featured as explanatory variables for the health impacts measures but only age (in a non-linear form) and prior health were predictors of all three. Non-homeownership and age 75+ were explanatory variables for two out of three of the measures but for home ownership, the direction of the prediction was not consistent across the three measures. It had been anticipated that home-ownership, as an indicator of higher income, would be a predictor of lower scores but the reverse was the case in this pilot analysis. It may be that home-ownership is now so widespread that it is not a good indicator of higher income and home-owners on modest incomes may experience flooding as more stressful than those who do not have financial responsibility for the structural damage to the property. The GHQ Likert score appeared to be best explained in terms of a large number of social variables.

It is usually assumed that the type of property occupied, particularly ground floor flats and bungalows can make residents more vulnerable to the impacts of flooding. However there were only seven households resident in ground floor only or basement property in the pilot study and the main property types were semi-detached and terraced property.

As illustrated in the example analysis presented above, it is possible that the actions of others during the flood event itself and during the recovery process may also be factors in the health effects of flooding. The survey did not measure social or organisational support but it did include measures of the importance of problems with builders and insurers on the household. The exploratory research had shown these to be important factors in how stressful victims found the flood event and its aftermath. Clearly, how problematic dealing with builders and insurers is, will partly depend upon the extent and depth of flooding and flood damage experienced but whether or not the builders and insurers handle matters in a competent, efficient and sympathetic manner can also

8 The GHQ Likert scoring method data was used because this 0-36 scale uses more of the data available and discriminates more finely than the GHQ Method scoring on a 0-12 scale does.

contribute to the health effects of flooding. The inclusion of two variables on the importance of problems with builders and insurers enhanced the level of variance explained in the above models, particularly in the case of the self-reported psychological effects, suggesting that the stress experienced by flood victims is closely related to the way insurers and builders carry out their work during the recovery process in the pilot data.

3.6 Analysis of responses to the choice modelling questionnaire

3.6.1 Objectives

The pilot surveys for the choice modelling component of the study served a number of objectives:

- to identify any remaining problems in the wording of the questionnaire and the formats used for answering each of the questions;
- to test whether respondents could understand the valuation scenario and the choice task and whether this was able to produce sensible results; and
- to test how long it took to administer the questionnaire, and assess whether it was too long.

Comments from interviewers on the first pilot indicated a number of problems with the wording of some of the questions. These and the implications of the statistical analysis of the responses were used to revise the questionnaire and change the valuation scenario before the second pilot survey by adding further explanation, a worked example for the choice task and a fifth attribute.

In total there were 90 respondents, split equally between the two rounds of pilot surveys. Overall, the mean time to undertake the WTP questionnaire was 32 minutes (cf 'target' time of 30 minutes) with a range of 15 to 75 minutes. As would be expected, the time taken to complete the 'at risk' version of the questionnaire tended to be shorter than the 'flooded' version with mean times of 26 and 38 minutes respectively.

As for the health questionnaires, the key findings from the two rounds of the pilot surveys are discussed below with further detail on the responses provided in Annex 1.

3.6.2 The willingness to pay model

The standard economic model that underlies the choice modelling technique used in this study is based on the following indirect utility function U_{ij} that represents the satisfaction that individual i receives from flood scenario j:

$$U_{ij} = V_{ij} + \varepsilon_{ij} = b_1 RISK_{ij} + b_2 DEPTH_{ij} + b_3 WARNING_{ij} + b_4 PRICE_{ij} + b_5 DURATION_{ij} + \varepsilon_{ij}$$

where V_{ij} is a deterministic element which is a linear index of the attributes of the j different flood scenarios; and ε_{ij} is a stochastic element which represents unobservable influences on individual choice.

In the model for the first pilot, the flood attributes are risk of flood occurring in a given area (RISK); depth of water inside the property once the flood occurs (DEPTH); the warning time before the flood occurs (WARNING); and the cost to the household of achieving a given flood scenario collected by an annual local charge over the next five years (PRICE).

In the second pilot, a fifth attribute, namely, the period water stays inside the property once the flood occurs (DURATION) is also added to the choice question and hence the WTP model. This attribute was not consistently identified as one of the 'most worrying' attributes during focus groups and one-to-one interviews (see Section 3.3). However, it was thought appropriate to test whether it was a significant attribute and also whether its inclusion added further significance to the overall results. Four levels were used to define the attribute, namely, 3 hours, 12 hours, 1 day and 3 days.

In responding to the choice modelling questions, respondents are asked to select one out of three scenarios (each assigned a different combination of characteristics). Each set of scenarios included one scenario corresponding to the current situation. Each respondent was asked to repeat this exercise for up to eight sets of scenarios.

The first pilot performed well. The best fitting model for the first pilot showed that all coefficient signs were correct with some significance. These can be interpreted as follows (all else remaining the same):

- the lower the level of flood risk in a scenario, the more likely a respondent is to choose it;
- the longer the warning period in a scenario, the more likely a respondent is to choose it; and
- the higher the cost of a scenario, the less likely a respondent is to choose it.

The second pilot on the whole performed worse than the first pilot. The best fitting model for the second pilot (flooded only) showed that only the PRICE coefficient was significant. The best fitting model for the second pilot (at risk only) showed that the sign of the coefficient for DURATION was incorrect since we cannot expect respondents to be more likely to choose scenarios in which the duration of a flood is higher. The coefficient for DEPTH was insignificant. All other attributes had the correct sign and were significant at the 5% level.

3.6.3 Willingness to pay results

The results are summarised in Table 3.7. Note that where the coefficients were found to be insignificant (depth in pilot 1 and all variables for the flooded sample and duration in pilot 2), the average WTP could not be estimated. The reported estimates should not be taken as absolute values but orders of magnitude. The order clearly shows that respondents are willing to pay more for a marginal reduction in the risk of flooding than for a marginal increase in warning time.

Table 3.7 Estimated range of mean values for flood attributes (£ /household/year)

Attribute	Definition	Range of Mean WTP (£)	
		Pilot 1	Pilot 2
RISK	Value of decreasing the chance of a flood occurring by 1 in 100 (reduction range: 0.5/100-20/100)	flooded: £147 at risk: £84	- at risk: £100
DEPTH	Value of reducing the depth of water inside the property when flood occurs by 1 cm (reduction range: 10-100 cm)	-	-
WARNING	Value of increasing the warning time by 1 hour (reduction range: 0-15 hours)	flooded: £105 at risk: £54	- at risk: £75
DURATION	Value of reducing the duration of floodwaters inside the property by 1 hour (reduction range: 3 - 72 hours)	not asked	-

3.6.4 Implications of pilot surveys

Overall the first pilot worked well. All but one (DEPTH) of the variables had correct and significant coefficients. The insignificance of the DEPTH variable was perhaps not surprising. There was no overall consensus in the focus groups that this was one of the most worrying attributes of flooding. Some participants had thought that there was no difference between a few or more inches of water once it entered the property. This indifference may have been a legitimate reason for the insignificance of the DEPTH variable. As can be seen from Section 3.5.3, this is not inconsistent with the results of the health impacts questionnaire which showed, at best, a weak correlation with flood depth.

The second pilot was used as a chance to test another attribute, DURATION. This was not significant in itself. Its addition to the valuation scenario is also likely to have been the cause of the second pilot producing less significant results than the first one. It seems that five attributes are too many for the respondents to work with. On the positive side, neither of the pilots showed any evidence of learning or fatigue effects which suggests that eight choice cards per respondent are acceptable.

Especially in the second pilot, there was a high number of protest responses. For example, all baseline choices in Lewes and Waltham Abbey were protest responses. Although this coincides with high risk, high severity flood areas, there were only seven respondents in these areas. Therefore, a conclusion could not be reached on what responses would be like in the main survey. It is, nonetheless, important to identify the likely causes of such high protest rates and two potential causes were identified.

Firstly, there is no particular pattern of protest responses that depends on a specific interviewer (interviewer bias) or flooded/at risk sub-samples (sampling bias). Therefore, it may be that the even the lowest level of the price range was simply not low enough. This suggests having a greater range of prices in the flood scenarios. Secondly, it is crucial to note that this is a very topical issue, with extensive on-going debate. It is also possible that those who are affected by flooding do not have confidence in any proposed improvements for a variety of reasons, some of which were mentioned in the focus groups. It is, therefore, likely that accuracy of the responses and hence the valuation exercise decreases under these circumstances due to protest votes.

Although it was considered that none of these findings should preclude the planned main survey work, they indicated that it would be desirable to undertake a third pilot that tested:

- a revised scenario with four attributes and more levels for the price attribute; and, possibly,
- an alternative contingent valuation format to see if this would work better, even though its ability to meet the objectives of the study could be limited compared to that of a choice modelling design.

3.7 Conclusion from Phase 1 work

The key finding from Phase 1 is that there are intangible impacts of flooding with supporting evidence from both the health impacts and the 'willingness-to-pay' questionnaires. These are associated with a wide range of factors. These cover not only flood attributes and socio-economic factors but would also appear to relate to post-flood difficulties with insurers and builders. There may also be factors associated with the nature of the property at risk but these were not significant within the pilot areas. Although for a given locality, predictions can be made as to the nature of potential floods and of the people at risk, it is much more difficult to predict who will or will not suffer insurer/builder difficulties.

The complexity of the issues involved, together with a prevalent view that 'someone else should pay', have made it difficult to develop a robust methodology to establish people's 'willingness-to-pay' to reduce the intangible impacts associated with a range of flood characteristics (risk, depth, warning, etc.). One aspect which makes this study a particularly difficult one is that respondents may think that not enough has been done and/or improvement scenarios are not credible and/or do not believe that if they paid more (positive WTP) any of the improvements would actually happen. In all WTP surveys, there is an assumed level of trust in the institutions to deliver the improvements that the respondents are being asked to pay for. Clearly, a lack of such trust jeopardises the quality of the WTP results - which may be a factor in this study.

3.8 The need for a revised approach

3.8.1 Numbers of responses

It was originally envisaged that the main survey would involve 2,000 questionnaires made up as follows:

- 1,000 'Health Impact' questionnaires for those flooded since January 1998;
- 500 'Choice Modelling' (WTP) questionnaires for those flooded since January 1998; and
- 500 'Choice Modelling' (WTP) questionnaires for those at risk of flooding.

As can be seen, this equates to a target of 1,500 respondents amongst those that have been flooded in recent years. The Consultants were concerned that such a target would be difficult to achieve since it would involve interviewing a substantial proportion of all those who have been flooded in England and Wales in the last few years. This issue was discussed at the Project Advisory Group Meeting held on 18 July 2002 and it was agreed that a potential solution would be to develop a combined health/WTP questionnaire for those that had been flooded. As a consequence, it would be possible to obtain 1,000 'health' responses and 1,000 'WTP' responses from those that had been flooded (using 1,000 'combined' questionnaires) with an additional 500 WTP responses from those at risk of flooding (as originally envisaged).

3.8.2 Revised questionnaires

It was agreed that the revised questionnaires to be taken forward for further testing would be of the form:

For those that had been flooded:

- Part A: Questions about the property, household members and nature of flooding and associated damages;
- Part B: Questions about the health impacts of flooding;
- Part C: Self-completion health questionnaires (GHQ-12 for current health and at the worst time, and PTSS[9]);
- Part D: Valuation questions; and
- Part E: Standard socio-demographic questions.

For those at risk of flooding:

- Part A: Questions about the property, household members and awareness of flooding (i.e. similar questions to above but reflecting that respondents have not been flooded);
- Part B: Not used (as flooding not experienced);
- Part C: Self-completion health questionnaire (GHQ-12 for current health only to provide a comparison with 'flooded' respondents);
- Part D: Valuation questions (similar to above); and
- Part E: Standard socio-demographic questions (as above).

3.8.3 Approach to valuation questions

As discussed above, there was agreement that there was a need to revise the approach to eliciting respondents' willingness-to-pay (WTP) to avoid the impacts of flooding. Two fundamental changes were made to the approach used in the Phase 1 work:

- a standard contingent valuation (CV) approach was used in which respondents are asked direct questions of the form 'are you willing to pay £X to avoid ...'; and

9 Note that use of the SF-12 was abandoned as previously indicated.

- respondents were asked to value the benefits of avoiding specified stress effects rather than of changes in flood characteristics (such as a reduced depth or frequency of flooding).

The stress effects were based on an analysis of the Post-Traumatic Stress Scale (PTSS) results from the 72 respondents in the Phase 1 pilots. The analysis suggested that the levels of stress amongst those that had been flooded could be characterised as shown in Table 3.8.

Table 3.8 Characterisation of stress levels

Level of stress	Characteristics (associated with past flood events)
Low	You are sometimes reminded of the flood by triggers (such as TV programmes). You experience rare feelings of nervousness, palpitations or tension, caused by these triggers. You experience rare occasions of being overtly alert or watchful for no reason. You experience rare sleeping difficulties. You experience rare memories of the flood. All of these symptoms cause you a little distress.
Mild	You are often reminded of the flood by triggers (such as TV programmes). You are often overtly alert or watchful for no reason. You sometimes feel nervous, have palpitations or feel tense when reminded of the flood. You sometimes have recurring memories of the flood. You sometimes experience flashbacks to the event. All of these symptoms will cause you a fair amount of distress.
Moderate	You often have difficulty concentrating on tasks or completing tasks. You are often reminded of the flood by triggers (such as TV programmes). You often feel nervous, have palpitations or feel tense when reminded of the flood. You often experience strong startled reactions. You are often overtly alert or watchful for no reason. These symptoms will cause you quite a lot of distress.
High	You always feel nervous, have palpitations or feel tense when reminded of the flood. You always feel emotionally estranged, separated or cut off from others. You are always being reminded of the flood by triggers (such as TV programmes). You always have difficulty concentrating on tasks or completing tasks. You often experience difficulty sleeping. These symptoms will distress you very much.

These descriptions (as shown in Table 3.8) were then used as a basis for the WTP questions to elicit how much a person was willing to pay to avoid the characteristics corresponding to a certain stress level. In relation to eliciting a WTP value, two approaches were trialled - dichotomous choice questions and use of a payment ladder.

The dichotomous choice approach trialled questions of the form:

- 'are you willing to pay £X to avoid ...';
- IF 'NO', then ask 'what is the maximum you are willing to pay to avoid ...';
- IF 'YES', then ask 'are you willing to pay £Y to avoid ...' (where Y > X);
- IF 'YES' or 'NO', then ask 'what is the maximum you are willing to pay to avoid ...' .

For the payment ladder, respondents are asked to match a value from a pre-defined 'ladder' of payments to their willingness to pay. By way of example, one of the payment ladders used in the interviews described below listed 15 values (in ascending order) between £0 and £450.

3.9 Phase 1A one-to-one interviews

3.9.1 Introduction

Eleven one-to-one interviews were conducted by members of the research team in Waltham Abbey on 22 August 2002, which was last flooded in October 2000. The objectives of these interviews were to:

- test the new valuation scenario wording;
- test the two new valuation scenario elicitation formats, i.e. dichotomous choice questions and use of payment ladder; and
- test how well the 'combined' questionnaire works in the field.

3.9.2 Results

Valuation scenario wording

The wording of the new valuation scenario was intended to encourage respondents to think only about the stress effects of flooding. The definition of different stress levels was clear and respondents did not have any difficulty thinking about the 'stress', 'hassle', and 'trauma' effects separately[10] from insured or uninsured financial losses. They were also aware that even if they received prompt and adequate insurance payments for the financial damage, there was still hassle involved. However, the wording of the scenario was found to be long and repetitive, suggesting that this could be reduced without losing detail.

---

[10] Note that respondents to the 'payment card' questionnaires were asked to consider 'stress' characteristics (from Table 3.9) whilst those to the 'dichotomous choice' questionnaires were asked to consider the impacts (in terms of health, distress, etc.) of their 'worst flood'.

Elicitation format

The dichotomous choice format was found to be easier for the respondents to think about than the payment ladder approach and hence was easier and quicker to administer. This would allow more than two bid levels to be asked, if necessary.

Respondents found the payment ladder approach difficult since it required comparing the 'moderate' and 'high' levels of stress simultaneously and then assigning a WTP value from the payment ladder for each of the two stress levels. This was designed to test whether people were willing to pay more to avoid high stress than moderate stress, as might be expected. However, these are the two highest levels of stress, and in most cases respondents were not able to differentiate between the descriptions of characteristics. This suggests that, given there are four levels of stress, respondents should be presented with levels 1 and 3, or 2 and 4, so that there is a greater difference between the scenarios.

WTP results

Respondents' WTP ranged from £0 to £1,000. There was some suggestion that the payment values offered influenced the WTP values expressed. For example, in some cases, respondents' maximum bids were the same as one of the values presented to them. Some respondents believed that so long as there is a flood, there would be stress no matter how mild the flooding is. Thus, these respondents found the scenario not credible and were not prepared to pay for it. In total there were two protest responses, representing 18% of the sample. However, it should be remembered that this is a very small sample, and thus may not be representative. Whilst the interviews suggest that more people are willing to pay to avoid stress effects than flood characteristics (as presented in Phase 1), the Phase 1A pilot surveys provide a better indication of the protest rate (as discussed in Section 3.12).

Questionnaire duration

The main concern about combining the original health and WTP questionnaires was that the combined questionnaire may be too long, boring or tiring for the respondent, jeopardising the successful implementation of both health and WTP components. In practice the combined questionnaire took an average of approximately 45 minutes to complete, whilst the WTP alone questionnaire took approximately 35 minutes. This suggests that combining the 'health' and 'WTP' questionnaires adds little to the overall length, due to the fact that the separate questionnaires had originally used comparable questions. There was also little difference in overall duration between the two versions of the valuation approach used in the combined questionnaire.

Summary

The key points to emerge from the series of one-to-one interviews were:

- use of the combined health/WTP questionnaire was a practical proposition;
- respondents were able to value stress effects without undue difficulty; and
- the dichotomous choice approach was found to be more effective than the use of payment ladders.

In relation to the order of questions, the prevailing view was that the valuation questions should come after the health questions (which is in accordance with current best practice[11]). The final issue was whether the wording accompanying the valuation questions should be further expanded to minimise the potential for 'protest votes' (i.e. respondents refuse to express a WTP). This was discussed internally and with the Project Advisory Group at the meeting on 23 September 2002. It was decided that the wording should be reduced rather than be expanded.

3.10 Phase 1A pilot survey

3.10.1 The questionnaires

For the third round of pilots surveys, two questionnaires were used - one for those that had been flooded and one for those at risk of flooding. The questionnaire components of each may be summarised as:

For those that had been flooded:

- Questions about the property, household members and nature of flooding and associated damages;
- Questions about the health impacts of flooding;
- Self-completion health questionnaires (GHQ-12 and PTSS);
- Valuation questions (dichotomous choice); and
- Standard socio-demographic questions.

For those at risk of flooding:

- Questions about the property, household members and awareness of flooding (i.e. similar questions to above but reflecting that respondents have not been flooded);
- Self-completion health questionnaires (GHQ-12 only to provide a comparison with 'flooded' respondents);
- Valuation questions (similar to above); and
- Standard socio-demographic questions (as above).

Following consideration of the results of the one-to-one interviews, it was decided that the dichotomous choice questions would have a third payment point to assist in eliciting a WTP value. The resultant frameworks of the valuation questions for the 'flooded' and 'at risk' questionnaires are shown in Figures 3.1 and 3.2 (overleaf). Flooded respondents were asked to express a WTP to avoid both the effects experienced and those symptoms associated with a 'high' level of stress. 'At risk' respondents were asked to express a WTP to avoid the symptoms associated with both 'mild' and 'high' levels of stress.

---

[11] See, for example, DTLR (2002): **Economic Valuation with Stated Preference Techniques**, London, DTLR, dated March 2002.

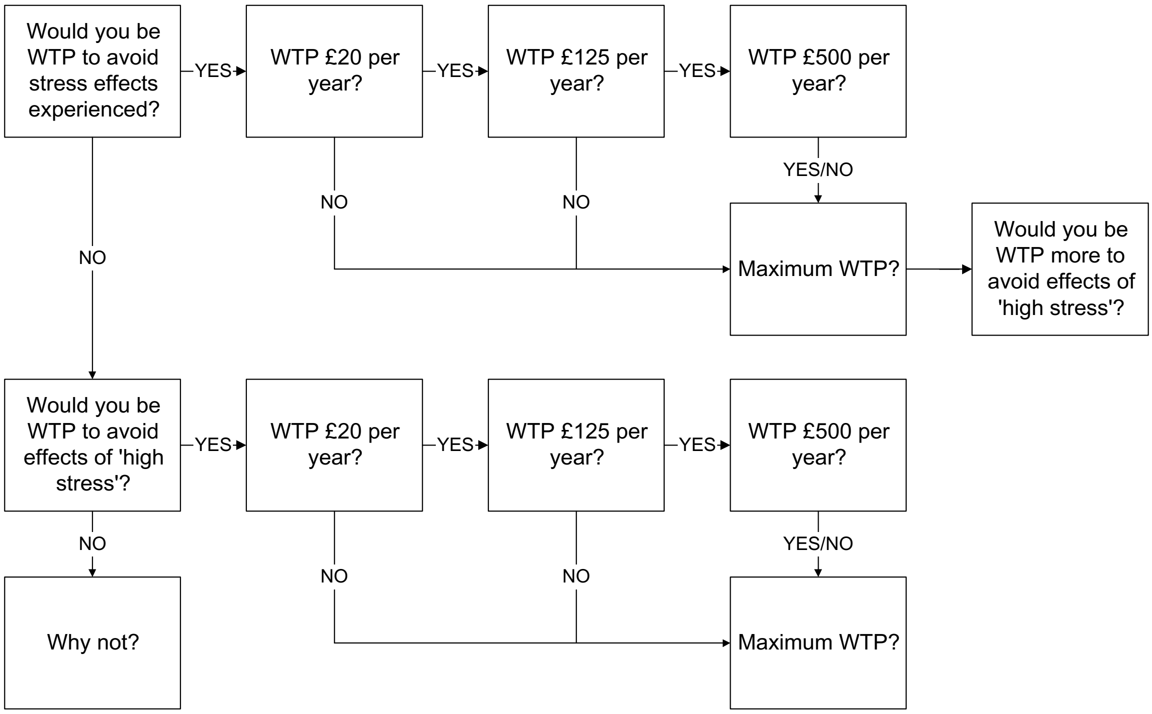


Figure 3.1 Valuation questions for 'flooded' respondents

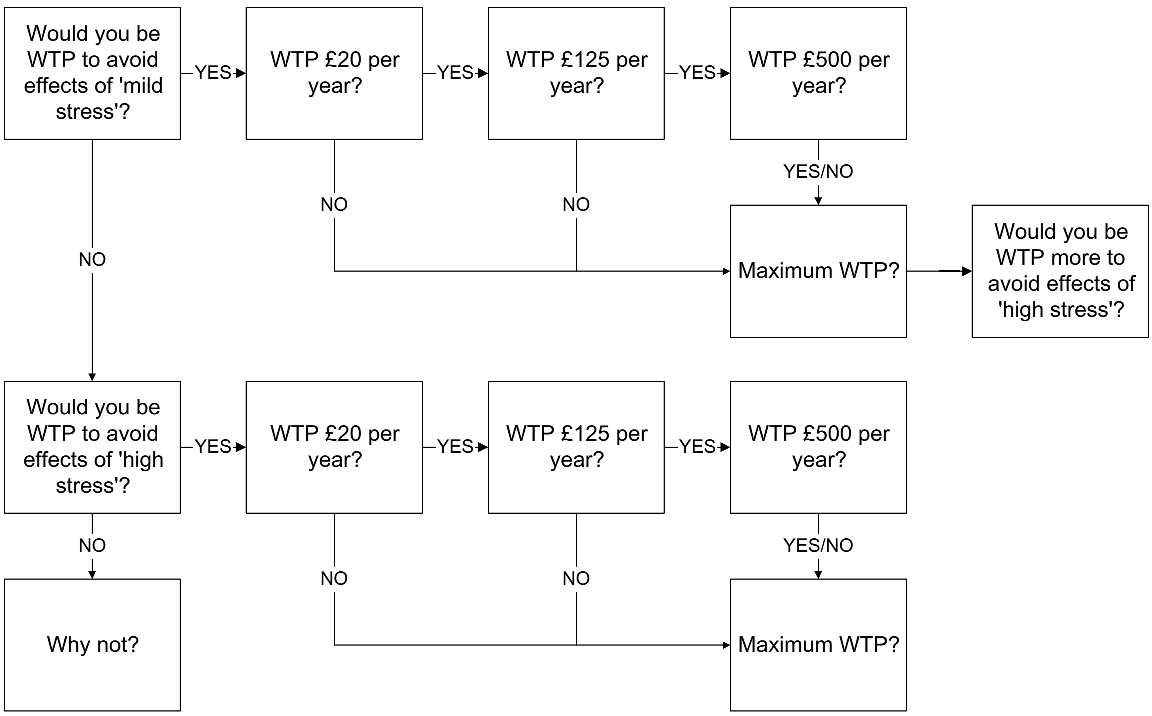


Figure 3.2 Valuation questions for 'at risk' respondents

3.10.2 Survey locations

The survey work was undertaken by Carrick James at two locations. The nature of the survey locations and numbers of responses are summarised in Table 3.9.

Table 3.9 Pilot surveys - targets and responses

Pilot Area	Addresses Provided	Targets	Responses	Further Comment
Newport Pagnell, Bucks.	150	22 flooded 8 at risk	23 flooded 8 at risk	Newport Pagnell (mainly Lakes Lane) suffered flooding in Easter 1998
Bocking, Essex	40	13 flooded 7 at risk	14 flooded 8 at risk	Parts of Bocking suffered flooding in October 2001
Overall		35 flooded 15 at risk	37 flooded 16 at risk	
Totals		50	53	

3.10.3 Overview of responses and respondents

In light of the difficulties encountered during earlier pilots, visits were made to both survey locations to validate the addresses provided by the Environment Agency. This proved worthwhile as many addresses in Bocking were found to be incorrect.

Once contact had been made with interviewees by the market researchers, the response rate was high (about 75%).

The time taken to complete the combined questionnaire (for those that had been flooded) ranged from 35 to 90 minutes, with an average of 50 minutes. As expected, this is only slightly longer than the time taken for the individual health and WTP questionnaires used in Phase 1 (48 and 38 minutes respectively).

The 'at risk' questionnaire took an average of 26 minutes to complete, ranging from 14 to 55 minutes. This was the same duration as for the WTP 'at risk' questionnaire used in Phase 1.

The key findings are outlined below with further detail provided in Annex 1.

3.11 Health impacts from the Phase 1A pilot survey

3.11.1 Measures of health impacts

The three main measures used in the pilot survey were:

- GHQ-12 scale;
- PTSS scale; and
- Self-reported health effects of flooding.

The three scales were administered to each respondent that had been flooded, whilst only the GHQ-12 was relevant for those that were at risk, allowing for some comparability between the questionnaires.

3.11.2 GHQ-12

As in the earlier pilots, the GHQ-12 was administered twice, once for the respondents' current health 'over the past few weeks' (current) and then 'with reference to their health at the time when flooding was most severe for them' (the worst time).

Using the Likert GHQ scoring method as before, the GHQ-12 scores from 0 (no psychological distress) to 36 (high psychological distress) with a score of 11-12 being the indicative threshold for potential mental health cases. Using this scoring method, 16 (43%) of the flood victims came into the 'case' category on the basis of their current GHQ Likert score, with half of these scoring 12, just over the threshold.

Respondents were asked 'at what stage during or after the flooding were the health impacts the most severe or worst for you personally'. From the pilot results, it appears that the worst health effects occurred early on: during the event itself and in the first weeks and up to a month after the event for most of those affected (79% - which is slightly higher than the corresponding figure of 70% derived in the Phase 1 pilot surveys).

The GHQ scores reported were markedly higher for 'the worst time' when effects on health were regarded as most severe, with 73% of respondents scoring above the threshold level.

In comparison, the scores of the at risk sample were much lower, with only 31% of these scoring 11 or 12, and none scoring higher.

3.11.3 Post Traumatic Stress Scale (PTSS)

The mean PTSS score (using the same approach as in the earlier pilots) was found to be 14.7 (ranging from 0 to 162), compared to a mean of 43 in Phase 1. Thus the psychological health of respondents to Phase 1A surveys was considerably less affected than in Phase 1, as measured by the PTSS. The results from the PTSS can be compared with those from the GHQ-12 and the self-reported health scales (discussed below). Whilst there is some correlation between these scores, it was less than that in Phase 1, possibly due to being a smaller sample.

3.11.4 Self-reported health effects of flooding

As before, respondents were asked about three categories of health effects that they or other members of their household might have experienced:

- physical health effects during or immediately after flooding;
- physical health effects in the weeks or months after the flooding; and
- psychological health.

Only 14 respondents out of 37 (38%) experienced immediate physical health effects from the flooding, compared to 82% in Phase 1. Of the 10 listed effects, the most common response was colds, coughs and flu, followed by shock.

Respondents also reported on the immediate health effects on other adults in the household and on effects on children. In total, 30 households contained another adult and 8 contained children aged under 18. Perhaps surprisingly, seven out of eight households containing under 18 year olds indicated that there were no effects on the children in the household.

Fewer respondents reported health effects in the weeks and months after flooding than had felt immediate effects. More than three-quarters reported no physical effects to themselves in the post event period. Of the 16 listed possible health effects, the most common were gastro-intestinal illness, respiratory illness and cuts and bruises.

Fourteen respondents did not report any psychological effects of flooding. This indicates that more respondents experienced psychological effects than physical effects, which correlates with previous findings. The most common psychological effect reported was anxiety when it rains which 57% of flood victims experienced, followed by increased stress levels and sleeping problems.

Several flood victims suffered from multiple psychological effects. Four respondents (10%) reported that they experienced 5 or more of the 17 possible psychological effects.

3.11.5 Multivariate analysis of health impacts

The results of the 37 combined questionnaires from the flooded respondents were subject to multivariate analysis to explore the dependence of the PTSS scores on the variables found to be the most significant in explaining the results of flood victims in Phase 1.

Overall, the correlation was not as good as in Phase 1 with an R^2 of 0.38 (0.47 in Phase 1) and an R_{adj}^2 of 0.11 (0.36 in Phase 1).

A direct indication of the relative significance of the variables is the t-test. This compares the ratio of the coefficient to the standard error and Table 3.10 presents the t-value for variables used in the Phase 1 and Phase 1A analysis. As a guide, t-values of more than 2 suggest significance with a 95% confidence.

3.12 WTP findings from the Phase 1A pilot survey

3.12.1 WTP Results

Both questionnaires (i.e. 'flooded' and 'at risk') introduced the concept of payment with the question:

> *Would you in principle be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?*

Table 3.10 Results of sample multivariate analysis

Variable	t-value in Phase 1	t-value in Phase 1A	Comment
maxD	1.44	1.80	There was a significant correlation between depth and stress (stronger than in Phase 1)
Speed	1.88	0.44	Unlike Phase 1, speed of onset and warning time were not found to be significant factors
WarnT	2.57	0.39	
Age	3.02	1.43	Although not as strongly correlated as in Phase 1, age appears to be a factor. However, the Phase 1A results correspond to a shallow U-shaped distribution - the inverse of that found in Phase 1
$(Age)^2$	3.05	1.74	
Prior	2.03	0.69	Unlike Phase 1, prior health and residence time were not found to be significant factors
ResT	1.86	0.48	
ResN	0.65	0.28	As in Phase 1, number of people in household, time for house to get back to normal and degree of insurance were not significant factors
OutT	0.75	0.34	
Ins	0.38	0.08	
ProbI	1.88	0.37	Unlike Phase 1, problems with insurers and builders were not found to be significant factors
ProbB	1.24	0.79	

Overall, 29 (55%) respondents were in favour. Note that there was no significant difference between flooded and at risk respondents. Of those who were prepared to pay, the mean annual WTP was £102 (flooded) and £162 (at risk).

For those who provided an initial WTP, the question was asked as to whether they would be prepared to pay more to avoid 'high' stress effects which, for the 'flooded' respondents, may or may not have been experienced. Only four respondents (all 'flooded') slightly increased their WTP.

For those who did not provide an initial WTP, the question was asked as to whether they would, in principle, be in favour of paying to avoid 'high' stress effects which, for the 'flooded' respondents, may or may not have been experienced. Nine of the 24 respondents who did not provide an initial WTP (to avoid actual/mild stress effects) were in favour of paying something. This gives an overall number of respondents WTP to avoid stress effects of 38 (= 29 + 9) which represents over 70% of respondents.

3.12.2 Analysis of protest bids

Fifteen respondents (28% of total) were not in favour, in principle, of paying to avoid the stress effects of flooding. The reasons given are grouped by category as indicated in Table 3.11. In five cases, respondents did not provide a valuation of the benefits being offered on the grounds that others (usually the government) should provide the benefits in any event and these are sometimes referred to as 'protest' bids (DTLR, 2002). It was possible that the two 'other' reasons could also fall into this category resulting in up to a potential seven (or 47%) of 'protest' bids amongst those not in favour of paying.

Table 3.11 Reasons for non-WTP

Reason	N
The government or council should pay for this *('protest' bids)*	4
I cannot afford to pay	3
I do not believe I am at risk of being flooded	2
I do not believe flood defence improvements can help me avoid stress effects	2
I do not believe flood defence will be improved	1
I object to paying higher taxes *('protest' bid)*	1
Other *(potential 'protest' bids)*	2
Total	15

3.12.3 Multivariate analysis of WTP responses

A multivariate analysis was undertaken based on all WTP values given by flooded and at risk respondents, with the individual WTP response as the dependent variable and 16 'candidate' explanatory variables. These were related to either the respondent's actual PTSS score where they were valuing the stress effects experienced, and to average 'mild' and 'high' scores of 59 and 175 respectively (based on Phase 1 results). With the seven most significant variables, values 0.32 and 0.27 were derived for R^2 and R_{adj}^2 respectively.

Although the explanation of the WTP responses using these variables is not comprehensive, the analysis provides an indication of the 'significance' of each factor used as indicated in Table 3.12.

Table 3.12 Results of multivariate analysis of WTP responses

Variable	Coeff.	t-value	Comment
PTSS	0.21	1.66	Perhaps surprisingly, only a weak correlation between PTSS and WTP was observed
Income Age Age^2	0.00 -2.44 0.02	1.35 0.87 0.98	No significant correlations with income and age were observed
GHQ	-9.07	3.09	Although GHQ (current health) was found to be highly significant, the correlation is counter-intuitive (since WTP increases with well-being)
ResN	17.00	1.78	WTP was found to increase (weak correlation) with numbers in household
Months since flood	-1.04	2.54	As might be expected, WTP was found to decrease with time since flood with a significant correlation
Worry about flooding	30.41	3.98	The most significant factor in explaining the WTP response was found to be the degree of worry over future flooding

3.13 Summary of Phase 1A work

Overall, it was found that the use of the revised questionnaires based on standard contingent valuation questions worked successfully under 'field conditions' (i.e. when administered by a market research company). The valuation questions were of the form '*Are you willing to pay £X to avoid these effects?*' in which 'these effects' were those stress effects associated with the impacts of flooding. Furthermore, the level of protest bids was found to be less than 30%. As such, the prime objective of Phase 1A to develop a WTP questionnaire that could be used more reliably in the main survey of Phase 2 was considered to have been met.

In general, the results from the pilot survey work in Newport Pagnell and Bocking confirm the key finding from Phase 1 that the intangible impacts of flooding (both in terms of health and WTP) are dependent on a wide range of factors.

On the basis of the successful piloting of the revised questionnaires, it was recommended that the format and content of the questionnaires used were carried forward to the main survey work with two modifications:

1) To provide a check for the validity of the WTP responses, it was recommended that two valuation scales were used as follows:

   - Scale 1 (as used in the pilots): £20, £125 and £500
   - Scale 2 (higher scale): £40, £250 and £1,000; and

2) To provide additional combinations of stress levels to elicit WTP values as follows:

   - for 'flooded' respondents: i) actual and high (as used in the pilots)
     ii) actual and moderate (additional combination)
   - for 'at risk' respondents: i) mild and high (as used in the pilots)
     ii) low and moderate (additional combination).

4. MAIN SURVEY WORK

4.1 Preparatory work

4.1.1 Numbers of questionnaires

As previously indicated (see Section 3.8), it was agreed with the Project Advisory Group that if the combined questionnaire proved successful in trials, then it would be possible to obtain 1,000 'health' responses and 1,000 'WTP' responses from those that had been flooded (using 1,000 'combined' questionnaires) with an additional 500 WTP responses from those at risk of flooding (as originally envisaged).

On this basis, it was decided to proceed with 1,500 questionnaires using the WTP variants proposed following the third round of pilots. This led to the use of four variants for both the flooded and at risk questionnaires. These are shown in Table 4.1, together with the associated (target) numbers of each to be used in the main survey.

Table 4.1 Variants for the main survey

Respondents	Stress Levels Valued	WTP Valuation Scale	Approx. No.
Flooded	Actual & High	1 (£20, £125, £500)	250
	Actual & Moderate	1 (£20, £125, £500)	250
	Actual & High	2 (£40, £250, £1,000)	250
	Actual & Moderate	2 (£40, £250, £1,000)	250
At Risk	Mild & High	1 (£20, £125, £500)	125
	Low & Moderate	1 (£20, £125, £500)	125
	Mild & High	2 (£40, £250, £1,000)	125
	Low & Moderate	2 (£40, £250, £1,000)	125

4.1.2 Selecting survey locations

At an early stage of the study (May 2001), a list of 27 potential study locations was proposed and accepted. This list included those locations used in focus groups.

Table 4.2 presents a list of 30 potential study locations proposed in July 2002, where this was based on the May 2001 list together with some other sites of major flooding (which effectively includes all locations in which 100 or more properties have been flooded in the last few years).

The total number of properties listed in Table 4.2 approaches 4,500. It is important to note that this list represents a significant proportion (perhaps approaching 50%) of all properties that have been flooded since January 1998.

All locations were subsequently used in the main survey.

Table 4.2 Study locations for main survey work

Past Flood	Location	Props. Flooded	Comment
April 1998	Alconbury, Cambs	91	Area used for focus groups
April 1998	Banbury, Oxon	168	Area has been studied in other studies but included in main survey
Nov 2000	Barlby/Selby, N Yorks	152	Additional location
Oct 1998	Bollington, Cheshire	120	From initial list
Oct 1998	Congleton, Cheshire	103	Additional location (close to Bollington)
April 1998	Evesham, Worcs	75	Additional location
May 2000	Five Oak Green, Kent	50	From initial list (Note 100 properties flooded in Dec 99)
Nov 2000	Gowdell, E Yorks	105	Additional location
Nov 2000	Hatton, Derbys	142	Additional location
April 1998	Hemingford, Cambs	56	From initial list
Jan 1999	Kendal, Cumbria	95	From initial list
April 1998	Leamington Spa, Warwickshire	400	Proved problematic in pilot surveys - but remained a study location
Nov 2000	Lewes, E Sussex	800	Difficulties in undertaking pilot surveys. Area also used by other researchers. However, included in main survey.
Nov 2000	London Colney, Herts	60 (40?)	Used for focus groups
June 1998	Macclesfield, Ches	80	Additional location
Mar 1999	Malton, N Yorks	198	Additional location (Note 170 properties flooded in Nov 2000)
April 1998	Melton Mowbray, Leics	160	From initial list
April 1998	Newport Pagnell, Bucks	78	From initial list
Oct 2000	Newport, Gwent	130	Additional location
Nov 2000	Ponteland, Northumberland	147	From initial list
Nov 2000	Rhydymwyn, Wales	74	From initial list
Nov 2000	Ruthin, Wales	180	Attempted to use in pilot surveys but not possible due to Welsh language requirements
Oct 2000	Ryde, Isle of Wight	75	Additional location
June 2000	South Church/West Auckland, Co Durham	400	From initial list
June 2000	Todmorden and Hebden Bridge in Calderdale	numerous	Todmorden used in focus groups
Nov 2000	Waltham Abbey, Essex	120	Used successfully in pilot surveys
Nov 2000	Weybridge, Surrey	48-90	Used for focus groups
Nov 2000	Woking, Surrey	100-142	Additional location
Nov 2000	Worcester, Worcs	80	From initial list
Nov 2000	York (Rawcliffe), N Yorks	86	From initial list

4.1.3 Identifying 'contact' addresses

The next stage was to obtain address data from the Environment Agency's at-risk database (as used for flood warning) for each of the areas listed in Table 4.2 (using the first portion of the postcode e.g. NR14). At the time of obtaining such data (August 2002), addresses of those properties which had been flooded (as opposed to being at risk of being flooded) were not available.

It was anticipated that it would be possible to use the 'at risk' addresses to provide sufficient flooded and at risk respondents. Of course, some people within the previously flooded areas may be 'at risk' (as opposed to being flooding victims) for various reasons including: recently moved into area, previous flooding did not affect property, living abroad at time of flooding, etc.

The experience of the pilot surveys (and, indeed, the focus group locations) was that some on-the-ground screening is a pre-requisite to a successful outcome. In essence, a site visit allows the scale and extent of flooding to be ascertained through a few doorstep interviews as well as identifying any site specific problems (presence of sheltered housing, etc.).

Consequently, site visits to 24 locations were undertaken during September 2002 to identify the locations of flooded properties and to review the validity of the addresses provided. Detailed address data on the remaining six locations had already been collated and/or reviewed during earlier stages of the study. Following the site visits, it was possible to produce:

- a list of addresses, most of which had been flooded in recent years (Level 1 addresses);
- a list of predominantly 'at risk' addresses (Level 2 addresses);
- targets for the numbers of flooded and at risk respondents in each of the 30 locations; and
- a guide (commentary) for the market research company on each of the locations.

The intention was that the interviewers would focus on the Level 1 addresses in order to achieve the desired 1,000 flooded respondents. Of course, if someone on the Level 1 list had not been flooded, they would then be asked the 'at risk' questionnaire. On completing the flooded quota (or maximising the number of flooded respondents) in a particular location, the interviewers could then move on to the Level 2 addresses to complete the at risk quota.

The listing of the numbers of Level 1 and Level 2 addresses together with the associated interview targets is presented in Table 4.3.

The resultant guide which was supplied to the market research company to facilitate the interviewing process is to be found in Annex 2. The guide has been slightly amended (from that supplied to the market research company) to include the numbers of interviews achieved at each location.

Table 4.3 Addresses and interview targets

Location	Level 1 addresses	Level 2 addresses	Interview targets	
			Flooded	At risk
Alconbury, Cambs	130	40	26	13
Banbury, Oxon	130	70	37	19
Barlby (nr Selby), N Yorks	175	170	48	24
Bollington, Cheshire	60	120	17	9
Congleton, Cheshire	24	50	7	3
Evesham, Worcs	77	56	21	11
Five Oak Green, Kent	65	80	18	9
Gowdall, E Riding of Yorks	140	0	32	16
Hatton, Derbys	125	50	40	20
Hemingford Grey, Cambs	38	60	11	5
Kendal, Cumbria	50	71	15	8
Leamington Spa, Warwickshire	500	0	104	51
Lewes, E Sussex	550	350	161	78
London Colney, Herts	55	80	12	6
Macclesfield, Ches	85	0	23	11
Malton, N Yorks	150	170	45	23
Melton Mowbray, Leics	95	40	27	14
Newport Pagnell, Bucks	65	60	17	9
Newport, Gwent	150	0	42	21
Ponteland, Northumberland	28	44	9	5
Rhydymwyn, Wales	66	5	21	11
Ruthin, Wales	205	180	58	29
Ryde, Isle of Wight	75	0	24	12
South Church/West Auckland, Co Durham	170	20	50	25
Todmorden in Calderdale	98	115	32	16
Waltham Abbey, Essex	180	0	35	17
Weybridge, Surrey	70	20	18	9
Woking, Surrey	37	40	10	5
Worcester, Worcs	45	28	15	7
York (Rawcliffe), N Yorks	85	0	25	14
Totals	3723	1919	1000	500

Although most of the addresses from the Environment Agency's data-base were found to be valid, there were several points which should be noted:

- addresses of the form The Hawthorns, 8 Maple Drive often appear three times as: The Hawthorns, Maple Drive; 8 Maple Drive; and The Hawthorns, 8 Maple Drive. Clearly, this leads to an overstatement of the numbers of properties at risk;
- within the data-base, all flats/apartments for properties within the floodplain appear at risk, even where these may be well above ground level;

- in some areas, numbers of properties are listed but are clearly not at risk from flooding (due to local topographical features for example); and
- as already mentioned, no indication is provided as to which properties have actually been flooded in recent years.

These points highlight the need for local Environment Agency staff to provide feedback from 'on the ground' to the National Flood Warning Centre to ensure the accuracy and usefulness of the data-base.

4.1.4 Preparing for the main survey

MORI was appointed to undertake the main survey work following a formal tendering exercise in September 2002 and, subsequently, was provided with the guide to the locations, the final address lists and final interview targets. However, given the uncertainties as to the outcome of the concurrent Phase 1A work, formal approval to proceed with undertaking the main surveys was not granted until late October 2002. In the intervening period MORI had made a start on recasting the questionnaires (based on those used in the third round of pilots) into its standard house-style.

4.1.5 Questionnaires for the main survey

As indicated earlier, there were four variants for each questionnaire. It was originally envisaged that each variant would be separately bound and that the interviewers would select the variants at random. However, MORI advised that it would be more robust to pre-assign variants to individual addresses to avoid biases, for example by interviewers using one variant on one street and another on the next street. Furthermore, MORI advised that it would be easier for the four variants (for each type of questionnaire) to be contained within a single document. These suggestions were accepted, albeit with some reservation, by the research team.

As a result, the two questionnaires containing internal routing for the four variants became fairly lengthy and complex. Full copies of both questionnaires are attached as Annex 3. As will be seen from Annex 3, the routing (i.e. variant) is determined by the colour coding pre-assigned to the respondent's address. The coding and variants are summarised in Table 4.4.

Table 4.4 Coding of questionnaire variants

Respondents	Stress Levels Valued	WTP Valuation Scale	Colour (Code)
Flooded	Actual & High	1 (£20, £125, £500)	Yellow (1)
	Actual & Moderate	1 (£20, £125, £500)	Pink (2)
	Actual & High	2 (£40, £250, £1,000)	Blue (3)
	Actual & Moderate	2 (£40, £250, £1,000)	Green (4)
At Risk	Mild & High	1 (£20, £125, £500)	Yellow (1)
	Low & Moderate	1 (£20, £125, £500)	Pink (2)
	Mild & High	2 (£40, £250, £1,000)	Blue (3)
	Low & Moderate	2 (£40, £250, £1,000)	Green (4)

4.2 Main survey responses and respondents

4.2.1 Overview

In total, 1,510 responses were received from interviews carried out in autumn 2002, consisting of:

- 983 responses to the 'flooded' questionnaire; and
- 527 responses to the 'at risk' questionnaire.

The respondents were drawn from 30 locations across England and Wales, all of which had been subject to flooding since January 1998. The numbers of respondents were very close to the target numbers in each of the 30 locations.

The 'flooded' questionnaire took an average of 48 minutes to complete, ranging from 19 to 106 minutes. The 'at risk' questionnaire took an average of 23 minutes to complete, ranging from 10 to 65 minutes.

A full account of the responses is presented in Annex 4 with summaries of key points presented in the following sections.

4.2.2 Socio-demographic characteristics

Gender and age

About 60% of both flooded and at risk respondents were female.

The mean age of respondents was 51. Flooded respondents tended to be slightly older with about 28% being 65 or over compared to 18% for the at risk respondents.

Prior health and long-term illness

Flooded respondents were asked to rate their state of health prior to their worst flooding on a scale 1 (poor) to 5 (excellent). Over 60% of respondents rated their health as good (3) or very good (4). Men tended to rate their health slightly better than women.

Flooded respondents were also asked whether they or any member of their household prior to the flooding had any long-term illness, health problems or disability which limited daily activities or the work they could do. 16% of respondents and 24% of households fell into this category.

As might be expected, there were significant variations in both prior health and long-term illness with age. Strikingly, social grade DE households were associated with poorer prior health and increased levels of long-term illness, etc.

Type of household

The distributions of household types were very similar for flooded and at risk respondents with 44% of households comprising two or more adults with no children, 26% of households having single occupancy, 25% with both adults and child(ren) and 5% single parent families.

Social grade

The respondents represented the following mix of social grades: 20% AB, 28% C1, 22% C2, 28% DE and 2% unknown. The distributions of social grade were very similar for flooded and at risk respondents.

Education

The respondents represented the following mix of education: 29% no formal qualifications, 22% degree or higher and 49% with intermediate qualifications. The distributions of educational qualifications were very similar for flooded and at risk respondents.

Housing and ownership

The distributions of house types for both flooded and at risk respondents were very similar with about 50% of respondents living in terraced houses and about 25% in semi-detached houses.

Nearly all (88%) of the flooded respondents were owner occupiers and, since many were older people, a high proportion (46%) owned their homes outright. About 67% of the at risk respondents were owner occupiers. As a result, there were more tenants, particularly private tenants, among those at risk. It is possible that these were people renting properties which their owners no longer wished to live in because they had been flooded.

Income, employment and car ownership

About 20% of respondents refused to supply an indication of income. The distributions of income for those that did respond were very similar for flooded and at risk respondents.

Although the distributions of employment status were similar, with about 55% in full or part-time work, the flooded respondents contained a significantly greater number of retired people (31%) as opposed to those at risk (20%).

Over 70% of the households owned 1 or 2 vehicles and there was no significant difference between the flooded and at risk respondents.

Residence time

There were major differences between flooded and at risk respondents - with the mean residence time for the flooded respondents (17.7 years) being more than twice as long as for the at risk respondents (8.4 years). Over 40% of the at risk respondents had been resident for less than two years whilst the corresponding figure for flooded respondents was 1%. Of course, such differences are explained, in part at least, by the requirements of the flooded questionnaire. For most areas, the floods of concern occurred in Easter 1998 or autumn 2000, at least two years before the interviews (autumn 2002).

Location (house price)

The respondents were drawn from 30 locations across England and Wales. It was considered that it may be necessary to include a factor which may reflect, in part, variations from one location to another. As a surrogate for a set of locational characteristics, local house prices were used.

Typical house prices for individual wards are readily available from National Statistics Online (www.neighbourhood.statistics.gov.uk) by entering a postcode. For each of the 30 locations, typical house prices (from 2001) for both terraced and semi-detached houses were obtained by entering a range of sample postcodes (from the address lists supplied to MORI). The prices were then compared to the national averages and assigned a simple rating value on a scale 1 to 5 (1 equates to areas where house prices are more than 1.4 times the national average whilst a 5 equates to areas where house prices are up to 60% of the national average).

4.2.3 Awareness and worry over flooding

Flood risk awareness

Of the 983 flooded respondents, only 238 (24%) reported that they were aware of the flood risk in the area before the flooding. For those at risk, the awareness of being within a flood risk area was found to be much higher at 86% (454 of the 527 respondents). It is likely that this increased awareness is the result not only of flooding events in the area but also of the Environment Agency campaigns to raise awareness. There was variation by area with some areas scoring 100% awareness.

Worry about future flooding

Both flooded and at risk samples were asked how worried they were about the possibility of being flooded during the next twelve months. People who have been flooded worry more than those who have not been flooded. 65% of flooded respondents were either somewhat or very worried compared to the corresponding figure of 42% for at risk respondents.

The degree of worry was analysed by area and it was found that although there is some consistency between the flooded and at risk respondents, the degree of worry does vary from area to area. It emerged that the residents of Waltham Abbey and the Rawcliffe area of York are most worried about the prospect of further flooding. Such worries may be fuelled by local issues. By way of example, concern was expressed (during the pre-screening of addresses) in York about the potential impact of surface water runoff from a major new commercial development and associated park and ride scheme. By contrast, in some areas where works have been undertaken since the last major flooding event, there is very little worry as demonstrated by the scores for Gowdall, Newport Pagnell, Congleton and Evesham.

In addition, respondents were asked which characteristic of the flood worried them the most. The results showed a surprising degree of consistency between those that are at risk of flooding and those that have been flooded. Those characteristics causing the greatest concern were found to be speed of onset (for 23% of respondents), dirtiness of water (for 22%), depth (for 17%) and warning time (for 11%).

Most respondents had taken one or more flood prevention measures as illustrated in Table 4.5. It is interesting to note that measures taken by those that have been flooded are very similar to those for the at risk respondents - except that the degree of 'take up' is significantly higher amongst those that have been flooded.

Table 4.5 Flood protection measures taken by respondents

Measure	Flooded	At Risk
Take out household insurance against flooding	60%	44%
Keep alert for flood warnings during high-risk months	51%	48%
Avoid keeping irreplaceable items or goods of sentimental value on ground floor of my home at all or certain times	36%	18%
Keep sand and bags in the property	25%	15%
Keep ditches and drains around the property clean	22%	21%

Of the 78 flooded respondents who had built walls and/or purchased water pumps, 62 provided cost estimates and for these respondents, the average expenditure was about £1,750. Of the 19 at risk respondents who had built walls and/or purchased water pumps, 13 provided cost estimates and for these respondents, the average expenditure was about £2,050.

4.2.4 Flood experience of (flooded) respondents

Timing and frequency of flooding

Most respondents (80%) had been flooded just once since living at their address. The majority had been flooded in the major events of Easter 1998 or autumn 2000. In some areas (notably Five Oak Green, Ruthin and Todmorden), some residents had been flooded three times or more.

Flood warning

Only 299 (23%) of the 983 flooded respondents received a flood warning. The mean warning time (for those 204 respondents that did receive a warning and were able to provide an estimate of the warning time) was 16 hours. The Environment Agency is a major source of flood warnings, accounting for about 40% of the flood warnings received by the respondents.

Whether or not a warning was received was, as would be expected, area specific. In ten areas, none of the flooded respondents received a warning[12]. These included five areas with over 20 respondents.

Although the results indicate that more warnings were received in 2000 and 1999 than in 1998, the figures still fall well short of the Environment Agency's long-term target of achieving an 80% target for delivering a flood warning to those at risk.

Speed of onset of flooding

627 (64%) flooded respondents reported that the floodwaters rose so quickly that you could see them rising. It is of note that there was a direct correlation between speed of onset and the receipt of a flood warning (the more gradual the event, the more likely a flood warning was received).

Flood depth

Although flood depths were asked for a range of rooms including living rooms, hallways and garage, for the purpose of the analysis which follows, attention is focused on two depth variables:

- maximum flood depth within a 'main room' taken as one or more of the living room(s), bedroom(s), kitchen and bathroom(s); and
- maximum flood depth in the cellar(s).

980 flooded respondents reported flood depths within one (or more) of the main rooms within the house, with depths ranging from zero (86 respondents) to over five metres (sixteen feet). The mean and median values were 55 cm (21 ins) and 46 cm (18 ins) respectively. 156 (16%) respondents reported main room flood depths of one metre or more.

Over three quarters of the 144 respondents with cellar flooding reported depths of one metre or more. It is worth noting that cellars were concentrated in a few locations - most noticeably in Todmorden, where nearly 90% of the respondents had flooded cellars. Other locations with a significant proportion of flooded cellars were Bollington, Leamington Spa, Lewes and Melton Mowbray.

It was unfortunate that this important parameter suffered from a number of coding errors primarily due to the complexities involved in entering and coding responses which may be given in several formats (inches, feet and inches, centimetres, etc.). However, the flood depth responses were subject to a further round of checking (and, in some cases, correction) which generated a robust set of data.

---

12 It should be noted that these included three areas which flooded primarily due to poor drainage (Bollington, Kendal and Macclesfield) for which the Environment Agency would not be expected to provide flood warnings.

Numbers of rooms flooded

The average number of rooms flooded was 3.4. If attention is restricted to the main rooms (as defined above), most (56%) respondents had flooding in two main rooms. As would be expected, there was a correlation between maximum flood depth and number of main rooms flooded.

Contamination

Nearly 80% (755) of the flooded respondents reported that the floodwater contained sewage or other pollution.

Flood duration

The mean flood duration (for the 934 respondents that were able to provide an estimate) was 50 hours with a median of 24 hours.

As would be expected, the flood duration varied greatly by area. Four locations were under water for a week or more with the longest mean flood durations in Gowdall and Worcester (both over 12 days). By contrast, four areas had mean flood durations of less than 12 hours and those with the shortest flood duration were Bollington (6 hours) and Waltham Abbey (7 hours).

Time to get home back to normal

Overall, the time to get the home back to normal following a flood event was considered by 977 respondents to be about 6 months.

In most cases of flooding, members of the household are forced to move out, sometimes for many weeks. 634 respondents (64% of the total) reported that this had occurred following their worst flood. The proportion evacuating was high compared with the proportions found in other research. 80% of the 'evacuees' were out of their home for six weeks or more and 44% were out for six months or more.

Help from others

Respondents were asked whether they received any help during or after a flood episode from ten different sources. Those who received help were asked to rate the level of help from 1 (very little help) to 5 (all the help I needed). Not surprisingly, neighbours, friends and family outside the household were the most common sources of help to most of the flood victims. They were also rated the most highly in terms of the amount of help received. Local authorities and emergency services were the next most common source of help but they received rather lower ratings for what they offered than the informal sources of help.

Women reported receiving significantly more help than men. Households containing children, and more particularly households containing young children, also attracted more support than other households.

4.2.5 Tangible losses

Of the 983 flooded respondents, 949 (97%) reported that they suffered damage to property or contents.

Insured losses

912 respondents reported that they were covered by insurance (the remainder did not know or were covered by the landlord's insurance) and 886 (90% of the total) had made a claim. Of the 886 claimants, 540 were able to provide estimates of the total insured losses and/or the sums for both buildings/structure damage and contents damage. The mean value paid out per flooded household was about £27,000 (with an approximate 2:1 split for structural damage and for contents).

Uninsured losses

Of the 983 flooded respondents, 375 (38%) reported that they suffered uninsured losses. Of these 375 respondents, 164 were able to provide estimates of the total uninsured losses and/or the sums for both buildings/structure damage and contents damage with a mean value of about £2,750 (generally associated with loss of contents).

Irreplaceable items

In this survey, almost all the respondents, 89%, reported that they lost some irreplaceable items or items of sentimental value.

4.3 Health impacts

4.3.1 Overview of responses

Three main measures of health impacts of flooding were used in the survey for flooded respondents.

- GHQ-12 scale (for current health and health when the effects of the flood were at their worst);
- PTSS scale; and
- Self-reported health effects of flooding.

The health measures therefore cover two different periods of time:

- current health status (GHQ current and PTSS) which may be taken as an indicator of the long-term (years) effects of flooding; and
- health at the time of the flooding (GHQ at worst time and self-reported health effects) which may be taken as an indicator of the short-term (weeks/months) effects of flooding.

The at risk respondents only completed one scale - the GHQ-12 in relation to their current health.

The response rates for the self-completion questionnaires (GHQ-12 and PTSS) are summarised in Table 4.6.

Table 4.6 Response rates for self-completion questionnaires

Questionnaire	Flooded	At Risk
GHQ-12 current	814 (83%)	485 (92%)
GHQ-12 at worst time	810 (82%)	n/a
PTSS (current)	747 (76%)	n/a
Total number of respondents	983	527

For the flooded respondents, the response rates did vary by area with some areas having relatively low rates of self-completion (such as Alconbury, Bollington, Evesham and Five Oak Green). Further enquiries of interviewers in these areas suggested various reasons including questionnaires being too long and too personal.

4.3.2 Measures of health impacts

GHQ-12

For flooded respondents, as in the earlier pilots, the GHQ-12 was administered twice, once for the respondents' current health 'over the past few weeks' (current) and then 'with reference to their health at the time when flooding was most severe for them' (the worst time). For the at risk respondents, the GHQ-12 was administered once for current health. In all cases, the GHQ-12 was scored using the Method score (0-12) and the Likert score (0-36).

Respondents were asked 'at what stage during or after the flooding were the health impacts the most severe or worst for you personally'. The results varied from during the flood to several months later with a median value of about one month after the flood. The duration of this 'worst time' also had a median value of three to four weeks.

The key GHQ-12 findings (see Table 4.7) were that:

- for flooded respondents, GHQ scores were higher for the worst time than for the present time;
- GHQ scores were higher for flooded respondents than for at risk respondents; and
- women score more highly than men.

Table 4.7 Summary of GHQ responses

Population	GHQ-12 Method score of 4 or more	GHQ-12 Likert mean score
Flooded respondents at worst time - women	68%	19.4
Flooded respondents at worst time - all	64%	18.3
Flooded respondents at worst time - men	55%	16.6
Flooded respondents current - women	26%	12.9
Flooded respondents at worst time - all	25%	12.6
Flooded respondents current - men	22%	12.3
Health Survey for England - women	18%	
Health Survey for England - men	13%	
At risk respondents - women	12%	11.0
At risk respondents - all	10%	10.7
At risk respondents - men	7%	10.1

Table 4.7 also includes some results from the Health Survey for England 1998 (Erens and Primatesta, 1999). Although a direct comparison is difficult since the make-up of the survey locations may not be representative of the national picture, it appears that those that have been flooded have significantly higher scores than the national average. It should be borne in mind that the flooded and at risk respondents were drawn from the same locations so that the difference between flooded and at risk respondents is highly significant.

There is also some indication that those flooded respondents in their 50s score more highly than younger or older respondents.

Post Traumatic Stress Scale (PTSS)

The mean PTSS score (using the same approach as in the pilots) was found to be 21 (ranging from zero to 221) amongst the 747 flooded respondents who completed the questionnaire[13].

Table 4.8 illustrates that the main survey findings are consistent with those found in the earlier pilots and with the work of Scott and Dua. Whilst the general level of stress amongst flood victims may not be as high as in other trauma groups, it is clear that some people are severely affected.

For the flooded respondents, and as would be expected, there are moderately strong correlations between the PTSS Intensity score and the GHQ Method and Likert scores.

Table 4.8 Comparison of PTSS and GHQ-12 scores

Sample	PTSS Mean Intensity score	PTSS Number of subjects	GHQ-12 current Likert score mean	GHQ-12 Number of subjects
PTSD group[1]	222.6	52	35.6	52
Trauma group[1]	73.1	64	31.7	64
Phase 1 Pilots	*43.4*	*69*	*15.0*	*70*
Main Survey	*21.1*	*747*	*12.6*	*814*
Phase 1A Pilots	*14.7*	*37*	*10.0*	*37*
Non-trauma group[1]	11.0	176	21.1	176

Notes: [1] These results are taken from the work of Scott and Dua (1999) on those suffering Post-Traumatic Stress Disorder (PTSD) and other at risk groups.

The flooded and at risk respondents in the main survey (and in the Phase 1A pilots) were asked to value the benefits of avoiding specified stress effects. The stress effects used were based on an analysis of the PTSS results from the 72 respondents in the Phase 1 pilots. As indicated in the PTSS Manual, the level of stress may be characterised as ‘low’, ‘mild’, ‘moderate’, ‘high’ and ‘extreme’ with reference to the PTSS Intensity score. For each category, the responses to each of the PTSS questions were analysed to identify the five most significant symptoms to the overall scores and the associated frequency of occurrence and level of distress that such symptoms caused.

Comparison of the responses for individual symptoms from the Phase 1 pilots and the main survey suggests that the characterisation of stress levels based on the main survey responses would have produced broadly similar descriptions to those actually used. In three out of the four stress categories, the top three symptoms from the main survey were included in the description (albeit in a different order). In the moderate category,

[13] It should be noted that the ‘formal’ PTSS questionnaire (Dua and Scott, 2001) used as a basis for that used for the flooded respondents (see Annex 3) has since been revised by Dua and Scott. These were not incorporated into this study.

the top scoring symptom, B1-recurring memories of the flood was missing. In the main survey responses, five symptoms featured very strongly, contributing to the top five scores in at least three of the categories:

- B4 – reminded of the flood by triggers;
- B5 – feeling nervous, having palpitations or feeling tense;
- B1 – recurring memories of the flood;
- D1 – difficulty falling or staying asleep; and
- D4 – being overtly alert or watchful for no reason.

Overall, it can be concluded that the stress characterisations presented to the main survey respondents broadly matched their experiences and provided valid descriptions of the stress resulting from flooding.

Self-reported health effects of flooding

As before, respondents were asked about three categories of health effects (based on previous FHRC work - Tapsell *et al*. 1999; Tapsell and Tunstall, 2001) that they or other members of their household might have experienced:

- physical health effects during or immediately after flooding;
- physical health effects in the weeks or months after the flooding; and
- psychological health.

A majority of the flooded respondents (54%) experienced at least one immediate physical health effect from the flooding. The most common response was shock experienced by a third of the respondents (33%), followed by colds, coughs, sore throats and flu (20%), and headaches (12%).

Respondents also reported on the immediate health effects on other adults in the household and on effects on children. Although the number of reported effects is a little lower for others and for children (as found in the pilots), the pattern of responses was broadly similar to that of the respondents themselves.

Two thirds of the respondents did not recall suffering from any physical health effects in the weeks and months after flooding and the picture and pattern was similar for other adults. For children too, the aftermath of the flooding had less impact in terms of physical health effects than the immediate effect of the flooding. Children did not experience some of the effects that were common among the older people: stiffness in the joints and muscle cramps and other less common but more serious conditions affecting adults: heart problems and raised blood pressure. Thus, children were reported to be affected by a narrower range of physical health impacts than the adults.

Most of the respondents (72%) reported experiencing some psychological effects of flooding. The most common psychological effect reported was anxiety when it rains which 55% of flood victims experienced, followed by increased stress levels and sleeping problems. A very small minority, thirteen individuals, reported that they had had thoughts of suicide.

Many more flood victims suffered from multiple psychological effects than experienced multiple physical effects. As with the physical effects, there were fewer reported effects amongst other adults and children in their household. It is particularly notable that the respondents thought that 44% of the children in their households suffered no psychological effects from the flooding.

Consultations and treatment by a doctor

29% of the female flooded respondents had consulted a doctor following physical or psychological effects of the worst flood. This was twice the corresponding rate of 15% for men.

Subjective health effects in the context of other impacts

The flooded respondents were asked to rate a number of effects of the flood upon their household's life using a scale from 1 (no effect) to 10 (an extremely serious effect). The results are summarised in Table 4.9. It is important to note that these subjective ratings are in terms of the effect on the household whereas most of the other health measures are for the individual respondent.

Table 4.9 Subjective rating of severity of the effects of flooding

Effect	Mean Rating	N
Getting house back to normal	7.8	967
Stress of flood	7.1	972
Having to leave home	7.0	248
Worry about flooding	6.6	968
Damage to replaceables	6.5	943
Damage to house itself	6.4	951
Irreplaceable items loss	5.6	656
Builder problems	4.9	839
Insurance problems	4.7	895
Loss of or distress to pets	4.6	537
Loss of house value	4.6	779
Effects on health	4.5	966
Overall effect	7.3	973

In subjective terms, health effects were rated among the lesser effects of flooding on the households but, in contrast, the stress of the flood event itself features as one of the most serious effects, along with all the problems and discomfort whilst trying to get the house back to normal and having to leave home.

As with other health measures, women consistently rated the individual effects as more serious than did the men. They also rated the flood overall as having a more serious effect on their households than did the men.

Summary

Statistical analysis was used to assess the relationships amongst the eleven measures of health impacts of flooding. All the correlations were found to be positive and significant. However, some of the associations are stronger than others.

It is reassuring that the strongest associations for each of the measures of current health (GHQ-12 Method/Likert and PTSS) were with other measures of current health.

Looking at the health measures that refer to the time of the flood, generally, the strongest associations were again with other measures that refer to the same time. The GHQ scores for the worst time were most strongly associated with other measures that reflect health at the time of the flooding: the self-reported psychological effects of flooding and also the subjective rating of the health effects of the flood on the household. There was, however, also a moderately strong association between the GHQ Likert score for the worst time and the PTSS Intensity score.

The self-reported immediate physical health effects were most strongly associated with other self-reported effects: longer term physical effects and psychological effects.

These findings, therefore, indicate that the measures of health used have differentiated between the current health status of the flooded respondents and how they felt their health was during and after the flood. However, they also show that the current health status of the respondents is linked to the health effects experienced at the time of the flood and its aftermath as there were positive correlations between the measures for the two time periods.

4.3.3 Factors affecting health

Overview

There are three broad groups of factors to be considered:

- socio-demographic factors;
- flood characteristics; and
- post-flood factors.

The methodology adopted was to consider each factor in turn against the range of health measures (bivariate analysis), with particular attention given to two measures of current health (GHQ-12 Likert and PTSS) and consideration given to the other measures as appropriate. Annex 4 presents the key results in some detail. On completion, a multivariate analysis was undertaken to examine the relative importance of individual factors.

Socio-demographic factors

A summary of the results of the bivariate analysis for each of the socio-demographic factors considered is presented in Table 4.10.

Table 4.10 Summary of socio-demographic factors affecting health

Factor	Summary of findings
Gender	Women are more affected by flooding than men particularly at the 'worst time'. Since there were no significant differences in the health status that respondents reported prior to the worst flooding, these findings suggest that the flooding had a more marked short-term effect on women than on men but that women recovered over time so that there were fewer differences in the long-term effects as indicated by the current health measures.
Age	Flooded respondents in their 50s are most affected. A non-linear relationship of the form: Effect = a x Age + b x Age^2 + c was used in the subsequent analysis.
Prior health	As might be expected, those in excellent health (prior to the worst flood) tend to suffer less health effects than those in poor health. However, those with poor or fair prior health recovered from the flooding in much the same way as the others whose health was better prior to the flooding.
Long-term illness	Significantly worse health effects for both the time of flooding and for the current time were found in households where there was long-term illness and disability and for respondents themselves in such circumstances.
Type of household	Overall it was concluded that there is some evidence to suggest that adults without children are the least susceptible to health effects. It is difficult to specify the type of household which would be most susceptible.
Social grade	There was some indication that social grade may be a factor (social grade DE respondents are more likely to suffer health effects).
Education	Increased levels of education may reduce degree of health effects (based on PTSS results).
House type	Those in vulnerable housing (ground floor flats, bungalows, etc.) appear to suffer worse short-term effects of flooding but recover and do not show significantly more long-term effects than others.
House ownership	Owner-occupiers appeared to suffer less health effects than those in rented accommodation.
House price	Those in more expensive houses were more susceptible to stress.
Income	Increased levels of income may reduce degree of health effects (based on PTSS results but not GHQ results).
Employment	Those in employment appeared to be less affected than those at home.
Car ownership	The PTSS scores suggested some reduction with stress with increased car ownership but this was not reflected in the GHQ-12 Likert scores.
Residence time	The PTSS results suggested that health effects decrease with time in residence but this was not reflected in other health measures.
Awareness	Awareness of flood risk decreases health effects (across all measures).

Flood characteristics

A summary of the results of the bivariate analysis for each of the flood characteristics considered is presented in Table 4.11.

Table 4.11 Summary of flood characteristics affecting health

Factor	Summary of findings
Speed	There is a weak correlation between health effects and speed of onset (the faster the onset, the greater the effects).
Contamination	Respondents are more likely to suffer effects if they consider the floodwaters to be contaminated. This was statistically significant for the short-term effects.
Depth	Health effects vary significantly with maximum depth (in one or more of the main rooms). However there is a wide variability in that there were some respondents with deep flooding and virtually no health effects and some with virtually no flooding and severe health effects.
Cellar depth	Those with flooded cellars tended to have lesser health effects (perhaps because cellar flooding was specific only to a few locations). For those that had cellar flooding, there was some indication that short-term effects varied with depth of flooding.
Warning time	Surprisingly, receipt of a warning did not lead to reduced health effects in the long-term and only a marginal reduction in the short-term. For those that did receive a warning, there were indications that the greater the warning time the lesser the effects.
Years since flood	Health effects reduce over time. Furthermore, it would appear that the perception of effects at the worst time also reduces over time.
Frequency of flooding	No correlations were found between health effects and frequency of flooding.
Flood duration	Health effects did not appear to vary with flood duration.
Main parts flooded	Health effects increase with the number of main parts (living room(s), kitchen, bedroom(s), bathroom(s)) flooded.
Rooms flooded	Similar to above, health effects increase with the numbers of rooms flooded.

Post-flood factors

A summary of the results of the bivariate analysis for each of the post-flood factors considered is presented in Table A4.12.

Table 4.12 Summary of post-flood factors affecting health

Factor	Summary of findings
Tangible losses	It was difficult to ascertain the significance of losses (both insured and uninsured) due to a lack of definitive responses. The loss of irreplaceable items did not affect the health effects.
Problems with insurers	Difficulties in dealing with insurers (and loss adjusters) in the wake of a flooding event increased health effects.
Problems with builders	Difficulties in dealing with builders increased health effects.
Evacuation	Where members of the household had to leave home, the health effects were significantly greater.

Table 4.12 Summary of post-flood factors affecting health

Back to normal	There were some indications that the time taken to get back to normal correlated with short and long-term health effects.
Community support	Long-term health effects did not correlate with support received but there were some correlations with measures of short-term effects.

Multivariate analysis of all factors

The final stage of the analysis was to undertake a stepwise multivariate analysis of the key health measures against the variables listed in the previous tables. It was found that the inclusion of insured losses as a variable reduced both the size of the datasets and the degrees of correlation. As such, insured losses were excluded from further analysis.

In the stepwise analysis, the variables are progressively removed until only significant variables remain (together with an intercept). Given the large datasets involved, variables are considered to be significant if the probability of the observed relationship occurring by chance is less than 0.05 (5%) and this is equivalent to a t-value of about 2. The full results are presented in Annex 4 with a summary in Table 4.13.

Table 4.13 Factors influencing health measures (listed in order of decreasing statistical significance)

Significance	PTSS as ln(P+1)	Current GHQ-12 Likert	GHQ-12 Likert at worst time
Highly significant $p<0.001$ (0.1%)	Problems with insurers Prior health Gender Evacuation	Prior health Problems with insurers Time to get back to normal	Problems with insurers
Significant $p<0.05$ (1%)	Flood depth Age Warning time Time to get back to normal Contamination Vulnerable housing	Contamination Help received Evacuation Area house prices	Gender Evacuation Uninsured losses Prior health Age Time to get back to normal Contamination Rented accommodation Warning time
Initial number of variables	34	34	34
Overall R^2	0.26	0.13	0.27
N observations	630	753	521

Overall, the statistical explanations of the GHQ Likert scores at the worst time and the PTSS Intensity scores as measures of the short- and long-term psychological effects of flooding are reasonably good. In contrast, the statistical explanation of the current GHQ Likert scores is poor and, as such, it is considered that the PTSS Intensity scores provide a more reliable indication of the long-term psychological effects of flooding.

The other striking feature of the results presented in Table 4.13 is that problems with insurers and prior health are among the most statistically significant factors across all three measures. A further three factors (evacuation, time to get back to normal and contamination) are statistically significant across all three measures.

The relative importance of each factor depends not only on its statistical significance (as measured by p) but also by its contribution to the overall total. This was determined from the product of the potential range in value of each factor and the associated coefficient and comparing that with the total of all such products. The results are summarised in Table 4.14 from which it can be seen that most of the predicted variation in both short- and long-term effects is associated with four significant variables.

Table 4.14 Relative importance of key factors

Effects / Measure / Factor	Short-term GHQ-12 Likert at worst time	Long-term PTSS Intensity score as ln(P+1)	Comment
Problems with insurers	18%	17%	Short- and long-term psychological effects dominated by problems with insurers
Age	13%	11%	People in their early 50s suffered more than those younger and older
Time taken to get back to normal	13%	10%	The greater the time taken to get back to normal, the greater the psychological effects (both short- and long-term).
Prior health	11%	16%	Those in poor health suffered more than those in good health
Uninsured losses	10%		The scale of uninsured losses influenced short-term effects
Flood depth		12%	Increased flood depth resulted in more long-term effects
Contribution of key factors	66%	67%	

Nevertheless, most of the variation in the GHQ-12 and PTSS scores is not explained by the above factors. It should be noted that if the factors listed in Table 4.13 provided a full explanation then the value of R^2 would approach unity - although values above 0.2 are generally regarded as good within the context of social science surveys.

Apart from the natural variation from person to person in their response to a particular set of circumstances, other variables not accounted for in the analysis might include community and institutional factors. For example, the degree of trust that a particular community has in the authorities to deliver an appropriate flood defence scheme or to provide appropriate flood warnings and emergency plans was not directly measured.

4.4 WTP Responses

4.4.1 Overview

Both questionnaires (i.e. 'flooded' and 'at risk') introduced the concept of payment with the question:

> *Would you in principle be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?*

More than 60% of respondents (amongst both flooded and at risk respondents) had, in principle, a willingness to pay (WTP) to avoid the stress effects of flooding as shown in Table 4.15.

Table 4.15 Those in favour of paying something towards improvements

Respondents	N	N respondents WTP to avoid: Actual or low/ mild stress effects	N respondents WTP to avoid: High stress effects[1]	N not WTP	%WTP to avoid stress effects
Flooded	983	591	617 = 591 + 26	366	63%
At Risk	527	320	342 = 320 + 22	185	65%
All	1510	911	959 = 911 + 48	558	64%

Notes: [1] The number of respondents with a WTP to avoid high stress effects is based on the number who expressed WTP to avoid actual or low/mild stress effects plus those who did not have a WTP to avoid actual or low/mild stress effects but did have a WTP to avoid moderate/high stress effects.

For those who provided an initial WTP, the question was asked as to whether they would be prepared to pay more to avoid 'moderate' or 'high' stress effects which, for the flooded respondents, may or may not have been experienced. 101 (17%) of the 591 flooded respondents who provided an initial WTP increased their WTP. A similar proportion (49 or 15%) of the 320 at risk respondents who provided an initial WTP increased their WTP.

For those who did not provide an initial WTP, the question was asked as to whether they would, in principle, be in favour of paying to avoid 'moderate' or 'high' stress effects which, for the 'flooded' respondents, may or may not have been experienced. 26 flooded and 22 at risk respondents who did not provide an initial WTP (to avoid actual or low/mild stress effects) were in favour of paying something. This gives an overall number of respondents with a WTP to avoid stress effects of 959 (= 911 + 48), which represents 64% of respondents.

4.4.2 Values of WTP bids

Of those who were prepared to pay intially, the mean annual WTP[14] was £251 (for 591 flooded respondents) and £193 (for 320 at risk respondents).

Of the 101 flooded respondents who provided an initial WTP and were prepared to pay more to avoid 'moderate' or 'high' stress effects, 84 respondents increased their WTP with a mean value of £500 (and the remaining 17 respondents were in favour in principle but did not advance a value). For the 49 at risk respondents who were prepared to pay more, 45 respondents increased their WTP with a mean value of £380 (and the remaining 4 respondents stated that they would increase their WTP but did not provide a value).

For the 26 flooded and 22 at risk respondents who did not provide an initial WTP but had a WTP to avoid moderate/high levels of stress, the mean values were £64 and £131 per year respectively.

4.4.3 Reasons for WTP

Respondents were asked to provide the main reason for WTP for improved flood defence. The results were very similar from both flooded and at risk respondents.

Over 60% of respondents (both flooded and at risk) stated that the main reason for WTP was either avoidance of stress or damage to property/contents. The next most significant reason was 'other' and a sample of responses is presented in Annex 4. The vast majority of the responses were found to relate to avoiding the general experience of flooding.

It could be argued that the WTP values from the quarter of respondents who indicated that damage to property/contents (i.e. 'tangible' losses) was the key reason should be excluded from further analysis (since the values do not relate directly to health effects). However, all WTP values were retained on the grounds that excluding those for which damage to property/contents had been identified would not result in major changes to the overall WTP values.

4.4.4 Analysis of high values

There were several WTP values in excess of £1,000, all of which were carefully reviewed (as detailed in Annex 4). In the event, only one value was deemed to be invalid and was excluded from further analysis[15].

14 All WTP values quoted are an amount per year per household.

15 A further WTP value of £9,050 per year was also excluded from the analysis at an early stage as this was clearly an incorrect entry.

4.4.5 Analysis of non-WTP responses

366 flooded and 185 at risk respondents (36% of total) were not in favour, in principle, of paying to avoid the stress effects of flooding. The treatment of non-responses in WTP surveys is an important issue with particular regard to determining which (non) responses represent a 'genuine' zero value bid (for example due to being unable to afford a payment). In other cases, respondents do not provide a valuation of the benefits being offered on the grounds that others (usually the government) should provide the benefits in any event. As detailed in Annex 4, the distribution of reasons for non-WTP for both sets of respondents are very similar - although a significantly greater number of at risk respondents did not believe that they were at risk of flooding.

The results are summarised in Table 4.16 which show that about 40% of non-responses may be considered as zero value bids. In accordance with current practice (DTLR, 2002), only these bids were carried forward to further analysis.

Table 4.16 Analysis of non-WTP values

Nature of bid and associated reasons	Flooded respondents	At risk respondents	All respondents
Zero value bid because: I cannot afford to pay, I do not believe flood defence will be improved, I do not believe I am at risk of being flooded, I do not believe I will suffer from stress in the event of a flood, etc.	144 (39%)	81 (44%)	225 (41%)
Non-response bid because: The government or council should pay for this, I object to paying higher taxes, water companies or industry should pay for this, other people causing flooding should pay, etc.	211 (58%)	94 (51%)	305 (55%)
Totals of those providing a response/reason	355 (97%)	175 (95%)	530 (96%)
No response/reason provided (considered to be a non-response)	11 (3%)	10 (5%)	21 (4%)
Total numbers of respondents not in favour of WTP	366 (100%)	185 (100%)	551 (100%)

4.4.6 Revised WTP values

The WTP data-sets were modified to incorporate the zero bids and the 'non-responses' together with the very high WTP bids were removed. As explored in earlier sections, less than 5% of flooded respondents suffered moderate or high stress effects. The prime WTP value of concern is therefore that associated with the 'initial' value offered to avoid actual or low/mild stress effects. The revised WTP values are shown in Table 4.17.

Table 4.17 Initial annual WTP to avoid actual or low/mild stress effects (incorporating zero bids)

Respondents	N sample	Mean	Median	Max
Flooded	734	£196	£80	£3,000
At risk	401	£154	£52	£1,000

As perhaps would be expected, the WTP values for those that have been flooded are somewhat higher than for those that are at risk of flooding. It is considered that the views of the flooded respondents more reliably reflect the 'true' value of being flooded and, as such, **the mean WTP to avoid stress effects associated with flooding is about £200 per year per household**.

4.4.7 Influence of questionnaire variant

The questionnaires for flooded and at risk respondents both involved the use of four variants (as detailed in Table 4.1). A comparison of the grouped WTP values to avoid actual or low/mild stress effects from each variant suggests that the results were not unduly influenced by either the payment scale or the stress scale used (and further detail is presented in Sections A4.8.7 and A4.8.8) and this was confirmed by the subsequent multivariate analysis.

4.4.8 Variation of WTP by stress

As indicated in Section 4.4.1, only about 16% of respondents who made an initial WTP bid (i.e. excluding 'zero' bids) to avoid actual or low/mild effects were prepared to offer a higher value to avoid moderate/high stress effects. Amongst those who did not provide an initial WTP to avoid actual or low/mild effects, only 8% were prepared to offer a higher value to avoid moderate/high stress effects. Such results suggest that respondents tend to value (or not) 'stress' effects in general as opposed to being able to adjust their WTP to a precise set of stress characteristics.

Combining data on initial WTP values, zero bids and WTP values for moderate/high levels of stress suggests that there is a slight increase in WTP values with levels of stress (from about £210 to avoid low stress effects to about £227 to avoid high stress effects[16]).

[16] It may be noted that these values are greater than the overall mean derived above (Section 4.4.6). This is due to a lack of PTSS results to which 'actual' WTP values could be associated.

4.4.9 Factors affecting WTP values

Introduction

The initial analysis suggested that, as for the health effects, there were numerous factors influencing the WTP value provided for a particular household and that the overall pattern of values would be difficult to explain.

WTP values by area

One finding to emerge from the analysis of health impacts was that the results are likely to be influenced by site specific factors. With this in mind, Table 4.18 provides a listing of the areas with the highest and lowest mean WTP values to provide a backdrop to the analysis which follows. The mean values are influenced by the presence of high values - particularly where there are relatively few (say less than 10) respondents.

Table 4.18 Analysis of mean WTP values by area (N respondents in brackets)

WTP value	Flooded respondents	At risk respondents	Rank for all respondents[1]
Six highest values	£520 Ponteland (5)	£275 Woking (6)	1. Ponteland (10)
	£400 Weybridge (5)	£260 Ryde (IOW) (5)	2. Kendal (27)
	£344 London Colney (10)	£258 York (6)	3. Ryde (IOW) (17)
	£339 Worcester (14)	£221 Kendal (15)	4. Waltham Abbey (39)
	£309 Waltham Abbey (22)	£204 Ponteland (5)	5. Woking (15)
	£284 Kendal (12)	£198 Barlby/Selby (19)	6. Alconbury (35)
Six lowest values	£99 Newport Pagnell (15)	£78 Weybridge (18)	25. Bollington (20)
	£96 Five Oak Green (9)	£62 Five Oak Green (10)	26. Macclesfield (12)
	£77 Evesham (14)	£61 Bollington (7)	27. Five Oak Green (19)
	£29 Macclesfield (7)	£36 Evesham (9)	28. Rhydymwyn (23)
	£24 Hemingford Grey (7)	£20 Congleton (2)	29. Evesham (23)
	£9 Congleton (7)	£0 Rhydymwyn (3)	30. Congleton (9)

Notes: [1] The rank for all respondents was determined by simply summing the ranks for flooded and at risk respondents.

The exercise was repeated using the logarithmic expression ln(WTP+1) to reduce the influence of extreme values and the results are shown in Table 4.19. Overall, it appears that while there is some consistency between the responses for flooded and at risk respondents for each area, there are also differences. As an extreme example, Weybridge attracted high and low WTP values from flooded and at risk respondents respectively. As would be expected, the overall ranking does depend on the manner in which it is derived (i.e. whether based on a linear or logarithmic function). Nevertheless, Kendal, Waltham Abbey and Woking appear in the top six in both tables while Rhydymwyn, Evesham and Congleton appear in the bottom six in both tables.

Table 4.19 Analysis of mean WTP values (as ln(WTP + 1)) by area

WTP value	Flooded respondents	At risk respondents	Rank for all respondents[1]
Six highest values	6.03 Ponteland (5)	4.88 York (6)	1. Kendal (27)
	5.32 Kendal (12)	4.75 Woking (6)	2. Barlby/Selby (63)
	4.96 Waltham Abbey (22)	4.48 Worcester (5)	3. Woking (15)
	4.75 Weybridge (5)	4.24 Barlby/Selby (19)	4. Lewes (190)
	4.66 Barlby/Selby (44)	4.10 London Colney (5)	5. Waltham Abbey (39)
	4.65 Ryde (IOW) (12)	4.00 Kendal (15)	6. London Colney (15)
Six lowest values	3.14 Ruthin (40)	2.87 Ruthin (17)	25. Rhydymwyn (23)
	3.12 Hatton (24)	2.82 Gowdall (10)	26. Hatton (4)
	2.39 Evesham (14)	2.03 Weybridge (18)	27. Ruthin (57)
	2.20 Macclesfield (7)	1.86 Congleton (2)	28. Hemingford Grey (9)
	1.22 Hemingford Grey (7)	1.83 Evesham (9)	29. Evesham (23)
	0.97 Congleton (7)	0.00 Rhydymwyn (3)	30. Congleton (9)

Notes: [1] The rank for all respondents was determined by simply summing the ranks for flooded and at risk respondents.

There is some consistency between WTP values and the degree of worry over future flooding (discussed in Section 4.2.3) since respondents in Waltham Abbey were the most worried whilst those in Evesham and Congleton were amongst the least worried. More generally, the degree of worry was found to be a significant explanatory factor for at risk respondents but not flooded respondents.

Multivariate analysis - at risk respondents

For the analysis of the WTP amongst at risk respondents, 27 variables were used:

- 15 socio-demographic factors (based on those listed in Table 4.10[17]);
- 8 flood prevention factors (keep alert for flood warnings, household insurance against flooding, avoid expensive furnishings downstairs, buy water pumps, build walls, avoid irreplaceable items downstairs, keep ditches/drains clear and keep sand/sandbags);
- 2 variables to account for the payment/stress scales used in the questionnaire variants;
- degree of worry over future flooding; and
- the current GHQ Likert score as a measure of psychological health

Initial analysis resulted in a poor correlation ($R^2 = 0.09$) and it was decided to repeat the analysis using the logarithmic transform ln(WTP+1). The results of the stepwise analysis are summarised in Table 4.20.

---

[17] Questions relating to prior health and long-term illness were not asked of at risk respondents so that there were fewer socio-demographic factors than used for the flooded respondents.

Table 4.20 Factors influencing ln(WTP+1) amongst at risk respondents (listed in order of decreasing statistical significance)

Factor	Significance	Relative importance	Comment
Degree of worry	significant $p<0.05$ (5%)	22%	WTP increased with degree of worry
Family type		23%	WTP was least for single-parent families and most for families with adults and children
Education		19%	Those with more educational qualifications were WTP more
Keep alert for flood warnings		12%	Those who keep alert were WTP more
Age		24%	Age is the dominant factor and those in their mid-30s were WTP the most
Initial number of variables	27		
Overall R^2	0.17		
N observations	368		

These findings are of interest in relation to those factors that do and do not appear as being significant. One might expect the degree of worry over future flooding to emerge as a key factor (but it is not a significant factor amongst flooded respondents - see below). As detailed in Annex 4 (see Table A4.95 and associated text), WTP increases progressively as one moves from a single parent family to a single occupation to two or more adults with no children to a household with both adults and children. Such a progression may be the result of both an ability to pay (single parent families might be expected to be amongst the least able to pay) and concern over the presence of children (those with children are WTP more). Although education is correlated to income, it is perhaps surprising that education is more significant than income itself. Of the various flood prevention measures considered, only keeping alert for flood warnings appeared as a significant explanatory measure. Surprisingly age was the dominant factor (although the least significant of those listed in Table 4.20). The relationship between WTP and age was non-linear with people in their mid-30s having the highest WTP. For comparison, it should be noted that those most affected by flooding tended to be in their early 50s (see Table 4.14).

Finally, it is of note that neither the payment nor the stress scale used in the questionnaire was a significant explanatory factor in the resulting WTP values.

Overall, the degree of explanation of the variation in WTP values amongst the at risk respondents was not particularly good ($R^2 = 0.17$).

Multivariate analysis - flooded respondents

For the analysis of the WTP amongst flooded respondents, 45 variables were used:

- 32 variables as used in the health analysis[18];
- 8 flood prevention factors (as listed above);
- 3 health measures (PTSS, GHQ now, GHQ at worst time);
- degree of worry over future flooding; and
- a variable to account for the payment scale used in the questionnaire variants.

As detailed in Annex 4, if the criterion for 'significance' is set at the relatively strict standard of $p<0.01$ (1% as opposed to the 5% used elsewhere in the analysis), the stepwise regression results in the elegant expression:

WTP = a x income + b x stress (as ln(P+1)) + c   (where a, b, c are constants)

This expression suggests that people's WTP is a function of the both the scale of the long-term psychological effects and their ability to pay which, in many ways, is the ideal result. Unfortunately, the overall correlation was relatively poor ($R^2 = 0.10$) and it was decided to repeat the analysis using the logarithmic transform ln(WTP+1) and the results of the stepwise analysis are summarised in Table 4.21 (with further detail in Annex 4).

Although income and stress reappear among the most significant factors, there were a number of other factors which produced an improved overall degree of explanation ($R^2 = 0.24$). Apart from income and stress, the other most important factors were age, residence time and help received. Of note is that none of the flood characteristics (flood depth, warning time, etc.) appeared as significant factors (in their own right) and neither did problems with insurers which dominated the health effects (see Tables 4.13 and 4.14). However, two flood prevention measures did appear although, interestingly, those who keep drains/ditches clear had a WTP less than those that do not (perhaps because they felt less at risk).

It is acknowledged that the factors presented in Table 4.21 are not truly independent in that some factors are inter-dependent. For example, stress has been shown (see Table 4.14) to be influenced by both age and prior health. Similarly, there is some correlation between income and social grade and between income and rented accommodation. Such inter-dependency is reflected in the analysis of the residuals which shows some degree of heteroscedasticity - in other words, the variation in ln(WTP+1) is not being correctly modelled using multi-linear functions (as discussed further in Annex 4).

Finally, it should be noted that the payment scale used in the questionnaire variants did not unduly influence the WTP values selected by the respondents.

---

18 In the health analysis (see Table 4.13), 34 variables were used but it was decided to exclude 'number of main parts flooded' as this effectively duplicated 'number of rooms flooded' and 'depth of cellar flooding' as this did not prove to be a useful explanatory variable (WTP increased with depth of cellar flooding).

Table 4.21 Factors influencing ln(WTP+1) amongst flooded respondents (listed in order of decreasing statistical significance within each group)

Factor Group	Factor	Relative Importance	Comment
Socio-demographic	Age	17%	Age is an important factor and those in their mid-50s were WTP the most
	Income	14%	WTP increased with income
	Residence time	16%	WTP decreased with residence time
	Rented accommodation	<10%	Owner-occupiers were WTP more than those in rented property
	Prior health		Those in good health were WTP more than those in poor health
	Social grade		WTP varied with social grade (highest for ABs)
Flood characteristics			No significant factors
Post-flood factors (inc. health effects and worry)	Stress (as ln(P+1))	11%	WTP increased with stress
	Help received	10%	People who received help were WTP more
Flood prevention measures	Household insurance	<10%	Those who have taken out household insurance against flooding were WTP more but those who kept ditches/drains clear were WTP less
	Keeping ditches/drains clear		
Initial number of variables	45		
Overall R^2	0.24		
N observations	448		

4.5 Factors affecting flooded respondents

The results of the analysis presented in the preceding sub-sections indicate that the short- and long-term psychological effects due to past flood events (as measured by GHQ at the worst time and ln(P+1) respectively) are both strongly influenced by four factors: problems with insurers; age; time taken to get back to normal; and prior health. Further key factors which influence short- and long-term effects are uninsured losses and flood depth respectively.

The WTP of flooded respondents could be expected to be a function of the extent of the long-term effects of the flooding and their ability to pay. If the analysis is forced (by using a high standard of significance), this result is obtained - albeit with limited statistical reliability. However, using the logarithmic transform (ln(WTP+1)) and a lower standard of significance, stress (as ln(P+1)) still emerges as the only significant health measure along with income and a number of other factors (as listed in Table 4.21). Such findings support the proposition that WTP is indeed influenced by long-term psychological effects and ability to pay (as indicated by income).

Clearly, it would be possible to undertake further analysis to explore the precise nature of the interdependence of the variables and to develop more sophisticated models to demonstrate the linkages among the various health measures, the WTP values as well as more site-specific factors (since each flood event is unique).

However, the focus of this study is on the following four questions:

- does flooding produce health effects?
- which factors influence such health effects?
- is there an appropriate WTP value which can be applied?
- which factors influence such a WTP value?

From the preceding sub-sections, it is clear that flooding does produce health effects and statistically significant influencing factors have been identified (from the results of the main survey work). A value of £200 per household per year has been selected as an appropriate WTP value to avoid, primarily, the long-term psychological effects of flooding. Furthermore, statistically significant factors which influence this WTP value have been identified.

As expected, the results include those factors that could be anticipated (such as income influencing WTP) and those that were not (such as the importance of age for both health and WTP). Similarly, some factors (such as flood characteristics) did not emerge as being as significant as was anticipated.

With these points in mind, it is fully accepted that more analysis would generate further interesting results but, for this study, the next step is to incorporate the WTP value of £200 into the flood and coastal defence appraisal methodology.

5. ECONOMIC APPRAISAL METHODOLOGY

5.1 Current guidance

Current guidance on the economic appraisal of flood and coastal defence projects is provided in FCDPAG3 (MAFF, 1999). The principles of FCDPAG3 may be summarised as follows:

- derive the damages associated with do-nothing (D_0);
- derive the damages associated with various improvement options (D_i);
- derive the benefits (i.e. damages avoided) associated with various improvement options ($B_i = D_0 - D_i$);
- derive the costs for each option (C_i); and
- derive the benefit/cost ratios for each option (B_i/C_i).

In all cases, the costs and benefits are transformed into their present value (PV) which is defined as:

> *the value of a stream of benefits or costs when discounted back to the present time* (MAFF, 1999 - p79).

The derivation of a PV depends on the expenditure (£), year of expenditure (n) and the discount rate (r). The basic formula is:

$$PV = £ \times 1 / (1 + r)^n$$

Before 2003, the Treasury (the *Green Book*) required a discount rate of 6% (HM Treasury, 1997). However, from 1 April 2003, a new version of the *Green Book* (HM Treasury, 2003) introduced lower discount rates of 3.5% (0-30 years), 3.0% (31-75 years) and 2.5% (76-125 years). The impact of lower discount rates is to increase PVs - so with the lower discount rate of 3.5%, £100 spent in 10 years time is now equivalent to £71 spent today[19]. Defra (2003) has advised that the guidance on discounting in the new *Green Book* should be applied to the economic appraisal of all new flood and coastal defence projects - and a sample spreadsheet is now available from Defra.

---

19 Mathematically, for expenditure in year N where N is between 31 and 75, the PV expression becomes:

$$PV = £ \times \{1 / (1 + 0.035)^{30}\} \times \{1 / (1 + 0.03)^{(N - 30)}\}$$

and, for expenditure in year N where N is between 76 and 125, the PV expression becomes:

$$PV = £ \times \{1 / (1 + 0.035)^{30}\} \times \{1 / (1 + 0.03)^{45}\} \times \{1 / (1 + 0.025)^{(N - 75)}\}$$

5.2 Valuing health impacts

Overall, it is considered that the value of avoiding the health impacts of fluvial flooding[20] (with particular regard to psychological impacts) is of the order of £200 per year per household.

This value should be applied to all residential properties at significant risk of flooding in project appraisal. In the course of this study, attention has been focused on those properties within the indicative floodplains, which for fluvial flooding is defined as the area bounded by the 1 in 100 year event[21] where this does not account for the presence of defences. For those areas protected by defences, the definition may be refined as the area protected to a 1 in 100 year standard[22].

The main implication of these definitions is that those who are not at significant risk (i.e. outside these areas) are considered to have very low 'willingness to pay' to avoid the health impacts associated with flooding (due to its low likelihood of occurrence). Since respondents who had been flooded more than once (in recent years) were not willing to pay more than those that had been flooded once, this suggests that there is low 'willingness to pay' associated with only slight improvements in the standard of protection.

On this basis, it is proposed that the 'intangible' benefits (in the form of reduced damages) associated with flood defence improvements be represented by a sigmoidal function as illustrated in Figure 5.1.

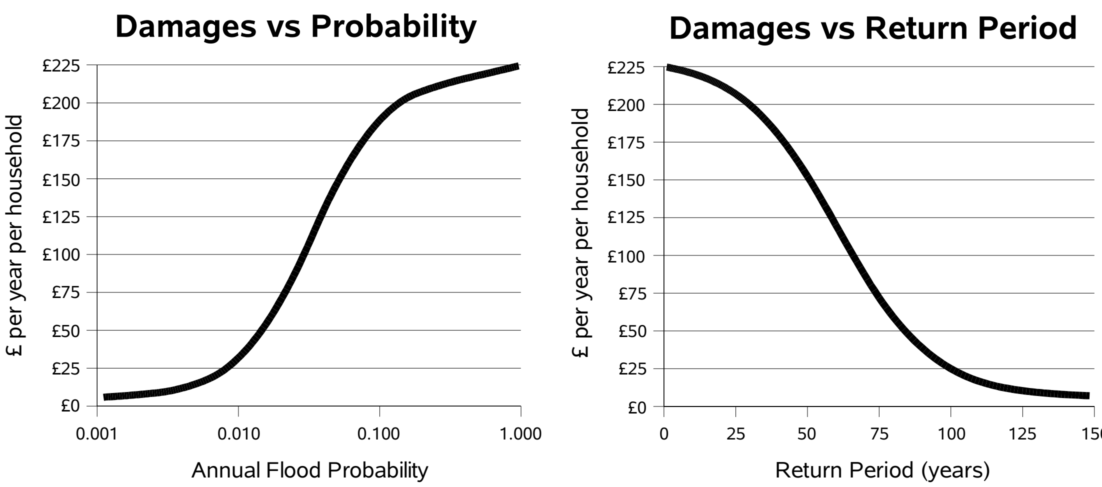


Figure 5.1: Value of human-related intangible damages against annual flood probabilities and flood return periods

---

20 It should be remembered that all study locations were subject to fluvial flooding - since there has been no significant coastal flooding in recent years.

21 For coastal areas, the corresponding standard is set at a 1 in 200 year event.

22 It is important to note that for the purposes of planning (with the intention to prevent further development in the floodplain), this zone is defined as 'high' risk in PPG25 (DTLR, 2001).

Mathematically, the values of the damages and benefits may be represented by the equations (and sample values are presented in Table 5.1):

- Damages (£/yr/household) = $225 \times \{ 1.026 - (1/(1 + 37.5\, e^{-0.06/AFP})\}$
- Damages (£/yr/household) = $225 \times \{ 1.026 - (1/(1 + 37.5\, e^{-0.06\, RP})\}$

where AFP = annual flood probability (in the range 0 to 1)
RP = flood return period (years)
and AFP = 1 / RP

Table 5.1 Damages and benefits against flood probabilities

Human-related intangible damages (£/yr/household)	Annual flood probability (return period in years)	Reduced damages (benefits) of moving from 'do nothing' (AFP ≈ 1)
£225	1 (1)	
£220	0.10 (10)	£5
£213	0.05 (20)	£12
£200	0.033 (30)	£25
£152	0.020 (50)	£73
£72	0.013 (75)	£153
£25	0.010 (100)	**£200**
£10	0.008 (125)	£215
£7	0.007 (150)	£218

As illustrated in Table 5.1, the benefits are derived by determining the difference in damages before and after improvements. Further examples are presented in Table 5.2.

Table 5.2 Benefits (reduced damages) associated with flood defence improvements

Standard before AFP (RP in years)	Standard after - AFP (RP in years)							
	0.007 (150)	0.008 (125)	0.010 (100)	0.013 (75)	0.020 (50)	0.033 (30)	0.05 (20)	0.10 (10)
1 (1)	£218	£215	**£200**	£153	£73	£25	£12	£5
0.10 (10)	£214	£210	£195	£148	£68	£21	£8	£0
0.05 (20)	£206	£202	£188	£141	£60	£13	£0	
0.033 (30)	£193	£189	£175	£128	£47	£0		
0.020 (50)	£145	£142	£127	£80	£0			
0.013 (75)	£65	£62	£47	£0	*Benefits = Damages (before) - Damages (after)*			
0.010 (100)	£18	£15	£0					
0.008 (125)	£4	£0						

Based on the information presented above, the following observations can be made:

- the value of £200 (as derived from the WTP analysis) is assumed to be equivalent to the reduction in damages associated with moving from a do-nothing option (with an annual flood probability approaching unity) to an option with an annual flood probability of 0.01 (i.e. a 1 in a 100 year standard);
- slight improvements in relatively low flood defence standards (for example, reducing the annual flood probability from 0.1 to 0.033) do not result in significant reductions in damages; and
- similarly, there are only slight reductions in damages associated with improving a relatively high standard further (for example, reducing the annual flood probability from 0.01 to 0.008). This is in accordance with the economists' expectation of diminishing marginal utility (i.e. law of diminishing returns).

5.3 Incorporation of intangible damages into economic appraisal

There are various means by which the intangible damages may be incorporated into the economic appraisal process. The key factor is the relationship between the flood risk and the associated damages. Although a sigmoidal relationship has been proposed to relate 'intangible' damages to flood defence improvements, the precise means by which it is to be implemented is not straightforward.

At one extreme, the damages may be assumed to be related directly to the standard of defence provided. In other words, the damages are related to the probability of flooding anywhere in the community. As such, the damages are a function of the maximum number of households at risk (N) and the associated standard of defence. This suggests that the WTP value is essentially an expression of the view "my household is at risk of flooding" rather than being dependent on the actual level of flood risk. To some extent, this suggestion is borne out by the results of the analysis - in that flood characteristics (including frequency of flooding) were not the key explanatory factors in the multivariate analysis of the WTP values. Nevertheless, it might be expected that those living in households close to the limit of the floodplain would be less concerned (and, hence WTP less) than those living closer to the source of the flooding.

At the other extreme, the damages may be assumed to be related directly to the level of flood risk to which households are exposed. In other words, the damages assigned to a particular group of households are related to the probability of those households flooding. As such, the damages are summed across groups of houses (Ni) at different levels of flood risk. This suggests that the WTP value is dependent on the actual level of flood risk - although this suggestion was not borne out by the results of the analysis.

To look at it another way, if the level of damages was directly related to flood risk, we could postulate the following scenario: someone living in a household which is at risk of flooding with a 0.02 annual probability (i.e. a 1 in 50 year event) would be unconcerned about the occurrence of a flood (perhaps on the same street) with a 0.04 annual probability (i.e. a 1 in 25 year event).

It is likely that the 'truth' will range from one extreme to the other depending on site-specific factors and, with this in mind, two methods were examined:

- damages based on standards of defence (which will provide an upper bound); and
- damages based on level of flood risk (which will provide a lower bound).

The former method will be appropriate when considering areas of uniform risk (such housing on level ground behind a flood defence) and the latter will be appropriate for areas of (greatly) varying risk (such as houses on a slope leading away from an undefended river). For cases in between, it might be appropriate to apply both methods to test the sensitivity of the overall results to the method adopted.

5.4 Damages based on standards of defence

5.4.1 The do-nothing option

Under the do-nothing option, the annual damages associated with impacts on health are simply:

Annual health damages = NumH x IntanVal

where, NumH = number of households within the floodplain
IntanVal = intangible damages per household per year (£)

The resultant damages are likely to be close to the value of £225 per year per household (assuming an annual flooding probability of greater than, say, 0.2). These values are then discounted to generate the present value (PV) intangible damage figure.

5.4.2 The do-something options

The do-something options represent a range of risk reduction schemes. The associated human-related intangible damages can be calculated for each option using the values given in Table 5.1 (or the source mathematical expression) and then discounted.

The associated intangible benefits of the options (as for the tangible benefits) are then simply the difference between the damages before and after the implementation of the option under consideration.

5.4.3 Using the FCDPAG3 spreadsheets

The incorporation of the (human-related) intangible benefits into the prescribed cost-benefit analysis approach (the FCDPAG3 spreadsheet) is straightforward. It is proposed to introduce an additional worksheet of the form shown in Table 5.3.

This is based on the Defra spreadsheet dated January 2003 (which incorporates the new discount rates and a 101 year time horizon).

Table 5.3 Sample FCDPAG3 spreadsheet for damages based on standards of defence

No. of households at risk: 133

Option:			Do-nothing		Option 2 - 1 in 20			etc
Yr	DF	AFP	Damages	Discounted damages	AFP	Damages	Discounted damages	AFP
0	1.000	0.100	£29,316	£29,316	0.05	£28,269	£28,269	...
1	0.966	0.101	£29,324	£28,333	0.05	£28,269	£27,313	...
2	0.934	0.102	£29,332	£27,382	0.05	£28,269	£26,389	...
3	0.902	0.103	£29,340	£26,463	0.05	£28,269	£25,497	...
4	0.871	0.104	£29,347	£25,574	0.05	£28,269	£24,635	...
...	...	...	...	...	...	...	...	...

As such, the year and associated discount factor (DF) is copied directly from other sheets within the spreadsheet. Furthermore, the annual flood probability is simply the 'probability of failure/breach' as used in each of the sheets for the options being considered[23]. The **only** data entry required is the number of households at risk of flooding[24] (NumH). In broad terms, it would be expected that this would be the greater of the maximum number of households being considered or the number within the indicative floodplain (i.e. within the 100/200 year boundary for fluvial/coastal flooding).

For each probability (AFP), the associated damages are calculated by multiplying NumH by the damages calculated using the expression presented in Section 5.2. These damages are then discounted by multiplying the damages by the relevant discount factor (DF). The discounted damages are then summed over the 101 years to give the overall discounted damages (PV damages).

In some cases, the households affected under the do-nothing option are written-off. Clearly, if people are not present to be flooded then there should be no intangible damages. However, it could be argued that the stress of knowing that one's household was to be written off would be much greater than that associated with having the household flooded. On this basis, the intangible damages are calculated based on all 'at risk' households being occupied during the lifetime of the project.

[23] In cases where probabilities of breaches/failures and overtopping are different, the higher probability (i.e. shorter return period) value should be used as the basis for determining the flood probability.

[24] As in the main survey work, households with no main room at ground or basement level (such as a first floor flat) are not considered to be at risk.

5.5 Damages based on level of flood risk

5.5.1 Overview

Estimation of the damages based on level of flood risk comprises four steps:

1. assign number of households per flood event 'band' (Ni) for the current situation with no defences;
2. calculate the average flood probability (AFPij) for each option and each band;
3. the associated value of intangible damages for each option and band, Vij = Nij x Damages per year per household (= function of AFPij)
4. sum component damages for each option (Vj) and discount

These calculations are illustrated by example in the following paragraphs based on the example from FCDPAG3 considered above. It is proposed that the method can be incorporated into FCDPAG3 using two worksheets (one for the damage calculations and one for the discounting).

5.5.2 Step 1: Number of households by flood risk band

The assumed distribution of the 133 households 'at risk' considered above is presented in Table 5.4. By way of example, there are 70 households affected by a flood with an annual probability of 0.02 (50 year return period), 50 of which would not be affected by a flood with an annual probability 0.04 (25 year return period).

Table 5.4 Distribution of households by flood risk 'band' (no defences)

Return period (years)	1	5	10	15	25	50	100	150	250	1000
Annual flood prob. (AFP)	1.000	0.200	0.100	0.067	0.040	0.020	0.010	0.007	0.004	0.001
N h'holds (cumulative)	0	0	5	10	20	70	100	120	133	133
Ni h'holds (per band)	0	0	5	5	10	50	30	20	13	0

5.5.3 Step 2: Flood probabilities under different options

For each group of households presented in Table 5.4, there will be an associated annual flood probability determined by both location (i.e. based on level of flood risk without defences) and the standard of defence. By way of example, 10 households lie between the 0.067 (1 in 15) and 0.04 (1 in 25) contours (in the absence of defences). Under Option 1 (do-nothing), the average annual flood probability is taken as 0.5 x (0.067 + 0.04) = 0.053 (1 in 19). Under the do-something options, the flood probability has been taken as that of the standard of defence[25]. The average annual flood probability (AFPij) by location ('band') and option are summarised in Table 5.5.

[25] Where the standard of defence lies between the limits of a 'band', the average flooding probability could be adjusted to reflect whether households were inside or outside a particular flood envelope. For Option 2 (with a 0.05 standard) and assuming an even distribution of households within the 0.04 to 0.067 band, the adjusted figure would be 0.048 which is not significantly different from the value of 0.05 used.

Table 5.5 Average annual flood probability per 'band' taking account of options

Annual flood probability with no defences[1]	0.600	0.150	0.083	0.053	0.030	0.015	0.008	0.005	0.003
Option 1 (do-nothing)	0.150	0.150	0.083	0.053	0.030	0.015	0.008	0.005	0.003
Option 2 (1 in 20)	0.050	0.050	0.050	0.050	0.030	0.015	0.008	0.005	0.003
Option 3 (1 in 50)	0.020	0.020	0.020	0.020	0.020	0.015	0.008	0.005	0.003
Option 4 (1 in 100)	0.010	0.010	0.010	0.010	0.010	0.010	0.008	0.005	0.003

Notes: [1] The AFP values relate to the average AFP between the contours (i.e. within the 'bands'). Thus, the first value of 0.6 = 0.5 x (1.0 + 0.2).

5.5.4 Step 3: Calculation of intangible damages

The intangible damages are then simply the product of the number of households per band (last line of Table 5.4) and the annual damages per household (where these are a function of the flood probabilities presented in Table 5.5). Using the formula presented in Section 5.2 generates the results presented in Table 5.6.

Table 5.6 Intangible damages (£k) per band

Annual flood probability with no defences	0.600	0.150	0.083	0.053	0.030	0.015	0.008	0.005	0.003
Option 1 (do-nothing)	£0.00	£1.11	£1.10	£2.14	£9.69	£2.92	£0.60	£0.08	£0.00
Option 2 (1 in 20)	£0.00	£1.06	£1.06	£2.12	£9.69	£2.92	£0.60	£0.08	£0.00
Option 3 (1 in 50)	£0.00	£0.76	£0.76	£1.52	£7.62	£2.92	£0.60	£0.08	£0.00
Option 4 (1 in 100)	£0.00	£0.12	£0.12	£0.25	£1.25	£0.75	£0.60	£0.08	£0.00

5.5.5 Step 4: Sum damages by option and discount

Summing the above damages by option than enables the (human-related) intangible benefits to be discounted as before as shown in Table 5.7.

Table 5.7 Sample FCDPAG3 spreadsheet for damages based on level of flood risk

				Option	1	2	3	4
No. of households at risk:			133	Damages	£17,636	£17,542	£14,266	£3,175
Option:		Do-nothing			Option 2 - 1 in 20			etc
Yr	DF	Pflood	Damages[1]	Discounted damages	Pflood	Damages	Discounted damages	Pflood
0	1.000	0.100	£17,636	£17,636	0.05	£17,542	£17,542	...
1	0.966	0.101	£17,636	£17,039	0.05	£17,542	£16,949	...
2	0.934	0.102	£17,636	£16,463	0.05	£17,542	£16,376	...
3	0.902	0.103	£17,636	£15,906	0.05	£17,542	£15,822	...
...	...	...	...	...	...	...	...	...

Notes: [1] Under the do-nothing option, although the flood probability increases with time, the impact upon the intangible damage values is marginal (since they are close to the maximum of £225 per household per year in any event). For this reason, the same value (derived from the average AFP for Years 0-100) is used in the 'damages' column.

5.6 Summary of results

Summary spreadsheets are reproduced in Tables 5.8 (below) and 5.9 (overleaf). It should be noted that all the calculations have been automated within the sample spreadsheet (as provided to Defra) with an accompanying concise and user-friendly manual (see Annex 6).

There are four immediate observations which can be made:

- substantial benefits (through reduced health-related damages) are only realised when the scheme provides a high degree of protection (approaching 1 in 100 years or better);
- the values for intangible damages using damages based on flood risk (the lower bound method) are about two thirds of those using damages based on standards of defence (the upper bound method) for schemes which do not provide a high degree of protection (although the precise ratios will vary depending on the distribution of households within the floodplain);
- the benefits of reducing health impacts are greatly outweighed by the 'tangible' benefits of reducing damage to properties; and
- the health impacts are only likely to be of significance where the (incremental) benefit/cost ratios are close to the thresholds in the decision criteria.

Table 5.8 Results from FCDPAG3 spreadsheet incorporating health impacts with damages based on flood risk (lower bound method)

	No Project	Option 2 (1 in 20)	Option 3 (1 in 50)	Option 4 (1 in 100)
PV costs from estimates	-	2,508	3,210	4,872
Optimism bias adjustment	-	752	963	1,462
Total PV Costs for appraisal PVc	-	3,260	4,174	6,334
PV damage PVd	8,105	1,897	825	468
Intangible damages	***527***	***524***	***426***	***95***
Total damages PVd	8,632	2,421	1,251	563
PV damage avoided		6,211	7,381	8,069
PV assets PVa				
PV asset protection benefits		-	-	-
Total PV benefits PVb		6,211	7,381	8,069
Net Present Value NPV		2,951	3,207	1,735
Average benefit/cost ratio		**1.91**	**1.77**	**1.27**
Incremental benefit/cost ratio			**1.28**	**0.32**
Without the 'intangibles', the last four rows would have read (as in the Defra spreadsheet):				
Total PV benefits PVb		6,208	7,280	7,637
Net Present Value NPV		2,948	3,106	1,303
Average benefit/cost ratio		**1.90**	**1.74**	**1.21**
Incremental benefit/cost ratio			**1.17**	**0.17**

Table 5.9 Results from FCDPAG3 spreadsheet incorporating health impacts with damages based on standards of defence (upper bound method)

	No Project	Option 2 (1 in 20)	Option 3 (1 in 50)	Option 4 (1 in 100)
PV costs from estimates	-	2,508	3,210	4,872
Optimism bias adjustment	-	752	963	1,462
Total PV Costs for appraisal PVc	-	3,260	4,174	6,334
PV damage PVd	8,105	1,897	825	468
Intangible damages	***880***	***844***	***605***	***99***
Total damages PVd	8,985	2,741	1,430	567
PV damage avoided		6,244	7,554	8,418
PV assets PVa				
PV asset protection benefits		-	-	-
Total PV benefits PVb		6,244	7,554	8,418
Net Present Value NPV		2,984	3,381	2,083
Average benefit/cost ratio		**1.92**	**1.81**	**1.33**
Incremental benefit/cost ratio			**1.43**	**0.40**
Without the 'intangibles', the last four rows would have read (as in the Defra spreadsheet):				
Total PV benefits PVb		6,208	7,280	7,637
Net Present Value NPV		2,948	3,106	1,303
Average benefit/cost ratio		**1.90**	**1.74**	**1.21**
Incremental benefit/cost ratio			**1.17**	**0.17**

5.7 Application of methodology to case studies

5.7.1 Approach to case studies

The four case studies selected were:

- Ottery St Mary in Devon;
- Pett Frontage Sea Defences in Sussex;
- Gowdall Urgent Works in the East Riding of Yorkshire; and
- Robertsbridge Flood Alleviation in East Sussex.

In each case, a proposed scheme had been analysed in detail and had been recently presented in a Project Appraisal Report (PAR) by the Environment Agency (2002, 2002a, 2002b and 2002c) to Defra in order to seek grant-aid funding.

The application of the methodology in each case may be summarised as follows:

- review the cost-benefit analysis (CBA) as presented in the PAR; and
- rework the CBA using the 'new' discount rates with and without human health impacts.

The full analysis is presented in Annex 5 and a summary is presented below. In each case for the PAR, the costs and benefits were discounted over a period of 50 years. To facilitate comparison, the period of 50 years (rather than the now recommended period of 100 years) was retained for the revised analyses.

5.7.2 Review of CBA in PAR

For each case study, a number of improvement options had been considered in the PAR and a preferred option selected through the application of the FCDPAG3 economic appraisal procedures.

The key features for each case study are summarised in Table 5.10.

Table 5.10 Outline of case studies

Location	Fluvial/ coastal	Residential properties at risk	Short-listed options[1] (standard)	Preferred option in the PAR
Ottery St Mary	Fluvial	31	A Do nothing B Do minimum Qi Improve (50 yr) Qii Improve (100 yr) Qiii Improve (150 yr) R Improve (100 yr)	Preferred option is Qii (100yr) as it has highest B/C ratio[2] and next option (Qiii) does not have an iB/C ratio of more than 3
Pett Frontage	Coastal	390	A Do nothing M Maintain S Sustain I-20 Improve (20 yr) *I-50 Improve (50 yr)* I -200 Improve (200 yr)	Option I-50 is not presented in the PAR and I-200 is presented as the preferred option. However, if included, the I-50 emerges as the preferred option.
Gowdall	Fluvial	140	1 Do nothing 2 Do minimum 3 Improve (50 yr) *3A Improve (100 yr)*	Option 3A has been added for illustrative purposes. With or without Option 3A, Option 3 emerges as the preferred option (since the iB/C of 3A is less than three)
Robertsbridge	Fluvial	80	1 Do nothing 2 Improve (5 yr) 3 Improve (25 yr) 4 Improve (50 yr) 5 Improve (100 yr) 6 Improve (200 yr)	Although Option 6 has the highest B/C ratio, Option 5 is selected as the preferred option. In the absence of Option 6, the application of FCDPAG3 would lead to Option 4

Notes: [1] Options in italics have been added for illustrative purposes.
[2] B/C is the benefit to cost ratio and iB/C is the incremental benefit to cost ratio.

5.7.3 Influence of the new discount rates and health impacts

As detailed in Annex 5, the CBA for each case study was reworked to account for the new lower discount rates. The main impact of lower discount rates is to increase the present value of costs and benefits incurred in the longer term. Since many flood and coastal defence schemes involve costs in the short term (for engineering works) with the resultant benefits occurring over the longer term, the use of lower discount rates tends to result in higher benefit/cost ratios.

The CBAs were reworked with and without the health impacts. For Ottery St Mary and Robertsbridge, the health damage calculations were based on flood risk since this varied significantly across the area at risk. For Pett Frontage and Gowdall, the level of flood risk was assumed to be fairly constant across the properties at risk and the health damage calculations were based on the standards of defence.

For Ottery St Mary, Option Qii remains the preferred option with or without health impacts. For the Pett Frontage, the preferred option of Option I-50 using the 6% discount rate is replaced by Option I-200 using the lower discount rates, with or without the health impacts. For Gowdall, Option 3 remains the preferred option without health impacts but Option 3A emerges as the preferred option if health impacts are included. For Robertsbridge (if Option 6 is excluded), the preferred option of Option 4 using the 6% discount rate would be replaced by Option 5 using the lower discount rates with health impacts but would be either Option 4 or Option 5 if health impacts were not included.

5.7.4 Summary

The proposed economic methodology to account for health impacts has been successfully trialled on four case studies. Overall, the effects of including health impacts within the CBA FCDPAG3 methodology and the use of the new lower discount rates is to favour schemes with a higher standard of protection as summarised in Table 5.11.

Table 5.11 Standards of protection afforded by the preferred options under different appraisal methodologies

Basis for appraisal	Ottery St Mary[1]	Pett Frontage[2]	Gowdall[3]	Robertsbridge[4]
PAG3 without health impacts, 6% discount rate	100 years (Option Qii)	50 years (Option I-50)	50/75 years (Option 3)	50 years (Option 4)
PAG3 without health impacts, 3.5/ 3% discount rates	100 years (Option Qii)	200 years (Option I-200)	50/75 years (Option 3)	50 or 100 yrs (Option 4 or 5)
PAG3 with health impacts, 3.5/3% discount rates	100 years (Option Qii)	200 years (Option I -200)	100/150 years (Option 3A)	100 years (Option 5)

Notes: [1] For Ottery St Mary, the calculations for the new discount rates were based on the single rate of 3.5% as presented in the PAR.
[2] For the Pett Frontage, Option I-50 has been included for illustrative purposes as this was not a PAR short-listed option.
[3] For Gowdall, Option 3A has been added for illustrative purposes.
[4] The results for Robertsbridge have been presented in the absence of Option 6 (with an associated 200 year standard) for illustrative purposes.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

There are three main conclusions from this study.

Firstly, flooding leads to health impacts including physical effects in the short-term and, more significantly, psychological effects in the short- and long-term. The scale of these effects depends on numerous varied factors including socio-demographic characteristics, flood attributes and post-flood activities. In relation to psychological effects, the most important influencing factor to emerge was problems in dealing with insurance companies and loss adjusters in settling claims for flood damage.

Secondly, results from a survey carried out in thirty locations across England and Wales suggest a mean willingness-to-pay (WTP) value of around £200 per year per household to avoid such health impacts. As for the health impacts, the WTP values were dependent on numerous factors but income and extent of long-term psychological effects (i.e. stress) emerged among the most important influencing factors. However, the most important factor was age with people in their 50s having the highest WTP values. It was also this age group which suffered the greatest short- and long-term psychological effects.

Thirdly, the value of £200 can be readily incorporated into the economic appraisal of flood and coastal defence projects and this has been demonstrated by its application to several case studies. Although the economic appraisal will tend to be dominated by the much larger ‘tangible’ losses (damage to property, etc.), the inclusion of a value for associated health impacts will, in some cases, lead to the selection of options with higher standards of protection.

6.2 Recommendations

There are three main recommendations from this study.

Firstly, it is recommended that the proposed methodology (and associated guidance) to account for the health impacts of flooding is incorporated into the standard economic appraisal methodology for flood protection.

Secondly, although the work is based on the health impacts of non-coastal flooding (due to an absence of coastal flooding events in recent years), it is recommended that the methodology be applied to both fluvial and coastal projects.

Thirdly, it is recommended that consideration be given to the merits of undertaking further work to assess the health impacts on other groups who may be affected by flooding, with particular regard to the impacts on those who run small businesses (such as shopkeepers).

7. REFERENCES

Benight *et al.* (1999): *Psychometric Properties of a Hurricane Coping Self-Efficacy Measure*, Journal of Traumatic Stress, Vol. 12, No. 2, pp 379-386.

Bennet G (1970): *British Floods 1968: Controlled Survey of Effects on Health of Local Community Disaster*, British Medical Journal, August 22 1970, pp 454-485.

Bromet EJ *et al.* (1986): *Long-Term Reliability of Diagnosing Lifetime Major Depression in a Community Sample*, Archives of General Psichiatry, 43, 435-440.

Carr VJ *et al.* (1997): *A Synthesis of the Findings from the Quake Impact Study: A Two-Year Investigation of the Psychosocial Sequale of the 1989 Newcastle Earthquake*, Social Psychiatry and Psychiatric Epidemiology, Vol. 32, No. 3, pp 123-136.

Defra (2003): **Revision to Economic Appraisal Procedures arising from the new HM Treasury "Green Book"**, London, Defra dated 14 March 2003.

Department of Health (1999): **Economic Appraisal of the Health Effects of Air Pollution**, London, The Stationary Office.

Diener AA *et al*. (1997): *Willingness-to-Pay for Improved Air Quality in Hamilton-Wentworth : A Choice Experiment*. Working Paper No 97-08. Hamilton, Ontario, Canada: Department of Economics, McMaster University.

DTLR (2001): **Planning Policy Guidance Note 25: Development and Flood Risk**, London, DTLR, dated July 2001.

DTLR (2002): **Economic Valuation with Stated Preference Techniques**, London, DTLR, dated March 2002.

Dua J and Scott W (2001): **Manual for the Post-Traumatic Stress Scale**, Melbourne, PsychPress.

Enarson E and Fordham M (2001): *Lines that Divide, Ties that Bind: Race, Class and Gender in Women's Flood Recovery in the US and UK,* Australian Journal of Emergency Management, Vol. 15 (4), pp 43-52.

Enarson E and Morrow B (eds) (1998): **Through Women's Eyes: The Gendered Terrain of Natural Disasters**, Westport, Praeger.

Environment Agency (2002): **Ottery St Mary Flood Defence Scheme**, Project Appraisal Report dated September 2002.

Environment Agency (2002a): **Pett Frontage Sea Defences**, Project Appraisal Report dated September 2002.

Environment Agency (2002b): **Gowdall Urgent Works**, Project Appraisal Report dated March 2002.

Environment Agency (2002c): **River Eastern Rother - Robertsbridge Flood Alleviation**, Project Appraisal Report dated May 2002.

Erens B and Primatesta P (eds) (1999): **Health Survey for England, 1998**, London, The Stationery Office.

Fordham MH (1998): *Making Women Visible in Disasters: Problematising the Private Domain,* Disasters, Vol. 22 (2), pp 126-143.

Goldberg D and Williams P (1988): **A User's Guide to the General health Questionnaire**, Windsor, NFER-Nelson.

Green CH *et al*. (1994): *Vulnerability Refined: Full Flood Impacts* in Penning-Rowsell EC and Fordham M (Eds.) **Floods across Europe: Flood Hazard Assessment, Modelling and Management** Enfield: Middlesex University Press.

HM Treasury (1997): **Appraisal and Evaluation in Central Government**, London, The Stationery Office (usually referred to as the Green Book).

HM Treasury (2003): **The Green Book - Appraisal and Evaluation in Central Government**, London, TSO.

Horowitz M *et al*. (1979): *Impact of Event Scale: A Measure of Subjective Stress*, Psychosomatic Medicine, Vol. 41, No. 3, pp 209-218.

Johnson FR *et al*. (1997): *Valuing Morbidity: An Integration of the Willingness-to-Pay and Health-Status Index Literatures*, Journal of Health Economics, Vol 16(6), pp 643-665.

MAFF (1999): **Flood and Coastal Defence Project Appraisal Guidance: Economic Appraisal (FCDPAG3)**, London, MAFF (now Defra).

McFarlane AC *et al*. (1997): *Psychiatric Morbidity Following a Natural Disaster: an Australian Bushfire*, Social Psychiatry and Psychiatric Epidemiology, Vol. 32, No. 5, 261-268.

McGuffin P *et al.* (1986): *Past and Present State Examination: the assessment of 'lifetime ever' psychopathology*, Psychological Medicine, 16, 461-465.

Power MJ (1988): *The 'Worst Ever' Version of the General Health Questionnaire,* Journal of Clinical Psychology, Vol.44, No. 2, 215-216.

Power MJ (undated): **The 'Worst Ever' Version of the General Health Questionnaire (extended version)**, London: Institute of Psychiatry.

Rick J *et al*. (1998): **Workplace Trauma and its Management: Review of the Literature**, report for the Health and Safety Executive, Brighton, Institute for Employment Studies, University of Sussex.

Schwartz JC and Zuroff DC (1979): *Family Structure and Depression in Female College Students: Effects of Parental Conflict, Decision-Making Power, and Inconsistency of Love,* Journal of Abnormal Psychology 88, 398-405.

Scott W and Dua J (1999): *Development of a Scale to Assess Posttraumatic Stress Disorder*, International Journal of Stress Management, Vol. 6, No. 3, pp 149-165.

Sturgis P *et al*. (1998): **Comparative Review and Assessment of Key Health State Measures of the General Population**, Report for the Department of Health, UK, www.doh.gov.uk/public/healthreport.pdf

Tapsell SM *et al*. (1999): **The Health Effects of the 1998 Easter Flooding in Banbury and Kidlington**, draft report prepared for the Environment Agency (Thames Region) by Middlesex University Flood Hazard Research Centre, Enfield.

Tapsell SM and Tunstall SM (2001): **The Health and Social Effects of the June 2000 Flooding in the North East Region**, report prepared for the Environment Agency by Middlesex University Flood Hazard Research Centre, Enfield.

Viscusi WK *et al*. (1991): *Pricing Environmental Health Risks: Survey Assessments of Risk-Risk and Risk-Dollar Trade-Offs for Chronic Bronchitis*, Journal of Environment, Economics and Management, Volume 21, pp 32-51.

Zuroff DC (1981): *Depression and Attribution: some New Data and a Review of Old Data*, Cognitive Therapy and Research, 5, 273-281.

ANNEX 1

FURTHER DETAIL ON PILOT SURVEYS

A1.1 Further detail on Phase 1 pilot surveys

A1.1.1 Socio-demographic characteristics

Gender and age

The pilot sample was predominantly female (46 out of 72 respondents). This pattern occurred across all the survey areas. The pilot sample was also weighted towards the older age groups (mean age 55).

Social Grade

A general mix of social grades was represented. Social grade can be approximately interpreted as (with % respondents in brackets):

- AB - professional and managerial (18%)
- C1 - clerical and other white collar (32%)
- C2 - skilled manual (18%)
- DE - semi skilled/unskilled manual (31%)

Housing

Most pilot respondents lived in terraced (38, 53%) or semi-detached houses (21, 29%). Only 7 (10%) were particularly vulnerable as they lived in ground floor flats or bungalows, 4 (6%) in detached properties and the remainder (3, 4%) in a basement or other accommodation. There were some differences in the type of properties in the different areas. The few detached houses in the pilot sample were in Lewes. In Northfield, most lived in terraced housing and in Waltham Abbey the housing was exclusively semis or terraced housing.

A1.1.2 Flood characteristics

Flood experience and awareness

Only 22 (31%) reported that they were aware of the flood risk in the area before the flooding. Flood risk awareness was lowest in Northfield and highest in Lewes (differences not statistically significant however). Major flooding had occurred in Leamington Spa in Easter 1998 and in Waltham Abbey and Lewes in October 2000. Northfield has suffered several floods including ones in the summers of 1998 and 2000.

Most (52 households, 72%) had only experienced the one flood at or since Easter 1998[1]. Multiple flood events were concentrated in Northfield. For over three-quarters of respondents (79% or 54 people), the last flood was the worst one and the one that their responses were focused on.

---

1 Flooding is defined as 'flooding above floor level in your home' in this survey.

Onset of flooding

Most respondents (76% or 55) reported that the floodwaters rose so quickly that you could see them rising.

Depth of flooding

The depth of flooding in different rooms was obtained from respondents. Flood depths in the living room are summarised in Table A1.1, from which it can be seen that Lewes suffered the worst flooding (in terms of depth).

Table A1.1 Depth of flooding in living room

Area	No flooding	< 25cm	25-99 cm	>100 cm
Northfield	4	5	10	0
Leamington Spa	1	0	3	0
Waltham Abbey	2	11	6	1
Lewes	1	4	4	18
All	8 (11%)	20 (29%)	23 (33%)	19 (27%)

A1.1.3 Health impacts and socio-demographic characteristics

Gender and health impacts

In the pilot survey, no statistically significant differences were found in any of the health impact measures according to gender.

Age and health impacts

The scatter plots for respondents' age and both GHQ and PTSS scores suggest a non-linear relationship, with people approximately 50-60 years old recording the highest scores. A comparison of the mean number of self-reported effects reported showed the highest number in each case to be in the 40-64 age group, mirroring the findings of the GHQ and the PTSS.

Children in the household and health impacts

The presence of children in the home might be expected to add to the vulnerability and stress of a flood event and thence to additional health effects. However, there were no statistically significant differences in the proportions reporting high scores among those in households with children compared with households without children.

Social grade, benefits, employment status, tenure and income and health impacts

These classifications were included as potential measures of household vulnerability to flooding. In the pilot survey, a very simple social grade classification was used based on the occupation of the chief wage earner in the household. None of the cross tabulations produced statistically significant differences for the health impacts measures.

Those on benefits were a little more likely than those not on benefits to have high grouped PTSS Intensity scores (37% compared with 26%) although again differences were not statistically significant. Likewise, there were no statistically significant or observable difference in the proportion with high current GHQ scores or high or very high scores 'at the worst time' among respondents who themselves were (20) or were not (52) in receipt of state benefits. The employment situation of the respondents was varied. The retired respondents did not differ greatly in their GHQ scores from the pilot sample as a whole.

As there were only 43 respondents who gave their income group, grouped income is not very useful as an explanatory variable. Similarly, respondents predominantly owned their properties outright or on a mortgage so that tenure proved not a useful variable for analysis.

A1.1.4 Health impacts and flood characteristics

Overview

The possible flood factors that might be relevant to health effects include the recency, frequency, and duration of the ('worst') flooding, speed of onset, flood awareness and whether or not there was a warning. A key question for the pilot research was to establish whether health impacts varied according to the depth of flooding experienced. The analysis has focused on this issue, with preliminary consideration of other flood characteristics.

Flood depth

The scatter plots presenting current and 'at worst time' GHQ and Likert scores against flood depth in the living room, show a wide range of impacts experienced as indicated by the GHQ scores at given depths of flooding, particularly at the lower levels of flooding. The correlations between the GHQ scores for 'the worst time' and living room flooding depth were not significant. There were, however, weak but significant correlations between current GHQ scores and depth of flooding.

This would seem to suggest that the earlier and most severe impact of flooding is less closely related to flooding depth than the longer-term impact experienced months or years after the event.

A scatter plot showing PTSS Intensity scores in relation to depth of flooding suggests that there is some relationship between the two but that there is a great deal of variability in PTSS Intensity scores associated with given levels of flooding particularly at the lower levels of flooding. There are individuals who experienced only a few centimetres of flooding but who nonetheless had high PTSS scores and also rather fewer respondents who were badly flooded but had low scores. The correlation between PTSS Intensity score and living room flood depth is weak but significant.

Duration of flooding

It can be hypothesised that the longer the floodwaters remain in the home, the greater will be the damage and disruption and thus stress suffered. However, there were no significant correlations between duration of flooding in hours and GHQ and PTSS scores. Scatter plots of the scores against duration of flooding showed a very wide range of scores at a given length of flood event. By way of example, some respondents who had floodwaters in their home only very briefly had very high scores whilst some experiencing longer events had fairly low scores.

Correlation analysis also suggests that the duration of the flood is not a significant factor in the self-reported physical effects and mental health effects experienced. However, the mean scores for those flooded briefly, for a moderate and a longer duration show some differences. There are thus very limited indications that the duration of flooding may contribute to the health impacts of flooding but any conclusions on this must be tentative given the small sample size, possible measurement error associated with the duration of flooding and lack of clearly significant findings.

Speed of onset of flooding, flood warnings and awareness of flooding

It can be hypothesised that flooding will be more traumatic where it occurs suddenly, without warning and to a population not aware of the risk of flooding. Some evidence was found in support of this in that those experiencing a speedy onset in the worst flood event had significantly higher PTSS scores and a higher number of self-reported mental health effects than those who experienced slower flooding. However, differences with speed of onset were not found for the GHQ or for the physical self-reported effects.

Although those few respondents (13) who had received some kind of warning had slightly lower scores on all the health impact measures (GHQ, PTSS and self-reported effects), the differences were not statistically significant in these bivariate analyses.

Similarly, prior awareness of the risk of flooding did not appear to be associated with health effects in the bivariate analysis. The PTSS scores and self-reported mental health effects of those who were aware were very slightly lower than those of flood victims unaware of the risk but these differences were small and were not found for the other health measures. In this pilot data set, therefore awareness of flooding does not appear to be significantly related to health impacts.

Recency of flooding

We would expect the flood victims to recover from some of the health effects of flooding over time. Prior research has indicated that the physical health effects of a flood event are reduced over time (Tapsell, 2000). However, evidence from the qualitative research has shown that mental health effects of flooding can be quite long lasting (Tapsell, 2000). The comparison of GHQ scores 'at the worst time' and currently indicates that mental health effects are also reduced as the flood event recedes into the past. Another way of exploring the possible time decay factor in health effects is to compare those flooded more recently (in the year 2000) with those flooded earlier who have had more time to recover.

Simple correlations between the months since flooding and the various health scores (GHQ, PTSS scores) do not appear significant. The relationship is (just) in the expected direction with very slightly lower scores the longer the time since the flood but the relationship is very weak and not significant.

If we look at the difference between current scores and 'at worst time' GHQ scores, we would expect a positive relationship with the difference increasing as the months since the flood increase and as victims have had time to recover. This occurs for the Likert score but not for the GHQ scoring and this may simply be that the GHQ scoring is less sensitive. Neither of these relationships are anything but very weak and insignificant. As the worst period occurred for most victims at the time of the flood or within a month of it, it is possible that the recovery from the worst effects of flooding occurs within a shorter period than 15 months and therefore that our recency variable and two time periods do not discriminate between the worst and longer term effects.

There is no reason to expect the number of self-reported health effects to be related in any way to the length of time that has passed since the flood event since the self-reports refer to the experience around the time of the flood and in its aftermath and not to the current health status. There were no significant correlations between the number of self-reported health effects and the number of months since flooding.

A1.1.5 Socio-demographic characteristics for choice modelling pilot surveys

Gender and age

As for the health questionnaires, there was a bias towards female and older age groups (mean age 51).

Social grade

The mix of social grades was similar to that for the health questionnaire respondents with 18% AB, 30% C1, 26% C2 and 26% DE.

Economic factors

50% of respondents were in full or part-time employment and the mean household income was about £22,000. Over 40% of respondents refused to answer the household income question and this is an indication that the questionnaire design needs to be more compatible with the incentives of the respondents for more of them to answer this question.

A1.2 Further detail on Phase 1A pilot survey

A1.2.1 Socio-demographic characteristics

Gender and age

Both the flooded and at risk samples were representative of gender, with equal numbers of women and men. The pilot sample was weighted towards the older age groups with mean ages of 55 and 52 for the flooded and at risk samples respectively, as was the case in Phase 1.

Social grade

The respondents represented the following mix of social grades: 11% AB, 40% C1, 17% C2, 8% DE and 25% unknown.

Housing

Most respondents lived in semi-detached (24, 45%) or terraced houses (14, 26%).

A1.2.2 Flood experience and awareness

Flood risk awareness

Of the flooded sample, only 6 (16%) reported that they were aware of the flood risk in the area before the flooding. For those at risk, the awareness was much higher, probably as a result of the flooding experienced in the area. This was equal to 50% in Bocking and 75% in Newport Pagnell.

Concern about flooding

Both flooded and at risk samples were asked how worried they were about the possibility of being flooded during the next twelve months. The majority of respondents were at least 'somewhat worried'.

In addition, respondents were asked which characteristic of the flood concerned them most. More than half were worried about the speed of the floodwaters, particularly amongst those who had been flooded

Flood experience of respondents

37 respondents had been flooded. The flood events occurred in Newport Pagnell and Bocking in 1998 and 2001 respectively.

Only one person in Newport Pagnell reported receiving a warning, this was from their neighbour approximately 15 minutes before the flood. Most respondents (35, 95%) reported that the floodwaters rose so quickly that you could see them rising.

The depth of flooding in different rooms was obtained from respondents. This ranged from 5 cm to 137 cm, with an average depth of 61 cm. Nearly a quarter of respondents experienced floods of more than one metre. In most cases (32, 86%) peoples' living rooms were flooded, 28 (76%) also had their kitchen flooded, and 8 (22%) had their living room, kitchen and bathroom flooded.

ANNEX 2

BRIEFING NOTE FOR
MAIN SURVEY LOCATIONS

A2.1 Alconbury, Cambridgeshire

Date Flooded: April 1998 Date Visited: September 2001

The neighbouring villages of Alconbury and Alconbury Weston were flooded in Easter 98 and have been used in focus groups earlier in the study. Information on flooded properties is based on a detailed house to house survey carried out by a firm of engineering consultants. Housing is a mixture ranging from large detached houses to terraced housing. Note that both villages are very quiet during week-days.

Parameters for Alconbury & Alconbury Weston	Value
Estimated No. of flooded properties	90
Number of Level 1 addresses	130
Number of Level 2 addresses	40
Interview Targets - Flooded/At Risk	26/13
Interviews Completed - Flooded/At Risk	28/15

A2.2 Banbury, Oxfordshire

Date Flooded: April 1998 Date Visited: 25 September 2002

Flooding in Grimsbury area of Banbury, from River Cherwell (ditch running behind housing area). Fergusson Road most badly flooded to about 2ft, whole road affected. Other small groups of housing also flooded. Many odd numbered houses in West Street are four storey buildings where the basement is used as a living area (or separate flat). Area is a complete mix of age, race and social class.

Parameters for Banbury	Value
Estimated No. of flooded properties	130
Number of Level 1 addresses	130
Number of Level 2 addresses	70
Interview Targets - Flooded/At Risk	37/19
Interviews Completed - Flooded/At Risk	27/30

A2.3 Barlby/Selby, North Yorkshire

Date Flooded: November 2000 Date Visited: 16 September 2002

Pre-screening concentrated on Barlby area where the River Ouse had overtopped the defences. Water approximately 1-2ft deep, and would have flooded most properties on Barlby Crescent (semi-detached). Residents were evacuated by the army. Also properties on East and West View were flooded, but some newer houses escaped as they had been built slightly higher.

Also went to a new housing estate near a school, where water had been 2ft deep. However, many houses on the estate were up for sale (apparently due to being good starter homes and therefore people moving when family size increases, rather than as a result of the flooding), so likely that many people who had experienced the flooding are no longer there.

Although it is unlikely that Level 2 addresses will be required, these should be treated with some caution - for example is 'Hilltop' really at risk of flooding?

Parameters for Barlby	Value
Estimated No. of flooded properties	c150
Number of Level 1 addresses	c175
Number of Level 2 addresses	c170
Interview Targets - Flooded/At Risk	48/24
Interviews Completed - Flooded/At Risk	48/24

A2.4 Bollington, Cheshire

Date Flooded: 27 October 1998 Date Visited: 19 September 2002

Flooding due to heavy rainfall and drainage in several streets. Water Street had water up to 1ft. Oldham Street also flooded to about 2ft. Story of water building up behind factory wall before blowing a hole in the wall. Houses around green in High Street may also have been flooded but not confirmed. Area mostly terraced, but also some semi-detached.

Parameters for Bollington	Value
Estimated No. of flooded properties	60
Number of Level 1 addresses	60
Number of Level 2 addresses	120
Interview Targets - Flooded/At Risk	17/9
Interviews Completed - Flooded/At Risk	16/9

A2.5 Congleton, Cheshire

Date Flooded: Oct. 1998 and Sept. 2001 Date Visited: 19 September 2002

Walked down Congleton High Street towards Bridge Street & Mill Street. Went into Chronicle Newspaper Office and saw a copy of the newspaper dated 31 October 1998, flash floods were reported on front page. Mill Street/Rood Hill area investigated but was not apparently flooded, in any case there were few houses in the area.

Went to Havannah Street, reported in the paper to have flooded. Spoke to one couple who, along with their next door neighbour, were flooded in September 2001 from water running off Buxton Road. They were out of their house for seven months (semi-detached house in a dip).

Across the road there is a row of terraces, spoke to a lady who was recently visited by Environment Agency and had agreed to become a flood warden. Most of the terraces are three storey, with utility and bathroom built below road level, towards the river.

These rooms were flooded 3ft caused by high river levels. Bridge Row, a row of terraces was also flooded.

Went to New Road (Walk through footpath). Houses flooded by inches of water (higher numbers), but deeper for lower numbers. Also, Ivanhoe and Bank Place Farm on Tomm's Lane (*this is difficult to find*).

Parameters for Congleton	Value
Estimated No. of flooded properties *(Environment Agency reports of over 100 properties being flooded seem overstated)*	40?
Number of Level 1 addresses	24
Number of Level 2 addresses	50
Interview Targets - Flooded/At Risk	7/3
Interviews Completed - Flooded/At Risk	7/2

A2.6 Evesham, Worcestershire

Date Flooded: April 1998 Date Visited: 25 September 2002

Flooding from River Avon. We started at Mortimers Quay - although flooded, only housing is flats where ground floor is garages/car parking only, so no homes affected. Went on to Burford Gardens, road is mixture of bungalows and flats, so mostly older people, but not sheltered housing. Meadow between river and Burford Gardens was flooded. Water probably reached up to 1ft in some properties. Lower Leys area flooded, terrace housing.

Along Waterside, water was 4ft deep, Northwick Arms Pub had photographs of the flood, as well as High Water mark of 1901 flood (also around 4ft). Some houses along Waterside had built a flood defence wall.

Further along, Pershore Road, some houses had been flooded. Spoke to a lady, who lived with her sister, (both in their 80s). They had lifted their three piece suite on to tables to save from flood. A resident from another house, closer to the river, had had to be rescued by boat from a bedroom window. Waterside and Pershore Road mix of large detached and semi-detached housing.

Parameters for Evesham	Value
Estimated No. of flooded properties	75
Number of Level 1 addresses	77
Number of Level 2 addresses	56
Interview Targets - Flooded/At Risk	21/11
Interviews Completed - Flooded/At Risk	21/11

A2.7 Five Oak Green, Kent

Date Flooded: Dec. 1999, May 2000 and others Date Visited: 27 September 2002

Five Oak Green is generally flooded by heavy rainfall - but not to a great depth. Area flooded is in village centre and along Norton's Way near railway line. In Norton's Way it seems only houses in the middle section of the road are affected, although a man living at the end of the street said he had to take several days off work because of the floods. Some properties in Willow Crescent may also have been affected.

Parameters for Five Oak Green	Value
Estimated No. of flooded properties	50-60
Number of Level 1 addresses	c65
Number of Level 2 addresses	80
Interview Targets - Flooded/At Risk	18/9
Interviews Completed - Flooded/At Risk	12/15

A2.8 Gowdall, East Riding of Yorkshire

Date Flooded: November 2000 Date Visited: 16 September 2002

Flooding due to cumulative waters in River Aire leading to widespread flooding. Majority of village flooded with water up to a few feet deep. Although exact addresses were not confirmed it is likely that most of those on the 'at risk' list (approx. 150 properties) were flooded, but interviewers should concentrate on the area north of the railway line, i.e. Main Street, High Meadow, parts of Lodge Lane and parts of Field Lane. Properties are mainly semi-detached and detached houses, farms do not need to be surveyed.

Parameters for Gowdall	Value
Estimated No. of flooded properties	100+
Number of Level 1 addresses (north of railway line)	c140
Number of Level 2 addresses	none
Interview Targets - Flooded/At Risk	32/16
Interviews Completed - Flooded/At Risk	36/13

A2.9 Hatton, Derbyshire

Date Flooded: November 2000 Date Visited: 15 September 2002

Floods of November 2000 are reported to have flooded 142 domestic properties - particularly on Yew Tree Road. Information on what really flooded was obtained from an inhabitant who had lived in the area for 17 years and others. Note that a few properties on Scropton Road may have flooded but all 'at risk'.

Parameters for Hatton	Value
Estimated No. of flooded properties	c140
Number of Level 1 addresses	125
Number of Level 2 addresses	50
Interview Targets - Flooded/At Risk	40/20
Interviews Completed - Flooded/At Risk	39/19

A2.10 Hemingford Grey, Cambridgeshire

Date Flooded: April 1998 Date Visited: 9 September 2002

To the east of the village is Victoria Terrace (on Hemingford Road) which comprises 38 terraced houses that experienced flooding up to windowsill level. The houses on the other side of the road were built 30 years ago, with flooding in mind, and are therefore much higher and have never been flooded.

It is possible that other houses around the church (in village centre) were also flooded, and, if not, they are at risk. These areas include the church end of Church St, Church Lane and the High Street (around junction with Church Lane and towards river). However, it was not possible to confirm exactly which houses these were.

Parameters for Hemingford Grey	Value
Estimated No. of flooded properties	40
Number of Level 1 addresses (Victoria Terrace)	38
Number of Level 2 addresses (village centre)	60
Interview Targets - Flooded/At Risk	11/5
Interviews Completed - Flooded/At Risk	10/4

A2.11 Kendal, Cumbria

Date Flooded: January 1999 Date Visited: 18 September 2002

Lowther Park Estate area, out of town centre (and well away from the areas 'at risk' from river flooding), was flooded. Flooding caused by poor drainage. Spoke to a gardener who knew the area before the houses were built. He said it had basically been a bog and had always flooded before the houses were built, so it was not surprising that they flooded. Water was 2ft deep in places.

Went to other 'at risk' areas in Kendal but could not find any other areas which had been flooded.

Parameters for Kendal	Value
Estimated No. of flooded properties	50
Number of Level 1 addresses (Lowther Park area)	50
Number of Level 2 addresses (close to river)	71
Interview Targets - Flooded/At Risk	15/8
Interviews Completed - Flooded/At Risk	16/17

A2.12 Leamington Spa, Warwickshire

Date Flooded: April 1998 Date Visited: March 2002

Leamington Spa was badly affected in the Easter 98 floods and it was one of the areas used in the pilot studies. Detailed information on c500 properties has been provided with although some will need to be drawn from blocks of flats (i.e. only the ground/basement flats were affected).

Parameters for Leamington Spa	Value
Estimated No. of flooded properties	400
Number of Level 1 addresses	c500
Number of Level 2 addresses	none
Interview Targets - Flooded/At Risk	104/51
Interviews Completed - Flooded/At Risk	101/55

A2.13 Lewes, East Sussex

Date Flooded: November 2000 Date Visited: March 2002

Lewes was the worst affected area in the Autumn 2000 floods. RPA has been involved in detailed work in Lewes and it was one of the areas used in the pilot studies. Detailed information on 500 properties has been provided with a further 50 which may be drawn from blocks of flats (i.e. only the ground/basement flats were affected).

Parameters for Lewes	Value
Estimated No. of flooded properties	c550
Number of Level 1 addresses	c550
Number of Level 2 addresses	350
Interview Targets - Flooded/At Risk	161/78
Interviews Completed - Flooded/At Risk	159/80

A2.14. London Colney, Herts

Date Flooded: November 2000 Date Visited: September 2001

Heavy rainfall led to overflow of River Colne. Flooded properties mainly along southern side of river - Lowbell Lane and Waterside. Properties at far end of Lowbell Lane also suffered from sewage overflows. Area has a range of incomes. Some residents were involved in focus groups at an early stage of the project.

Although exactly which properties were flooded have not been determined, most of the flooded properties are contained within the Level 1 addresses.

Parameters for London Colney	Value
Estimated No. of flooded properties	40
Number of Level 1 addresses	c55
Number of Level 2 addresses	c80
Interview Targets - Flooded/At Risk	12/6
Interviews Completed - Flooded/At Risk	10/6

A2.15 Macclesfield, Cheshire

Date Flooded: June 1998 Date Visited: 19 September 2002

Area flooded below Tescos. Rows of terraces, flooded by inches of water. Some houses with doorsteps may not have been flooded but often doorsteps have been removed where double glazed doors have been installed. Spoke to man fixing van who told us that flood was caused by a 12 inch culvert going into two 6 inch pipes! Problem has since been fixed. Man said area was not a flood risk area. On Hursfield Road, three houses set below road level were badly flooded. One person there has taken nearly four years to get back to normal. One house is called Floodlands!

Parameters for Macclesfield	Value
Estimated No. of flooded properties	80
Number of Level 1 addresses	85
Number of Level 2 addresses	none
Interview Targets - Flooded/At Risk	23/11
Interviews Completed - Flooded/At Risk	24/11

A2.16 Malton, North Yorkshire

Date Flooded: March 1999/November 2000 Date Visited: 17 September 2002

Started pre-screening in Old Malton. Area, particularly Town Street, had been badly flooded, with water reaching 'half way up the telephone box' (3ft). Old Malton is a small village with a mix of housing, from small terraced cottages to large detached houses.

Addresses on the 'at risk' list for Malton were found to be on a very steep hill. Conversations with local residents suggested that Norton, at the bottom of the hill had been flooded, as opposed to Malton. However, residents in Malton were generally annoyed as work on a pumping station had yet to be completed, and would not be finished for November this year.

In Norton, several streets were found to be flooded. In Springfield Garth, the houses were significantly below the height of the road so that the water drained from the road into the houses. Again, mix of housing from bungalows to terraced housing to semi-detached.

Also went to Riverside View which had been flooded, but area is mostly flats, so interviewers should approach those in the ground floor flats only.

Parameters for Malton, Norton & Old Malton	Value
Estimated No. of flooded properties	150
Number of Level 1 addresses	c150
Number of Level 2 addresses	c170
Interview Targets - Flooded/At Risk	45/23
Interviews Completed - Flooded/At Risk	45/25

A2.17 Melton Mowbray, Leicestershire

Date Flooded: April 1998 Date Visited: 17 September 2002

Information was taken from the Project Appraisal Report (PD June 2000) which included a detailed map of the area flooded. This was verified by speaking to a number of local people who lived in the flooded area. Some 150 properties were flooded including some sheltered housing but these have been excluded from the address lists. Some areas on 'at risk' list are sheltered accommodation.

Parameters for Melton Mowbray	Value
Estimated No. of flooded properties (excluding sheltered housing)	100 or more
Number of Level 1 addresses	95
Number of Level 2 addresses	40
Interview Targets - Flooded/At Risk	27/14
Interviews Completed - Flooded/At Risk	18/23

A2.18 Newport Pagnell, Buckinghamshire

Date Flooded: April 1998 Date Visited: September/October 2002

Lakes Lane (primarily semi-detached housing) was flooded and has been used in the pilots (30 properties). Interviewer(s) are advised to start from low numbers! Additional 'at risk' properties are to be found on Priory Street (mainly terraced housing).

Parameters for Newport Pagnell	Value
Estimated No. of flooded properties	78
Number of Level 1 addresses	95 (but some used!)
Number of Level 2 addresses	60
Interview Targets - Flooded/At Risk	17/9
Interviews Completed - Flooded/At Risk	19/10

A2.19 Newport, Gwent

Date Flooded: October 2000 Date Visited: 26 September 2002

Flooded at Malpas Brook. Area of terraced housing flooded up to 2ft. Spoke to lady in Goodrich Crescent, who suggested that Council had not shut sluice gates, so the houses had flooded instead of the fields. Majority of Goodrich Crescent and Walford Street flooded, but some people (particularly in Walford Street) may only have had water up to doorstep.

Parameters for Newport	Value
Estimated No. of flooded properties	130
Number of Level 1 addresses	150
Number of Level 2 addresses	none
Interview Targets - Flooded/At Risk	42/21
Interviews Completed - Flooded/At Risk	52/15

A2.20 Ponteland, Northumberland

Date Flooded: November 2000 Date Visited: 17 September 2002

Although a number of houses are included on the list, there is a high degree of uncertainty as to whether they have all been flooded. In general, it seems that the flooding in Ponteland was only a few inches, mostly flooding on the road and affecting relatively few properties. Certainly, there was little to suggest that as many as 147 properties were flooded as reported by the Environment Agency.

Parameters for Ponteland	Value
Estimated No. of flooded properties	30
Number of Level 1 addresses	28
Number of Level 2 addresses	44
Interview Targets - Flooded/At Risk	9/5
Interviews Completed - Flooded/At Risk	9/5

A2.21 Rhydymwyn, Flintshire

Date Flooded: November 2000 Date Visited: 20 September 2002

Area between river and main road flooded. Suggested that debris built up on weir gates, causing flood. House on end of Church Meadow (28?) experienced inches of water, enough just to damage carpets, but other streets are lower and may have had up to 3ft of water. Resident said it had never flooded before in 50/60 years. Area is a mixture of detached and semi-detached properties. The Antelope Pub on main road was flooded and there are photographs in the pub of the flood.

Parameters for Rhydymwyn	Value
Estimated No. of flooded properties	c70
Number of Level 1 addresses	66
Number of Level 2 addresses	5
Interview Targets - Flooded/At Risk	21/11
Interviews Completed - Flooded/At Risk	29/5

A2.22 Ruthin, Denbighshire

Date Flooded: November 2000 Date Visited: 20 September 2002

Flood caused by combination of heavy rainfall, collapsed culvert & high river flow.

Flood in Mwrog Street was inches, those with high door steps may not have been flooded. Mostly terraced housing, several houses have flood defence gates across front door. In lower end of Borthyn (towards Town Centre) water was above wellie height. Some flood defence gates and sandbags around, mixture of semis and terraces.

Parc Y Dre Road and Cae Seren, numbers very confusing! Water petered out half way up Parc Y Dre Road. Around the corner and into Cae Seren water was knee height. Parc Y Dre Road - semi-detached houses, lots of sandbags around. Cae Seren is a mixture of semis, bungalows and flats. Number of elderly people in bungalows and flats (even numbers are upstair flats). Mill Street (other side of bridge) also apparently flooded though this was not confirmed.

Parameters for Ruthin	Value
Estimated No. of flooded properties	180
Number of Level 1 addresses	205
Number of Level 2 addresses	180
Interview Targets - Flooded/At Risk	58/29
Interviews Completed - Flooded/At Risk	62/30

A2.23 Ryde, Isle of Wight

Date Flooded: October 2000 + Christmas 2001? Date Visited: 26 September 2002

Flooded by small brook running along side of recreation ground and drainage problems, so that houses on West Hill Road were flooded from front and back. Area mixture of terraced, semis, detached houses and flats. Along the Strand there are very many large houses with basements which would have flooded. In some cases there may be a separate basement flat. Some properties on The Strand are hotels or guest houses, these should not be approached by interviewers.

Parameters for Ryde	Value
Estimated No. of flooded properties	75 (max)
Number of Level 1 addresses	90
Number of Level 2 addresses	none
Interview Targets - Flooded/At Risk	24/12
Interviews Completed - Flooded/At Risk	17/6

A2.24 West Auckland/South Church (Bishop Auckland), Co Durham

Date Flooded: June 2000 Date Visited: 17 September 2002

Housing estate in West Auckland flooded by 3ft water. Area is a mixture of bungalows and terraced housing - very poor estate. Interviewers may feel uncomfortable working there in the evenings.

In South Church, rows of terraced houses (at bottom of Bonemill Bank) near River Gaunless had been badly flooded. On the other side of the bridge on the south side of Main Street there is an estate (again fairly deprived) which was badly flooded. Unfortunately, we have no detailed map for this area (and ran out of time whilst there to undertake a walk around). St Wilfrids Walk has been included in the Level 1 addresses but there may well be other streets (perhaps St Chads Close?). For this area, the interviewers will need initiative!

Although the Environment Agency has reported 400 properties flooded (200 in West Auckland and 200 in South Church), this may be an overestimate and we estimate that the figure may be closer to 200.

Parameters for West Auckland & South Church	Value
Estimated No. of flooded properties	200
Number of Level 1 addresses	170
Number of Level 2 addresses	20
Interview Targets - Flooded/At Risk	50/25
Interviews Completed - Flooded/At Risk	53/24

A2.25 Todmorden & Hebden Bridge

Date Flooded: June 2000 Date Visited: 18 September 2002

Hebden Bridge flooding was investigated. Whilst 80 properties may have been flooded, the majority of these are shops. Therefore this is not a suitable survey location.

Todmorden flooding was in an area of terraced housing east of the town centre, between Canal and River. Spoke to old man, who said flooding had never happened in 76 years. Old 19^{th} century back to back housing, socially deprived area. River flooded, backed up at bridge. Water 2-3ft deep.

Parameters for Todmorden	Value
Estimated No. of flooded properties	100
Number of Level 1 addresses	98
Number of Level 2 addresses	115
Interview Targets - Flooded/At Risk	32/16
Interviews Completed - Flooded/At Risk	35/13

A2.26 Waltham Abbey, Essex

Date Flooded: November 2000 Date Visited: March/August 2002

Heavy rainfall led to overflow of Cobbins Brook. It is reported that over 120 properties flooded which are within some 180 addresses provided by the Environment Agency. This was confirmed during the use of the area during the pilot stages of the project. Area is predominantly middle-class.

Although exactly which properties were flooded have not been determined, most of the flooded properties are contained within the Level 1 addresses.

Parameters for Waltham Abbey	Value
Estimated No. of flooded properties	120
Number of Level 1 addresses	c180
Number of Level 2 addresses	none
Interview Targets - Flooded/At Risk	35/17
Interviews Completed - Flooded/At Risk	30/18

A2.27 Weybridge, Surrey

Date Flooded: November 2000 Date Visited: 27 September 2002

The River Wey runs between Addlestone and Weybridge. Despite visiting several areas ‘at risk’ along the eastern bank (the Weybridge side) of the River Wey, no flooded properties were located. Subsequent enquiries indicated that the area which gets flooded is Wey Meadows which is an ‘island’ between the two towns. The area comprises a number of waterside properties and, uniquely in this study, a permanent mobile home park (Riverside Park). Some residents from Weybridge/Addlestone came to a focus group at an early stage of the project.

Parameters for Weybridge	Value
Estimated No. of flooded properties	50-60
Number of Level 1 addresses	c70
Number of Level 2 addresses	c20
Interview Targets - Flooded/At Risk	18/9
Interviews Completed - Flooded/At Risk	6/19

A2.28 Woking, Surrey

Date Flooded: November 2000 Date Visited: 27 September 2002

Flooded properties in Woking were difficult to find - despite reports that over 100 had been flooded. In the event three locations were identified:

- in Bonsey Lane, all the ground floor maisonettes had been affected;
- went to White Rose Lane, where some properties had been flooded from brook running at the bottom of the gardens, but difficult to tell exactly which ones. Spoke to a lady whose garden was flooded fairly regularly, which was eroding the soil; and
- Old Woking High Street had also been flooded but appeared to be only inches of water as some houses with higher doorsteps escaped flooding.

Parameters for Woking	Value
Estimated No. of flooded properties	c30 located
Number of Level 1 addresses	37
Number of Level 2 addresses	40
Interview Targets - Flooded/At Risk	10/5
Interviews Completed - Flooded/At Risk	10/6

A2.29 Worcester, Worcestershire

Date Flooded: November 2000 Date Visited: 26 September 2002

Flooding from River Severn. First area on at risk list, Warmstry Court is sheltered housing, so do not survey. Suspect that ground floor and basement flats of John Gwynn House, Bridge Street/Newport Street were also flooded, although not confirmed. Diglis Avenue is a row of terrace housing facing river, which is reported to flood fairly regularly.

There is another area of flooding north of city centre, in area of Waterworks Road. Again, row of terraced houses facing river flooded. Houses in Lyttleton Avenue are definitely at risk, may have had water in gardens.

Parameters for Worcester	Value
Estimated No. of flooded properties	50
Number of Level 1 addresses	45
Number of Level 2 addresses	28
Interview Targets - Flooded/At Risk	15/7
Interviews Completed - Flooded/At Risk	15/7

A2.30 York (Rawcliffe), North Yorkshire

Date Flooded: November 2000 Date Visited: 16 September 2002

Flooding caused partly by river and partly by stream running between Howard Drive and Furness Drive. Although deep water in gardens, flood was generally only inches inside the houses. Spoke to lady gardening in Shipton Road who was very stressed by the whole event and had taken a lot of time off work. Spoke to others in Rawcliffe Croft who had not been flooded but had watched the water rising on the road (middle section of Rawcliffe Croft flooded). Man in Howard Drive had had 5ft of water in garden, but house was much higher and therefore the water only reached the airbricks. Area is mixture of bungalows and semi-detached houses.

Parameters for York-Rawcliffe	Value
Estimated No. of flooded properties	85
Number of Level 1 addresses	85
Number of Level 2 addresses	none
Interview Targets - Flooded/At Risk	25/14
Interviews Completed - Flooded/At Risk	29/10

Summary Table:

Text Ref:	Last Big Flood	Location	Indicative Postcode	REVISED AFTER PRE-SCREENING Flooded Props, NF	Level 1 Adds, N1	Level 2 Adds, N1	INTERVIEW TARGETS Flooded, F	At Risk, AR
1	Apr-98	Alconbury, Cambs	PE28 4xx	90	130	40	26	13
2	Apr-98	Banbury, Oxon	OX16 3xx	130	130	70	37	19
3	Nov-00	Barlby (nr Selby), N Yorks	YO8 5xx	150	175	170	48	24
4	Oct-98	Bollington, Cheshire	SK10 5xx	60	60	120	17	9
5	Oct-98	Congleton, Cheshire	CW12 1xx/2xx	40	24	50	7	3
6	Apr-98	Evesham, Worcs	WR11 3xx	75	77	56	21	11
7	May-00	Five Oak Green, Kent	TN12 6xx	55	65	80	18	9
8	Nov-00	Gowdall, E Riding of Yorks	DN14 0xx	100	140	0	32	16
9	Nov-00	Hatton, Derbys	DE65 5xx	140	125	50	40	20
10	Apr-98	Hemingford Grey, Cambs	PE28 9xx	40	38	60	11	5
11	Jan-99	Kendal, Cumbria	LA9 6xx/7xx	50	50	71	15	8
12	Apr-98	Leamington Spa, Warwickshire	CV31 1xx/3xx	400	500	0	104	51
13	Nov-00	Lewes, E Sussex	BN7 2xx	550	550	350	161	78
14	Nov-00	London Colney, Herts	AL2 1xx	40	55	80	12	6
15	Jun-98	Macclesfield, Ches	SK10 2xx	80	85	0	23	11
16	Mar-99	Malton, N Yorks	YO17 7xx/9xx	150	150	170	45	23
17	Apr-98	Melton Mowbray, Leics	LE13 1xx	100	95	40	27	14
18	Apr-98	Newport Pagnell, Bucks	MK16 8xx/9xx	78	65	60	17	9
19	Oct-00	Newport, Gwent	NP20 5xx	130	150	0	42	21
20	Nov-00	Ponteland, Northumberland	NE20 9xx	30	28	44	9	5
21	Nov-00	Rhydymwyn, Wales	CH7 5xx	70	66	5	21	11
22	Nov-00	Ruthin, Wales	LL15 1xx	180	205	180	58	29
23	Dec-01	Ryde, Isle of Wight	PO33 1xx	75	75	0	24	12
24	Jun-00	South Church/ West Auckland, Co Durham	DL14 9xx	200	170	20	50	25
25	Jun-00	Todmorden in Calderdale	OL14 5xx	100	98	115	32	16
26	Nov-00	Waltham Abbey, Essex	EN9 1xx/3xx	120	180	0	35	17
27	Nov-00	Weybridge, Surrey	KT13 8xx	55	70	20	18	9
28	Nov-00	Woking, Surrey	GU22 7xx/9xx	30	37	40	10	5
29	Nov-00	Worcester, Worcs	WR1 2xx	50	45	28	15	7
30	Nov-00	York (Rawcliffe), N Yorks	YO30 5xx	85	85	0	25	14
			TOTALS	**3453**	**3723**	**1919**	**1000**	**500**

ANNEX 3

QUESTIONNAIRES USED IN MAIN SURVEY

MORI//18171.jfm/FLOODED Questionnaire No [ ] [ ]

6 DIGIT RESPONDENT ID – COPY OVER FROM CONTACT SHEET. USE LEADING ZEROS.

[ ] [ ] [ ] [ ] [ ] [ ]

Intangible Impacts Of Flooding - Flooded Sample

Name/Initial/Title: Mr/Mrs/Ms/Miss

Address:

Full Postcode [ ] [ ] [ ] [ ] [ ] [ ] [ ]

Telephone in home:	
Yes	1
No	2
Refused/Ex-directory	3
Full tel.no (inc STD code):	4

Age (RECORD EXACT AGE AND CIRCLE AGE/GENDER GROUP

[ ] [ ]

	MALE	FEMALE
18-39 years	1	5
40-64 years	2	6
65-74 years	3	7
75 and over	4	8

Occupation of Chief Income Earner

Position/rank/grade

Industry/type of company

Quals/degree/apprenticeship

Number of staff responsible for

Class

AB	1
C1	2
C2	3
DE	4

REMEMBER TO PROBE FULLY FOR PENSION AND CODE FROM ABOVE

Record weather at time of interview
MULTICODE OK

Windy	1
Cold	2
Sunny	3
Rainy	4
Cloudy/dry	5
Snow/sleet	6

Record Street Name Again:

Property Type:

Detached house	1
Semi-detached house	2
Terraced house	3
Ground floor maisonette	4
Bungalow	5
Ground floor flat	6
Basement flat	7
Mobile home	8
Other (PLEASE SPECIFY)	9

Interview Declaration
I confirm that I have carried out this Interview face-to-face with the above named person and that I asked all the relevant questions fully and recorded the answers in conformance with the survey specification and within the MRS Code of Conduct.

Signature: ....

Interviewer Name (CAPS): ....

....

Interviewer Number:

[ ] [ ] [ ] [ ] / [ ]

Day of Interview 1 2 3 4 5 6 7
(Mon) (Thur) (Sun)

Date of Interview: [ ] [ ] / [ ] [ ] /02

Length of Interview: [ ] [ ] (minutes)

INTERVIEWER RECORD START TIME ☐☐ Hours ☐☐ Mins

INTERVIEWER RECORD END TIME AFTER DEMOGRAPHICS ☐☐ Hours ☐☐ Mins

Q INTERVIEWER **please indicate which showcard version you are using**

Normal	1
Reversed	2

( )

SECTION A - QUESTIONS ABOUT THE FLOOD EVENTS

QA1. **Can I ask you how long you have lived in this property?** WRITE IN. USE LEADING ZEROS.

☐☐ years ☐☐ months

QA2. **Including yourself, how many people in your household are…?**
INTERVIEWER READ OUT A – E. SINGLE CODE ONLY.

A) Children aged 9 and under
B) Children aged 10 to 17
C) Adults aged 18 to 64
D) Adults aged 65 to 74
E) Adults aged 75 and over

	A 0 - 9	B 10 - 17	C 18 - 64	D 65 - 74	E 75+
One	1	1	1	1	1
Two	2	2	2	2	2
Three	3	3	3	3	3
Four	4	4	4	4	4
Five or more	5	5	5	5	5
None	6	6	6	6	6

QA3. **Were you aware of the flood risk in this area <u>before</u> you were first flooded?** SINGLE CODE ONLY

Yes	1
No	2

QA4. **How many times have you experienced flooding above floor level in your home since you have lived at this address, including basements and cellars but excluding outhouses and garages?** SINGLE CODE ONLY

One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten or more (PLEASE SPECIFY) ☐☐	10

QA5. **How many times have you experienced flooding above floor level in your home since January 1998, including basements and cellars but excluding outhouses and garages?** SINGLE CODE ONLY

One	1	GO TO QA7.
Two	2	
Three	3	
Four	4	
Five	5	
Six	6	ASK QA6.
Seven	7	
Eight	8	
Nine	9	
Ten or more (PLEASE SPECIFY) ☐☐	10	

ASK ALL WHOHAVE BEEN FLOODED MORE THAN ONCE SINCE JANUARY 1998 (CODES 2 – 10 AT QA5). OTHERS GO TO QA7

QA6. **When was the worst flood you have experienced since January 1998?**
IF RESPONDENT HAS DIFFICULTY REMEMBERING EXACT MONTH OR YEAR SAY
An estimation will do.
RECORD BOTH MONTH AND YEAR. SINGLE CODE ONLY FOR EACH.

Month	
January	1
February	2
March	3
April	4
May	5
June	6
July	7
August	8
September	9
October	10
November	11
December	12

Year	
2002	1
2001	2
2000	3
1999	4
1998	5

ASK ALL

QA7. **When was the last time you were flooded here?**
IF RESPONDENT HAS DIFFICULTY REMEMBERING EXACT MONTH OR YEAR SAY **An estimation will do.**
RECORD BOTH MONTH AND YEAR. SINGLE CODE ONLY FOR EACH.

Month	
January	1
February	2
March	3
April	4
May	5
June	6
July	7
August	8
September	9
October	10
November	11
December	12

Year	
2002	1
2001	2
2000	3
1999	4
1998	5

INTERVIEWER READ OUT: **From now on I would like you to think only about your experiences relating to your worst flooding in your home since January 1998**

QA8. SHOWCARD A (R) **How quickly did the floodwaters rise?** SINGLE CODE ONLY

A	So quickly that you could see them rising	1
B	Slowly over many hours	2
C	Somewhere in between the above	3
	Don't know	4

QA9. **Did the floodwater contain sewage or other pollution?** SINGLE CODE ONLY

Yes	1
No	2
Don’t know	3

QA10. **In your property, how many rooms in total do you have for use only by your household?** READ OUT: **Do not count bathrooms, toilets, halls or landings or rooms that can only be used for storage such as cupboards. Do count all other rooms e.g. kitchen, living rooms, bedrooms, utility room and study. Do not count communal rooms you share with other households.** SINGLE CODE ONLY

One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10
Eleven	11
Twelve	12
Thirteen	13
Fourteen	14
Fifteen	15
Sixteen or more (PLEASE SPECIFY) ❑❑	16

QA11.A SHOWCARD B (R) **Which of these rooms or areas were flooded?**
CODE IN COLUMN A. MULTICODE OK.

QA11.B ASK FOR EACH TYPE OF ROOM MENTIONED
How many rooms of that type were flooded? WRITE IN COLUMN B.

QA11.C THEN FOR EACH ROOM MENTIONED ASK
To what depth was it flooded?
RECORD ANSWERS GIVEN IN METRES AND CENTIMETRES IN COLUMN Bi.
OR RECORD ANSWERS GIVEN IN FEET AND INCHES IN COLUMN Bii.
USE LEADING ZEROS IN EACH CASE.

QA11.D **What was the maximum depth of flooding in the house as a whole?**
RECORD ANSWERS GIVEN IN METRES AND CENTIMETRES IN COLUMN Bi.
OR RECORD ANSWERS GIVEN IN FEET AND INCHES IN COLUMN Bii.
USE LEADING ZEROS IN EACH CASE.

		A	B No. of rooms	Ci Metres/Centimetres	Cii Feet/Inches
QA11.A - QA11.C	Living rooms	1	☐	☐☐.☐☐	☐☐.☐☐
	Bedrooms	2	☐	☐☐.☐☐	☐☐.☐☐
	Kitchen	3	☐	☐☐.☐☐	☐☐.☐☐
	Bathrooms	4	☐	☐☐.☐☐	☐☐.☐☐
	Basement/Cellar	5	☐	☐☐.☐☐	☐☐.☐☐
	Hallway/Landing	6	☐	☐☐.☐☐	☐☐.☐☐
	Garage	7	☐	☐☐.☐☐	☐☐.☐☐
QA11.D	Maximum depth of flooding	N/a	N/a	☐☐.☐☐	☐☐.☐☐

READ OUT: **Remember, I would like you to think only about your experiences relating to your worst flooding in your home since January 1998**

QA12. **For how many hours was your home flooded?** WRITE IN

☐☐☐ hours

QA13. **Did you receive a flood warning from any source before the flood?** SINGLE CODE ONLY

Yes	1	ASK QA14
No	2	GO TO QA16
Don't know	3	

ASK ALL WHO RECEIVED A WARNING (CODE 1 AT QA13). OTHERS GO TO QA16.
QA14. **Approximately how long before the flood waters entered your home did you receive the warning?** WRITE IN. USE LEADING ZEROS.

☐☐ hours ☐☐ minutes

QA15. SHOWCARD C (R) **From whom did you receive a warning?** MULTICODE OK

A	Environment Agency automatic telephone message (AVM)	1
B	Environment Agency Floodline	2
C	Environment Agency personnel	3
D	Emergency services (Fire/Police/Ambulance etc.)	4
E	Local authority	5
F	Neighbour	6
G	Family/friend	7
H	Media (TV/Radio etc.)	8
	Other (WRITE IN)	9

ASK ALL
QA16. **Did your home or contents suffer from flood damage?** SINGLE CODE ONLY

Yes	1
No	2

QA17. **Were you insured against flooding for the following…?** READ OUT A – C. MULTICODE OK

A	**Building/structure**	1	ASK QA18
B	**Contents - 'New for Old'**	2	
C	**Contents – Other**	3	
	Don't know / landlord's responsibility	4	GO TO QA19

ASK ALL WHO WERE INSURED IN SOME WAY (CODES 1 – 3 AT QA17). OTHERS GO TO QA19.
READ OUT: **The following question asks for financial information. Please be assured that this information will be treated as strictly confidential and that it will not be passed on to anyone outside of MORI in relation with your name.**

QA18. **Please estimate the total amount paid out by the insurance company(s) for…**READ OUT A-C.
INTERVIEWER: IF RESPONDENT CAN SEPARATE AMOUNTS, RECORD IN ROWS 1 & 2 AND LEAVE THE THIRD ROW BLANK. OTHERWISE RECORD DK FOR ROWS 1 & 2 AND OVERALL PAYMENT IN THIRD ROW.
ROUND ANSWERS UP TO THE NEAREST POUND. USE LEADING ZEROS.

			Don't know
A	**…building/structure damage**	£☐☐☐,☐☐☐	99
B	**…contents damage**	£☐☐☐,☐☐☐	99
C	**…both building/structure and content damage**	£☐☐☐,☐☐☐	99

ASK ALL
QA19. **Did you or your family bear any financial costs as a direct result of the flooding that were not covered by insurance (excluding loss of earnings, if any)?**

Yes	1	ASK QA20
No	2	GO TO QA21
Don't know	3	

ASK ALL WHO BEARED FINANCIAL COSTS (CODE 1 AT QA19). OTHERS GO TO QA21.
QA20. **Please estimate the total cost of your expenditure (in pounds) not covered by insurance for…**READ OUT A - C
INTERVIEWER: IF RESPONDENT CAN SEPARATE AMOUNTS, RECORD IN ROWS 1 & 2 AND LEAVE THE THIRD ROW BLANK. OTHERWISE RECORD DK FOR ROWS 1 & 2 AND OVERALL PAYMENT IN THIRD ROW.
ROUND ANSWERS UP TO THE NEAREST POUND. USE LEADING ZEROS.

			Don't know
A	**…building/structure damage**	£☐☐☐,☐☐☐	99
B	**…contents damage**	£☐☐☐,☐☐☐	99
C	**…both building/structure and content damage**	£☐☐☐,☐☐☐	99

ASK ALL
QA21. **Did you lose any irreplaceable items of sentimental value such as old family photos, diaries, heirlooms, jewellery etc.?** IF YES ASK **What did you lose?** WRITE IN. RECORD ANSWERS IN FULL.

Yes (WRITE IN)	1
No	2

QA22. **After your worst flooding, how long did it take to get your home back to normal?**
WRITE IN. ROUND UP TO NEAREST NUMBER OF WEEKS. USE LEADING ZEROS.

☐☐ weeks	1
Still not back to normal	2

QA23. **Did you or anyone in your household have to leave your home during or after the flood?** IF NECESSARY PROMPT **Who?** MULTICODE OK

Myself	1	ASK QA24
Other household member(s)	2	
No one had to leave	3	GO TO QA25

ASK ALL WHO ANSWERED CODES 1 OR 2 AT QA23. OTHERS GO TO QA25A.
QA24. **How long was it before the whole household could live in the property again?**
WRITE IN. ROUND UP TO NEAREST NUMBER OF WEEKS. USE LEADING ZEROS**.**

☐☐ weeks	1
Less than a week	2
Still not all home	3

ASK ALL
QA25.A **This card contains a list of institutions and people that might provide help or support during and/or after a flood episode.**

SHOWCARD D (R) **From which, if any, of these did you receive help?**
MULTICODE OK.

QA25.B ASK FOR EACH GROUP FROM WHICH HELP WAS RECEIVED:
SHOWCARD E (R) **Please rank the level of help by stating a score from 1 to 5, where 1 means 'received very little help' and 5 equals 'received all the help I needed'.** READ OUT ALL MENTIONED AT PART A. SINGLE CODE ONLY.

		QA25A	QA25B				
		Help received	1 Received very little help	2	3	4	5 Received all the help I need
A	Neighbours / friends	1	1	2	3	4	5
B	Community groups	2	1	2	3	4	5
C	Local authority	3	1	2	3	4	5
D	Charities	4	1	2	3	4	5
E	Environment Agency	5	1	2	3	4	5
F	Church	6	1	2	3	4	5
G	Local businesses/ shops	7	1	2	3	4	5
H	Police	8	1	2	3	4	5
I	Fire brigade	9	1	2	3	4	5
J	Family members outside the household	10	1	2	3	4	5

QA26. SHOWCARD F (R) **Have you undertaken any of these flood prevention measures?** MULTICODE OK

A	Take out household insurance against flooding	1	GO TO QA28
B	Keep sand and bags in the property	2	
C	Keep ditches and drains around the property clean	3	
D	Built walls around the property	4	ASK QA27.
E	Purchased water pumps	5	
F	Keep alert for flood warnings during high-risk months	6	GO TO QA28
G	Avoid buying expensive downstairs furnishings	7	
H	Avoid keeping irreplaceable items or goods of sentimental value on ground floor of my home at all or certain times	8	
	Other (PLEASE SPECIFY)	9	
	Did not take preventative actions/None of these	10	

ASK ALL WHO ANSWERED CODES 4 OR 5 AT QA26. OTHERS GO TO QA28

QA27. **Please estimate the total cost of your expenditure (in pounds) on these flood prevention measures.** WRITE IN. ROUND UP TO NEAREST POUND. USE LEADING ZEROS.

£☐☐☐,☐☐☐	1
Don't know	99

ASK ALL

QA28. SHOWCARD G (R) **Have you ever done any of the things listed on this card?** MULTICODE OK

A	Been a member of a local community group related to flooding	1
B	Written letters to relevant authorities about the flooding	2
C	Attended meetings related to flooding	3
	None of these	4

SECTION B - QUESTIONS ABOUT THE HEALTH EFFECTS OF FLOODING

READ OUT: **Remember, I would like you to think only about your experiences relating to your worst flooding in your home since January 1998**

ASK ALL
QB1. SHOWCARD H (R) **How was your state of health in general before the worst flooding?** SINGLE CODE ONLY

A	Poor	1
B	Fair	2
C	Good	3
D	Very good	4
E	Excellent	5

QB2. **Before the flooding, did you have any long-term illness, health problems or disability which limited your daily activities or the work you could do (including problems which are due to old age)?** SINGLE CODE ONLY

Yes	1
No	2

QB3A. **Did anyone else in your household have any long-term illness, health problems or disability before the flooding?**

Yes	1	ASK QB3B
No	2	GO TO QB4

ASK ALL WHO ANSWERED YES (CODE 1) AT QB3A. OTHERS GO TO QB4
QB3B SHOWCARD I **Please indicate number of people with a long term illness, health problems or disability in each age group.**

SINGLE CODE ONLY FOR EACH CATEGORY. ALL CATEGORIES MUST BE CODED.

A) Children aged 9 and under
B) Children aged 10 to 17
C) Adults aged 18 to 64
D) Adults aged 65 to 74
E) Adults aged 75 and over

	A 0 - 9	B 10 - 17	C 18 - 64	D 65 - 74	E 75+
One	1	1	1	1	1
Two	2	2	2	2	2
Three	3	3	3	3	3
Four	4	4	4	4	4
Five or more	5	5	5	5	5
None	6	6	6	6	6

QB4. **Did you need to take any days off work after the flooding (including days taken as annual leave)?** SINGLE CODE ONLY. IF 'YES', ASK **How many?** AND WRITE IN. USE LEADING ZEROS.

Yes (PLEASE SPECIFY) ☐☐ days	1
No	2
Not employed	3

QB5 SHOWCARD J (R) **On this card are a number of physical health effects which you or members of your household may have experienced <u>during</u> or <u>immediately after</u> the flooding. Thinking back to the time, which of these, if any, were suffered by…**READ OUT I - III BELOW

I. You personally
II. Other adult members of your household
III. Any children aged under 16

MULTICODE OK

		I - Self	II - Other adult members of household	III - Children aged 16 and under
A	Injuries, e.g. cuts and bruises, due to being knocked over by floodwaters, being thrown against hard objects, or being struck by moving objects	1	1	1
B	Injuries from over-exertion during the flood e.g. sprains/strains, heart problems	2	2	2
C	Hypothermia	3	3	3
D	Electric Shocks	4	4	4
E	Cold, coughs, flu, sore throats or throat infections	5	5	5
F	Headaches	6	6	6
G	Skin irritations e.g. rashes	7	7	7
H	Exposure to chemicals or contaminants in floodwaters	8	8	8
I	Shock	9	9	9
	Other (WRITE IN)	10	10	10
	None of these	11	11	11

QB6 SHOWCARD K (R) **On this card are a number of physical health effects which you or members of your household may have experienced in the <u>weeks and months following the flooding</u>. Which of these, if any, were suffered by…**READ OUT I - III BELOW

I. You personally
II. Other adult members of your household
III. Any children aged under 16

MULTICODE OK

		I - Self	II - Other adult members of household	III - Children aged 16 and under
A	Gastrointestinal illnesses/upset stomachs	1	1	1
B	Heart problems	2	2	2
C	Respiratory/chest illnesses e.g. asthma, pleurisy	3	3	3
D	Cuts and bruises	4	4	4
E	Sprains and strains	5	5	5
F	Skin irritations e.g. rashes, dermatitis etc.	6	6	6
G	High blood pressure	7	7	7
H	Kidney or other infections	8	8	8
I	Stiffness in joints	9	9	9
J	Muscle cramps	10	10	10
K	Insect or animal bites	11	11	11
L	Erratic blood sugar levels (diabetics)	12	12	12
	Other (WRITE IN)	13	13	13
	None	14	14	14

QB7 SHOWCARD L (R) **On this card are a number of <u>psychological</u> health effects which you or members of your household may have experienced since the flooding. Which of these, if any, were suffered by…**READ OUT I – III BELOW

I. You personally
II. Other adult members of your household
III. Any children aged under 16

MULTICODE OK

		I – Self	II - Other adult members of household	III - Children aged 16 and under
A	Anxiety e.g. when rains, when river rises	1	1	1
B	Panic attacks	2	2	2
C	Increased stress levels	3	3	3
D	Mild depression	4	4	4
E	Moderate depression	5	5	5
F	Severe depression	6	6	6
G	Lethargy/lack of energy	7	7	7
H	Sleeping problems	8	8	8
I	Nightmares	9	9	9
J	Flashbacks to flood	10	10	10
K	Increased use of alcohol or prescription (or other) drugs	11	11	11
L	Anger/tantrums	12	12	12
M	Mood swings/bad moods	13	13	13
N	Increased tensions in relationships e.g. more arguing	14	14	14
O	Difficulty concentrating on everyday tasks	15	15	15
P	Thoughts of suicide	16	16	16
	Other (WRITE IN)	17	17	17
	None	18	18	18

CHECK ANSWERS AT QB.5, QB.6 AND QB.7. IF RESPONDENT OR OTHER MEMBERS OF HOUSEHOLD HAS EXPERIENCED ANY HEALTH PROBLEMS AT ALL ASK QB.8.

ONLY IF RESPONDENT OR OTHER MEMBERS OF HOUSEHOLD HAVE EXPERIENCED NO HEALTH PROBLEMS AT ALL (CODE 'NONE' FOR I, II AND III AT QB.5, QB.6 AND QB.7), GO TO QB.10

ASK ALL WHO HAVE HAD HEALTH PROBLEMS AT QB.5, QB.6 OR QB.7. OTHERS GO TO QB10.
QB8. **If you or any other members of your household experienced health problems after the flooding, was a doctor consulted about these?** INTERVIEWER CLARIFY **Was that yourself or another member of your household?**

	Self	Other member(s) of household	
Yes doctor consulted	1	1	ASK QB9
No doctor not consulted	2	2	GO TO QB10

ASK ALL WHO VISITED A DOCTOR THEMSELVES OR HAD ANOTHER MEMBER OF THEIR HOUSEHOLD VISIT A DOCTOR (CODE 1 AT QB8)

QB9. **Did you or the other members of your household receive treatment from the doctor regarding the health problem?** INTERVIEWER CLARIFY **Was that yourself or another member of your household?**

	Self	Other member(s) of household
Yes - treatment received	1	1
No - treatment received	2	2

ASK ALL

QB10 SHOWCARD M (R) **At what stage during or after the flooding were the health impacts the <u>most severe or worst</u> for <u>you personally</u>? Please think about health in the broadest sense to include physical, mental and social well-being.** SINGLE CODE ONLY

A	During flood event itself	1
B	In the first week or two after the flood	2
C	In the first month after the flood	3
D	Between one to three months after flood	4
E	Between three to six months after flood	5
F	More than six months after flood	6
	Other (PLEASE SPECIFY)	7

QB11. **Thinking about your answer to the last question, why do you think the health impacts were most severe at that time? What specific factors do you think were affecting your health then?** WRITE IN. PROBE FULLY. DO NOT PROMPT.

ANY ANSWER (WRITE IN AND CODE '1)	1
None/no answer	X
Don't know	Y

(-)

QB12 **For how long did this 'worst' period last in total? Or was there more than one of these periods?** IF CODE 1, WRITE IN AND USE LEADING ZEROS. SINGLE CODE ONLY.

☐☐ Weeks	1
Less than a week	2
More than one period	3

QB13 SHOWCARD N (R) **This card shows a scale in which 0 indicates "no effect", 10 indicates "extremely serious effect" and 11 indicates "does not apply" (for example if you did not have to leave home then this effect would not be relevant). Using this scale, please rate the effects I am going to read to you of the flood upon your household's life.**
READ OUT A – M. ROTATE ORDER. CODE RESPONSES IN THE TABLE BELOW.

TICK START

- ❑ A **Effect upon your health**
- B **Having to leave home**
- C **Damage to replaceable furniture and contents**
- D **Worry about flooding in the future**
- ❑ E **Loss of irreplaceable objects (photos etc.)**
- F **All the problems and discomfort whilst trying to get the house back to normal**
- G **Damage to the house itself**
- H **Stress of the flood event itself**
- ❑ I **Problems dealing with insurers/loss adjusters**
- J **Problems dealing with builders**
- K **Loss of or distress to pets**
- L **Loss of house value**
- M **Anything else?** (WRITE IN)

CODE RESPONSES HERE:

Scale:	1 No effect	2	3	4	5	6	7	8	9	10 Extremely serious	11 Does not apply
A	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
B	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
C	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
D	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
E	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
F	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
G	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
H	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
I	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
J	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
L	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
M	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

QB14 SHOWCARD N (R) AGAIN **Using the same scale, overall, how serious were the effects of the flood upon your household? SINGLE CODE ONLY**

Scale:	1 No effect	2	3	4	5	6	7	8	9	10 Extremely serious	11 Not applicable
QB14	1	2	3	4	5	6	7	8	9	10	11

QB15. SHOWCARD O (R) **This card contains various characteristics of a house flooding. When thinking about your own home, which one worries you most?** SINGLE CODE ONLY

A	Duration of flood	1
B	Depth of water	2
C	Dirtiness of water	3
D	Speed of water rising / flowing	4
E	Time of day / night when it occurs	5
F	Season of the year when it occurs	6
G	Warning time	7
	Other (WRITE IN)	8
	Not worried about any specific flood characteristic	9

QB16. SHOWCARD P (R) **How worried are you about the possibility of your property being flooded during the next 12 months?** SINGLE CODE ONLY

A	Not worried at all	1
B	Not very worried	2
C	Indifferent	3
D	Somewhat worried	4
E	Very worried	5

READ OUT: **We would now like you to complete three sets of self-completion questions commonly used in health surveys that are designed to give us more a more detailed picture of your health.**

INTERVIEWER, PLEASE FOLLOW THESE STEPS:

1) ADMINISTER SELF COMPLETION QUESTIONNAIRE. THIS INCORPORATES

SECTION C1 HEALTH QUESTIONNAIRE - GENERAL HEALTH OVER THE LAST FEW WEEKS.

SECTION C2 HEALTH QUESTIONNAIRE - GENERAL HEALTH WHEN THE HEALTH EFFECTS FROM THE FLOODING WERE AT THEIR MOST SEVERE (FROM QB.10).

PTSS QUESTIONNAIRE. EMPHASISE THAT THIS AGAIN REFERS TO CURRENT HEALTH.

2) THEN GO TO **SECTION D**

SECTION D

INTERVIEWER PLEASE ENSURE YOU HAVE REFERRED TO THE INTERVIEWER INSTRUCTIONS AND ARE FULLY AWARE OF HOW THE ROUTING AND VERSIONING FOR SECTION D WORKS.

IT IS VERY IMPORTANT THAT EACH RESPONDENT IS ASKED THE CORRECT VERSION OF EACH SECTION. THE VERSIONING IS DETERMINED BY THE COLOUR OF THE CONTACT SHEET FOR EACH ADDRESS.

PLEASE REMEMBER THAT THERE ARE ROUTING INSTRUCTIONS AS WELL AS THESE VERSIONS.

- ALL RESPONDENTS SHOULD BE ASKED THEIR RELEVANT VERSION OF SCENARIO A.

- RESPONDENTS SHOULD ONLY BE ASKED THEIR RELEVANT VERSION SCENARIO B OR SCENARIO C, DEPENDING ON THEIR RESPONSE AT QDA1.

COLOUR CODING SUMMARY:

CONTACT SHEET COLOUR	SECTION D VALUATION SCENARIO A	SECTION D VALUATION SCENARIO B	**OR**	SECTION D VALUATION SCENARIO C
YELLOW	QDA (ii) – PAGE 21	QDB (i)	OR	QDC (i)
PINK	QDA (ii) – PAGE 21	QDB (ii)	OR	QDC (ii)
BLUE	QDA (i) – PAGE 19	QDB (i)	OR	QDC (iii)
GREEN	QDA (i) – PAGE 19	QDB (ii)	OR	QDC (iv)

SECTION D - VALUATION SCENARIO A - VERSION 1

ASK ALL WITH A BLUE OR GREEN CONTACT SHEET. OTHERS ASK QDA (ii) 1 – PAGE 21.

ASK ALL
INTERVIEWER READ OUT: **For the purpose of the following questions, please suppose that all damage to the buildings and contents of your home will be compensated and this will not result in increased insurance premiums for you. Here, we are considering the stress and hassle which may result from other impacts of flooding, such as those shown on this card**

READ OUT SHOWCARD Q (BELOW)

- **impacts on physical health: headaches, colds, injuries etc.**
- **disruption to normal life**
- **loss of irreplaceable items: photographs, personal letters etc.**

We have discussed similar impacts of your 'worst' flood and how these made you feel. Now suppose that through improved flood defence, these effects, as shown here, and the stress and hassle they may cause could be avoided in future. Such an improvement will have to be paid for by all households in the country through increased taxation.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDA(i)1 **In principle, would you be in favour of paying something towards such an improvement to ensure that you and other members of your household do not experience the effects shown on the card?**

Yes	1	ASK QDA(i)2
No	2	IF CONTACT SHEET IS BLUE GO TO QDC(iii) 9 - PAGE 29 IF CONTACT SHEET IS GREEN GO TO QDC(iv) 9 - PAGE 31

ASK ALL WHO ANSWERED YES (CODE 1) AT QD1
QDA(i)2 **It is not yet known how much such an improvement will cost but it will be at least £40 per year (or 80p per week) per household. Would you be willing to pay this amount to avoid the stress and hassle associated with the effects of your worst flood?**

Yes	1	ASK QDA(i)3
No	2	GO TO QDA(i)5

QDA(i)3 **It may be that such an improvement will cost £250 per year (or £5 per week) per household. Would you be willing to pay this amount to avoid the stress and hassle associated with the effects of your worst flood?**

Yes	1	ASK QDA(i)4
No	2	GO TO QDA(i)5

QDA(i)4 **It is possible that the cost of such an improvement could reach £1,000 per year (or £20 per week) per household. Would you be willing to pay this amount to avoid the stress and hassle associated with the effects of your worst flood?**

Yes	1	ASK QDA(i)5
No	2	

QDA(i)5 **What is the maximum amount you would be willing to pay per year for your household to avoid the stress and hassle associated with the effects of your worst flood?**
WRITE IN. ENTER VALUE TO THE NEAREST POUND. USE LEADING ZEROS.

£❑,❑❑❑ 1

QDA(i)6 **What is <u>main</u> reason why you would be willing to pay for improved flood defence?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER 1

None/no answer X

Don't know Y (-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I would like to avoid the stress effects described	1
I would like to avoid the impacts on my physical health	2
I would like to avoid loss of my irreplaceable items	3
I would like to avoid damage to my property and contents	4
I would like to avoid my property losing its value	5
I would like to avoid stress to my pets	6
I am concerned about others in this area	7
It is a good cause	8
Other (PLEASE SPECIFY)	9

IF CONTACT SHEET IS <u>BLUE</u> GO TO SECTION D – QDB(i)7 – PAGE 23

IF CONTACT SHEET IS <u>GREEN</u> GO TO SECTION D – QDB(ii)7 – PAGE 24

SECTION D - VALUATION SCENARIO A - VERSION 2

ASK ALL WITH A PINK OR YELLOW CONTACT SHEET. OTHERS ASK QDA(i)1 - PAGE 19

ASK ALL
INTERVIEWER READ OUT: **For the purpose of the following questions, please suppose that all damage to the buildings and contents of your home will be compensated and this will not result in increased insurance premiums for you. Here, we are considering the stress and hassle which may result from other impacts of flooding, such as those shown on this card**

READ OUT SHOWCARD R (BELOW)

- impacts on physical health: headaches, colds, injuries etc.
- disruption to normal life
- loss of irreplaceable items: photographs, personal letters etc.

We have discussed similar impacts of your 'worst' flood and how these made you feel. Now suppose that through improved flood defence, these effects, as shown here, and the stress and hassle they may cause could be avoided in future. Such an improvement will have to be paid for by all households in the country through increased taxation.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDA(ii)1 **In principle, would you be in favour of paying something towards such an improvement to ensure that you and other members of your household do not experience the effects shown on the card?**

Yes	1	ASK QDA(ii)2
No	2	IF CONTACT SHEET IS PINK GO TO QDC(ii)9 – PAGE 27 IF CONTACT SHEET IS YELLOW GO TO QDC(i)9 – PAGE 25

ASK ALL WHO ANSWERED YES (CODE 1) AT QD1
QDA(ii)2 **It is not yet known how much such an improvement will cost but it will be at least £20 per year (or 40p per week) per household. Would you be willing to pay this amount to avoid the stress and hassle associated with the effects of your worst flood?**

Yes	1	ASK QDA(ii)3
No	2	GO TO QDA(ii)5

QDA(ii)3 **It may be that such an improvement will cost £125 per year (or £2.50p per week) per household. Would you be willing to pay this amount to avoid the stress and hassle associated with the effects of your worst flood?**

Yes	1	ASK QDA(ii)4
No	2	GO TO QDA(ii)5

QDA(ii)4 **It is possible that the cost of such an improvement could reach £500 per year (or £10 per week) per household. Would you be willing to pay this amount to avoid the stress and hassle associated with the effects of your worst flood?**

Yes	1	ASK QDA(ii)5
No	2	

QDA(ii)5 **What is the maximum amount you would be willing to pay per year for your household to avoid the stress and hassle associated with the effects of your worst flood?**
WRITE IN. ENTER VALUE TO THE NEAREST POUND. USE LEADING ZEROS.

£❑,❑❑❑ 1

QDA(ii)6 **What is main reason why you would be willing to pay for improved flood defence?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I would like to avoid the stress effects described	1
I would like to avoid the impacts on my physical health	2
I would like to avoid loss of my irreplaceable items	3
I would like to avoid damage to my property and contents	4
I would like to avoid my property losing its value	5
I would like to avoid stress to my pets	6
I am concerned about others in this area	7
It is a good cause	8
Other (PLEASE SPECIFY)	9

IF CONTACT SHEET IS PINK GO TO SECTION D - QDB(ii)7 – PAGE 24

IF CONTACT SHEET IS YELLOW GO TO SECTION D - QDB(i)7 – PAGE 23

SECTION D - VALUATION SCENARIO B – VERSION 1

ASK ALL WITH A <u>YELLOW OR BLUE</u> CONTACT SHEET WHO ANSWERED 'YES' (CODE 1) AT QDA(i)1 OR QDA(ii)1

INTERVIEWER READ OUT **Now assume that in the event of flooding you experience the stress effects shown on this card. These may or may not correspond to your experience to date but please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD S (BELOW) AND KEEP ON SHOW FOR ENTIRE SECTION

You always feel nervous, have palpitations or feel tense when reminded of the flood.
You always feel emotionally estranged, separated or cut off from others.
You are always being reminded of the flood by triggers (such as TV programmes).
You always have difficulty concentrating on tasks or completing tasks.
You often experience difficulty sleeping.
These symptoms will distress you very much.

QDB(i)7 **Now suppose that through improved flood defence, these effects may be avoided. As before, such an improvement will have to be paid for by all households in the country through increased taxation. Would you be prepared to pay a higher amount to avoid these symptoms than the amount you have just stated as the maximum amount you would be willing to pay to avoid those associated with your 'worst' flood?**

Yes (WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS) £☐☐,☐☐☐	1	GO TO SECTION E
No	2	ASK QDB(i)8

QDB(i)8 **What is <u>main</u> reason why you are not willing to pay to pay more?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I cannot afford to pay any more	1	GO TO SECTION E
I do not believe I/we will suffer from the stress effects described	2	
The stress effects could be no worse than those I/we experienced in the 'worst' flood	2	
Other (PLEASE SPECIFY)	3	

INTERVIEWER: GO TO SECTION E

SECTION D - VALUATION SCENARIO B – VERSION 2

ASK ALL WITH A PINK OR GREEN CONTACT SHEET WHO ANSWERED 'YES' (CODE 1) AT QDA(i)1 OR QDA(ii)1

INTERVIEWER READ OUT **Now assume that in the event of flooding you experience the stress effects shown on this card. These may or may not correspond to your experience to date but please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD T (BELOW) AND KEEP ON SHOW FOR ENTIRE SECTION

You often have difficulty concentrating on tasks or completing tasks. You are often reminded of the flood by triggers (such as TV programmes). You often feel nervous, have palpitations or feel tense when reminded of the flood. You often experience strong startled reactions. You are often overtly alert or watchful for no reason. These symptoms will cause you quite a lot of distress.

QDB(ii)7 **Now suppose that through improved flood defence, these effects may be avoided. As before, such an improvement will have to be paid for by all households in the country through increased taxation. Would you be prepared to pay a higher amount to avoid these symptoms than the amount you have just stated as the maximum amount you would be willing to pay to avoid those associated with your 'worst' flood?**

Yes (WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS) £☐☐,☐☐☐	1	GO TO SECTION E
No	2	ASK QDB(ii)8

QDB(ii)8 **What is main reason why you are not willing to pay to pay more?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I cannot afford to pay any more	1	GO TO SECTION E
I do not believe I/we will suffer from the stress effects described	2	
The stress effects could be no worse than those I/we experienced in the 'worst' flood	2	
Other (PLEASE SPECIFY)	3	

INTERVIEWER: GO TO SECTION E

SECTION D - VALUATION SCENARIO C – VERSION 1

ASK ALL RESPONDENTS WITH A YELLOW CONTACT SHEET WHO ANSWERED 'NO' (CODE 2) AT QDA(ii)1. OTHERS WITH A YELLOW CONTACT SHEET SHOULD BE ASKED QDB(i)7 ON PAGE 23

INTERVIEWER READ OUT: **Now assume that in the event of flooding you experience the stress effects shown on this card. These may or may not correspond to your experience to date but please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD U (BELOW) AND KEEP ON SHOW FOR ENTIRE SECTION

You always feel nervous, have palpitations or feel tense when reminded of the flood.
You always feel emotionally estranged, separated or cut off from others.
You are always being reminded of the flood by triggers (such as TV programmes).
You always have difficulty concentrating on tasks or completing tasks.
You often experience difficulty sleeping.
These symptoms will distress you very much.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDC(i)9 **In principle, would you be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?**

Yes	1	ASK QDC(i)10
No	2	GO TO QDC(i)14

QDC(i)10 **It is not yet known how much such an improvement will cost but it will be at least £20 per year (or 40p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC(i)11
No	2	GO TO QDC(i)13

QDC(i)11. **It may be that such an improvement will cost £125 per year (or £2.50p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC(i)12
No	2	GO TO QDC(i)13

QDC(i)12 **It is possible that the cost of such an improvement could reach £500 per year (or £10 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1
No	2

QDC(i)13 SHOWCARD U AGAIN **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?** WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS.

£❑,❑❑❑ 1 GO TO SECTION E

ASK ALL WHO ANSWERED 'NO' AT QDC(I)9

QDC(i)14. SHOWCARD U AGAIN **What is the <u>main</u> reason why you would not be willing to avoid the stress effects shown on the card?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY.

I cannot afford to pay	1	GO TO SECTION E
I do not believe I am at risk of being flooded	2	
I have already taken flood protection measures and hence do not need improvements to flood defence	3	
I do not believe I will suffer from stress in the event of a flood	4	
I do not believe flood defence will be improved	5	
I do not believe flood defence improvements can help me avoid stress effects	6	
I object to paying higher taxes	7	
The government or council should pay for this	8	
Water companies or industry should pay for this	9	
Other people causing flooding should pay	10	
Other (PLEASE SPECIFY)	11	

INTERVIEWER: GO TO SECTION E

SECTION D - VALUATION SCENARIO C – VERSION 2

ASK ALL WITH A PINK CONTACT SHEET WHO ANSWERED 'NO' (CODE 2) AT QDA(ii)1. OTHERS WITH A PINK CONTACT SHEET SHOULD BE ASKED QDB(ii)7 ON PAGE 24

INTERVIEWER READ OUT: **Now assume that in the event of flooding you experience the stress effects shown on this card. These may or may not correspond to your experience to date but please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD V (BELOW) AND KEEP ON SHOW FOR ENTIRE SECTION

You often have difficulty concentrating on tasks or completing tasks.
You are often reminded of the flood by triggers (such as TV programmes).
You often feel nervous, have palpitations or feel tense when reminded of the flood.
You often experience strong startled reactions.
You are often overtly alert or watchful for no reason.
These symptoms will cause you quite a lot of distress.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDC(ii)9 **In principle, would you be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?**

Yes	1	ASK QDC(ii)10
No	2	GO TO QDC(ii)14

QDC(ii)10 **It is not yet known how much such an improvement will cost but it will be at least £20 per year (or 40p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC(ii)11
No	2	GO TO QDC(ii)13.

QDC(ii)11 **It may be that such an improvement will cost £125 per year (or £2.50p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC(ii)12
No	2	GO TO QDC(ii)13.

QDC(ii)12 **It is possible that the cost of such an improvement could reach £500 per year (or £10 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1
No	2

QDC(ii)13 SHOWCARD V AGAIN **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?**
WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS.

£❑,❑❑❑ 1 GO TO SECTION E

ASK ALL WHO ANSWERED 'NO' AT QDC(ii)9

QDC(ii)14 SHOWCARD V AGAIN **What is the <u>main</u> reason why you would not be willing to avoid the stress effects shown on the card?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I cannot afford to pay	1	GO TO SECTION E
I do not believe I am at risk of being flooded	2	
I have already taken flood protection measures and hence do not need improvements to flood defence	3	
I do not believe I will suffer from stress in the event of a flood	4	
I do not believe flood defence will be improved	5	
I do not believe flood defence improvements can help me avoid stress effects	6	
I object to paying higher taxes	7	
The government or council should pay for this	8	
Water companies or industry should pay for this	9	
Other people causing flooding should pay	10	
Other (PLEASE SPECIFY)	11	

INTERVIEWER: GO TO SECTION E

SECTION D - VALUATION SCENARIO C – VERSION 3

ASK ALL WITH A BLUE CONTACT SHEET WHO ANSWERED 'NO' CODE 2 AT QDA(i)1. OTHERS WITH A BLUE CONTACT SHEET SHOULD BE ASKED QDB(i)7 ON PAGE 23.

INTERVIEWER READ OUT: **Now assume that in the event of flooding you experience the stress effects shown on this card. These may or may not correspond to your experience to date but please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD W (BELOW) AND KEEP ON SHOW FOR ENTIRE SECTION

You always feel nervous, have palpitations or feel tense when reminded of the flood. You always feel emotionally estranged, separated or cut off from others. You are always being reminded of the flood by triggers (such as TV programmes). You always have difficulty concentrating on tasks or completing tasks. You often experience difficulty sleeping. These symptoms will distress you very much.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDC(iii)9 **In principle, would you be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?**

Yes	1	ASK QDC(iii)10
No	2	GO TO QDC(iii)14

QDC(iii)10 **It is not yet known how much such an improvement will cost but it will be at least £40 per year (or 80p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC(iii)11
No	2	GO TO QDC(iii)13

QDC(iii)11 **It may be that such an improvement will cost £250 per year (or £5 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC(iii)12
No	2	GO TO QDC(iii)13

QDC(iii)12 **It is possible that the cost of such an improvement could reach £1,000 per year (or £20 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1
No	2

QDC(iii)13 SHOWCARD W AGAIN **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?**
WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS.

£❑,❑❑❑ 1 GO TO SECTION E

ASK ALL WHO ANSWERED 'NO' AT QDC(iii)9

QDC(iii)14 SHOWCARD W AGAIN **What is the main reason why you would not be willing to avoid the stress effects shown on the card?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I cannot afford to pay	1	GO TO SECTION E
I do not believe I am at risk of being flooded	2	
I have already taken flood protection measures and hence do not need improvements to flood defence	3	
I do not believe I will suffer from stress in the event of a flood	4	
I do not believe flood defence will be improved	5	
I do not believe flood defence improvements can help me avoid stress effects	6	
I object to paying higher taxes	7	
The government or council should pay for this	8	
Water companies or industry should pay for this	9	
Other people causing flooding should pay	10	
Other (PLEASE SPECIFY)	11	

INTERVIEWER: GO TO SECTION E

ASK ALL WHO ANSWERED 'NO' AT QDC(iv)9

QDC(iv)14 SHOWCARD X AGAIN **What is the main reason why you would not be willing to avoid the stress effects shown on the card?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I cannot afford to pay	1	GO TO SECTION E
I do not believe I am at risk of being flooded	2	
I have already taken flood protection measures and hence do not need improvements to flood defence	3	
I do not believe I will suffer from stress in the event of a flood	4	
I do not believe flood defence will be improved	5	
I do not believe flood defence improvements can help me avoid stress effects	6	
I object to paying higher taxes	7	
The government or council should pay for this	8	
Water companies or industry should pay for this	9	
Other people causing flooding should pay	10	
Other (PLEASE SPECIFY)	11	

INTERVIEWER: GO TO SECTION E

SECTION D - VALUATION SCENARIO C – VERSION 4

ASK ALL RESPONDENTS WITH A GREEN CONTACT SHEET WHO ANSWERED 'NO' (CODE 2) AT QDA(i)1. OTHERS WITH A GREEN CONTACT SHEET SHOULD BE ASKED QDB(ii)7 ON PAGE 24

INTERVIEWER READ OUT: **Now assume that in the event of flooding you experience the stress effects shown on this card. These may or may not correspond to your experience to date but please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD X (BELOW) AND KEEP ON SHOW FOR ENTIRE SECTION

You often have difficulty concentrating on tasks or completing tasks.
You are often reminded of the flood by triggers (such as TV programmes).
You often feel nervous, have palpitations or feel tense when reminded of the flood.
You often experience strong startled reactions.
You are often overtly alert or watchful for no reason.
These symptoms will cause you quite a lot of distress.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDC(iv)9 **In principle, would you be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?**

Yes	1	ASK QDC(iv)10
No	2	GO TO QDC(iv)14

QDC(iv)10 **It is not yet known how much such an improvement will cost but it will be at least £40 per year (or 80p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC(iv)11
No	2	GO TO QDC(iv)13

QDC(iv)11 **It may be that such an improvement will cost £250 per year (or £5 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC(iv)12
No	2	GO TO QDC(iv)13

QDC(iv)12 **It is possible that the cost of such an improvement could reach £1,000 per year (or £20 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1
No	2

QDC(iv)13 SHOWCARD X AGAIN **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?** WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS.

£❑,❑❑❑ 1 GO TO SECTION E

SECTION E - STANDARD DEMOGRAPHIC QUESTIONS

ASK ALL

QE1. SHOWCARD Y (R) **Using this card, please tell me which, if any, is the highest educational or professional qualification you have obtained. Just read out the letter or letters which apply.** (IF STILL STUDYING, CHECK FOR HIGHEST ACHIEVED SO FAR)

A	GCSE/O-Level/CSE	1
B	Vocational qualifications (=NVQ1+2)	2
C	A-Level or equivalent (=NVQ3)	3
D	Bachelor Degree or equivalent (=NVQ4)	4
E	Masters/PhD or equivalent	5
F	Other	6
G	No formal qualifications	7
H	Still studying	8
	Don't know	9

QE2. SHOWCARD Z (R) **What is your current employment situation?** SINGLE CODE ONLY

A	Working full time (30hrs/wk+)	1
B	Working part time (8-29 hrs/wk)	2
C	Not working (ie under 8hrs/week)- housewife	3
D	Not working (ie under 8hrs/week)- retired	4
E	Not working (ie under 8 hrs/week)- unemployed (registered)	5
F	Not working (ie under 8 hrs/week)- unemployed (not registered but looking for work)	6
G	Not working (ie under 8hrs/week)- student	7
H	Not working (ie under 8hrs/week)- other (incl disabled)	8
	Refused/don't know	9

QE3. SHOWCARD AA (R) **Which of these ethnic groups, if any, most accurately describes your own? Just read out the letter that applies.** SINGLE CODE ONLY

A	White	1
B	Mixed (e.g. white/black, white/Asian)	2
C	Asian / Asian British	3
D	Black / Black British	4
E	Chinese or other ethnic group	5

QE4. SHOWCARD AB (R) **What is your marital status?** SINGLE CODE ONLY

A	Married	1
B	Living together	2
C	Single	3
D	Widowed	4
E	Divorced	5
F	Separated	6
	Refused/don't know	7

QE5. **How many cars or light vans are owned or available for use by one or more members of your household? Include company cars or vans if they are available for your private use.** SINGLE CODE ONLY.

1 car or light van	1
2 cars/light vans	2
3+ cars/light vans	3
None	4
Refused/don't know	5

QE6. SHOWCARD AC (R) **Which of these, if any, most accurately describes your housing situation? Just read out the letter that applies.** SINGLE CODE ONLY

A	Being bought on mortgage	1
B	Owned outright by household	2
C	Rented from Local Authority	3
D	Rented from Housing Association/Trust	4
E	Rented from private landlord	5
F	Other	6
	Refused /don't know	7

QE7. SHOWCARD AD **Can you please indicate which one of the following letters represents your gross household income per week, month, or year? Just read out the letter that applies.** SINGLE CODE ONLY

	Gross income per week	Gross income per month	Gross income per year	
A	Under £100	Under £400	Under £5,000	1
B	£100-£199	£400-£799	£5,000-£9,999	2
C	£200-£399	£800-£1,599	£10,000-£19,999	3
D	£400-£599	£1,600-£2,399	£20,000-£29,999	4
E	£600-£799	£2,400-£3,199	£31,150-£41,550	5
F	£800-£999	£3,200-£3,999	£41,550-£51,999	6
G	£1,000 or more	£4,000 or more	£52,000 or more	7
	Don’t know/Refused			8

QE8. SHOWCARD AE (R) **Here is a list of daily newspapers. Which of these do you read or look at regularly? By regularly I mean on average at least three out of four issues.** MULTICODE OK

A	Daily Express	1
B	Daily Mail	2
C	The Mirror	3
D	Daily Record	4
E	Daily Telegraph	5
F	Financial Times	6
G	The Guardian	7
H	The Herald (Glasgow)	8
I	The Independent	9
J	Metro	10
K	The Scotsman	11
L	Daily Star	12
M	The Sun	13
N	The Times	14
O	Evening Standard	15
	Other	16
	None of these	17

QE9. SHOWCARD AF (R) **Last of all, what did you think of this questionnaire?**

A	Interesting	1
B	Too long	2
C	Difficult to understand (WRITE IN WHICH SECTION/QUESTION)	3
D	Educational	4
E	Unrealistic/ not credible	5
	Other (PLEASE SPECIFY)	6

GO TO DEMOGRAPHICS ON THE FRONT PAGE

SECTION C1 - HEALTH QUESTIONNAIRE

GENERAL HEALTH OVER THE LAST FEW WEEKS

FOR OFFICE USE ONLY
RESPONDENT ID – COPY OVER FROM CONTACT SHEET. USE LEADING ZEROS. ❑❑❑❑

SECTION C1 - HEALTH QUESTIONNAIRE

GENERAL HEALTH OVER THE LAST FEW WEEKS

Please read this carefully:

We would like to know how your health has been in general **over the past few weeks.**

Please answer ALL the questions by ticking the box below the answer which you think most applies to you.

Have you recently…

	Better than usual	Same as usual	Less than usual	Much less than usual
QC1. …been able to concentrate on whatever you're doing? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)
	Not at all	No more than usual	Rather more than usual	Much more than usual
QC2. …lost much sleep over worry? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)
	More So than usual	Same as usual	Less useful than usual	Much less useful
QC3. …felt you were playing a useful part in things? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)
	More so than usual	Same as usual	Less so than usual	Much less capable
QC4. …felt capable of making decisions about things? **(Tick one box**	☐ (1)	☐ (2)	☐ (3)	☐ (4)
	Not at all	No more than usual	Rather more than usual	Much more than usual
QC5. …felt constantly under strain? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)
	Not at all	No more than usual	Rather more than usual	Much more than usual
QC6. …felt you couldn't overcome your difficulties? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

Have you recently…

		More so than usual	Same as usual	Less so than usual	Much less than usual
QC7.	…been able to enjoy your normal day-to-day activities? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

		More so than usual	Same as usual	Less able than usual	Much less able
QC8.	…been able to face up to your problems? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QC9.	…been feeling unhappy and depressed? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QC10.	…been losing confidence in yourself? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QC11.	…been thinking of your self as a worthless person? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

		More so than usual	About same as usual	Less so than usual	Much less than usual
QC12.	…been feeling reasonably happy, all things considered? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

THANK YOU. PLEASE INFORM THE INTERVIEWER THAT YOU HAVE FINISHED.

THIS PAGE HAS BEEN LEFT INTENTIONALLY BLANK

SECTION C2 - HEALTH QUESTIONNAIRE

GENERAL HEALTH WHEN THE HEALTH EFFECTS FROM THE FLOODING WERE AT THEIR MOST SEVERE

FOR OFFICE USE ONLY
RESPONDENT ID – COPY OVER FROM CONTACT SHEET. USE LEADING ZEROS.
❑ ❑ ❑ ❑

MORI

SECTION C2 - HEALTH QUESTIONNAIRE

GENERAL HEALTH WHEN THE HEALTH EFFECTS FROM THE FLOODING WERE AT THEIR MOST SEVERE

Please read this carefully:

We would like you to think back to how your health was **when the health effects from the flooding were at their most severe**.

Please answer ALL the questions by ticking the box below the answer which you think most applies to you.

Did you find you…

		Better than usual	Same as usual	Less than usual	Much less than usual
QCC1.	…were able to concentrate on whatever you were doing? **(Tick one box)**	❑ (1)	❑ (2)	❑ (3)	❑ (4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QCC2.	…lost much sleep over worry? **(Tick one box)**	❑ (1)	❑ (2)	❑ (3)	❑ (4)

		More So than usual	Same as usual	Less useful than usual	Much less useful
QCC3.	…felt you were playing a useful part in things? **(Tick one box)**	❑ (1)	❑ (2)	❑ (3)	❑ (4)

		More so than usual	Same as usual	Less so than usual	Much less capable
QCC4.	…felt capable of making decisions about things? **(Tick one box**	❑ (1)	❑ (2)	❑ (3)	❑ (4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QCC5.	…felt constantly under strain? **(Tick one box)**	❑ (1)	❑ (2)	❑ (3)	❑ (4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QCC6.	…felt you couldn't overcome your difficulties? **(Tick one box)**	❑ (1)	❑ (2)	❑ (3)	❑ (4)

Did you find you…

		More so than usual	Same as usual	Less so than usual	Much less than usual
QCC7.	…were able to enjoy your normal day-to-day activities? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

		More so than usual	Same as usual	Less able than usual	Much less able
QCC8.	…were able to face up to your problems? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QCC9.	…were feeling unhappy and depressed? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QCC10.	…were losing confidence in yourself? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QCC11.	…were thinking of your self as a worthless person? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

		More so than usual	About same as usual	Less so than usual	Much less than usual
QCC12.	…were feeling reasonably happy, all things considered? **(Tick one box)**	☐ (1)	☐ (2)	☐ (3)	☐ (4)

THANK YOU. PLEASE INFORM THE INTERVIEWER THAT YOU HAVE FINISHED.

THIS PAGE HAS BEEN LEFT INTENTIONALLY BLANK

PTSS Questionnaire

FOR OFFICE USE ONLY

RESPONDENT ID – COPY OVER FROM CONTACT SHEET. USE LEADING ZEROS.

❑ ❑ ❑ ❑

MORI

PTSS Questionnaire

The following questions relate to some of the effects that you may have experienced as a result of flooding. Any answers you give will be treated as completely confidential. There are no right or wrong answers to any of the questions.

Please answer questions by ticking the box next to the answer which you think most applies to you.

When you have answered a question, please check to the right of the box you have ticked for any instructions telling you how to proceed. If there is no instruction, please just go on to the next question.

PART A

QA-1 **As a result of you experiencing the flood, did you personally experience intense fear, helplessness or horror?**

Yes	❑ (1)	
No	❑ (2)	( )

PART B

B-1-1 **I have recurring memories of the flood in the way of thoughts, images and perceptions and I can't seem to push them out of my mind.**

Never	❑ (1)	SKIP TO B-2-1	
Rarely	❑ (2)	CONTINUE	
Sometimes	❑ (3)	CONTINUE	
Often	❑ (4)	CONTINUE	
Always	❑ (5)	CONTINUE	( )

B-1-2 **Indicate the degree to which such recurring memories distress, upset or bother you.**

Not at all	❑ (1)	
A little	❑ (2)	
Somewhat	❑ (3)	
Quite a lot	❑ (4)	
Very much	❑ (5)	( )

B-2-1 **I have recurring dreams of the flood.**

Never	❑ (1)	SKIP TO B-3-1
Rarely	❑ (2)	CONTINUE
Sometimes	❑ (3)	CONTINUE
Often	❑ (4)	CONTINUE
Always	❑ (5)	CONTINUE

( )

B-2-2 **Indicate the degree to which such recurring dreams distress, upset or bother you.**

Not at all	❑ (1)
A little	❑ (2)
Somewhat	❑ (3)
Quite a lot	❑ (4)
Very much	❑ (5)

( )

B-3-1 **I have acted or felt that the flood was happening again. For example, I have felt I have either relived the event, experienced hallucinations, illusions and/or flashbacks to the flood.**

Never	❑ (1)	SKIP TO B-4-1
Rarely	❑ (2)	CONTINUE
Sometimes	❑ (3)	CONTINUE
Often	❑ (4)	CONTINUE
Always	❑ (5)	CONTINUE

( )

B-3-2 **Indicate the degree to which such recurrences distress, upset or bother you.**

Not at all	❑ (1)
A little	❑ (2)
Somewhat	❑ (3)
Quite a lot	❑ (4)
Very much	❑ (5)

( )

B-4-1 **I am reminded of the flood by triggers which resemble or symbolise an aspect of the flood (for example, TV programmes, weather forecasts, etc).**

Never	☐ (1)	SKIP TO B-5-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

B-4-2 **Indicate the degree to which such reminders of the flood distress, upset or bother you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

B-5-1 **When reminded of the flood by triggers which resemble or symbolise an aspect of the flood, I feel nervous, have palpitations or feel tense.**

Never	☐ (1)	SKIP TO C-1-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

B-5-2 **Indicate the degree to which these reactions to the flood distress, upset or bother you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

PART C

C-1-1 **I deliberately avoid thoughts, feelings or conversations about the flood.**

Never	☐ (1)	SKIP TO C-2-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

C-1-2 **Indicate the degree to which your efforts to avoid thoughts, feelings or conversations about the flood distress, upset or bother you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

C-2-1 **I deliberately avoid activities, places, or people that arouse recollections of the flood.**

Never	☐ (1)	SKIP TO C-3-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

C-2-2 **Indicate the degree to which your efforts to avoid activities, places, or people that arouse recollections of the flood distress, upset or bother you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

C-3-1 **When I try to recall the flood I am unable to remember certain parts or important things that happened.**

Never	☐ (1)	SKIP TO C-4-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

C-3-2 **Indicate the degree to which your inability to recall important aspects of the flood distresses, upsets or bothers you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

C-4-1 **I find I am not interested in people, things and activities which were important to me prior to the occurrence of the flood (for example, family, friends and hobbies).**

Never	☐ (1)	SKIP TO C-5-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

C-4-2 **Indicate the degree to which this lack of interest distresses, upsets or bothers you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

C-5-1 **I feel I have become more emotionally estranged, separated or cut off from others.**

Never	☐ (1)	SKIP TO C-6-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

C-5-2 **Indicate the degree to which this emotional estrangement, separateness or feeling of being cut off from others distresses, upsets or bothers you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

C-6-1 **I feel I have a markedly reduced ability to feel emotions and share feelings, especially those associated with intimacy, tenderness and sexuality.**

Never	☐ (1)	SKIP TO C-7-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

C-6-2 **Indicate the degree to which the reduced ability to feel emotions and share feelings distresses, upsets or bothers you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

C-7-1 **I feel I do not have a future. (For example, not having a career, having a shortened life span or having marriage problems.)**

Never	☐ (1)	SKIP TO D-1-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

C-7-2 **Indicate the degree to which feeling you don't have a future distresses, upsets or bothers you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

PART D

D-1-1 **I have difficulty falling or staying asleep.**

Never	☐ (1)	SKIP TO D-2-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

D-1-2 **Indicate the degree to which having difficulty falling or staying asleep distresses, upsets or bothers you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

D-2-1 **I experience irritability or outbursts of anger.**

Never	☐ (1)	SKIP TO D-3-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

D-2-2 **Indicate the degree to which being irritable or experiencing outbursts of anger distresses, upsets or bothers you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

D-3-1 **I have difficulty concentrating on tasks or completing tasks.**

Never	☐ (1)	SKIP TO D-4-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

D-3-2 **Indicate the degree to which having difficulty concentrating on tasks or completing tasks distresses, upsets or bothers you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

D-4-1 **Since the flood there have been times when I have been overtly alert or watchful when there is no need to feel that way.**

Never	☐ (1)	SKIP TO D-5-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

D-4-2 **Indicate the degree to which being overtly alert or watchful when there is no need to feel this way distresses, upsets or bothers you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

D-5-1 **I have strong startled reactions. (For example, when someone comes behind me unexpectedly or when a car backfires I show strong signs of being startled).**

Never	☐ (1)	SKIP TO E-1-1
Rarely	☐ (2)	CONTINUE
Sometimes	☐ (3)	CONTINUE
Often	☐ (4)	CONTINUE
Always	☐ (5)	CONTINUE

( )

D-5-2 **Indicate the degree to which having strong startled reactions distresses, upsets or bothers you.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

D-6-1 **Have you ever attended counselling with a health professional such as psychologist or other qualified professional?**

Yes	☐ (1)	
No	☐ (2)	
Don't know	☐ (99)	( )

D-6-1 **Have you ever been diagnosed by a psychiatrist/psychologist as having Post-traumatic Stress Disorder?**

Yes	☐ (1)	
No	☐ (2)	
Don't know	☐ (99)	( )

PART E

In response to each of the following questions, please record your answer in the space available.

E-1-1 **How old (in years) were you at the time you experienced the flood?**

☐☐ Years 1

E-1-2 **How old (in years) are you now?**

☐☐ Years 1

PLEASE TURN OVER

MORI

PART F

Indicate how often the disturbances caused by the flood have significantly impaired or negatively influenced your personal and family relationships, your work and your general well-being.

Example of disturbances are: reliving the flood; intrusive memories of the flood; avoidance of people, places and situations connected to the flood; trouble sharing your feelings with others; difficulty in concentrating on tasks; difficulties related to sleep; and feeling irritated. If questions are not applicable, please indicate by writing 'N/A'.

F-1 **Mixing socially with others outside my family.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

F-2 **Family relationships.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

F-3 **Maintaining a normal healthy relationship with your partner.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

F-4 **Coping with everyday situations.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

F-5 **Coping with work.**

Not at all	☐ (1)
A little	☐ (2)
Somewhat	☐ (3)
Quite a lot	☐ (4)
Very much	☐ (5)

( )

THIS PAGE HAS BEEN LEFT INTENTIONALLY BLANK

MORI//18171.jfm/At Risk Questionnaire No

6 DIGIT RESPONDENT ID – COPY OVER FROM CONTACT SHEET. USE LEADING ZEROS.

Intangible Impacts Of Flooding – At Risk Sample

Name/Initial/Title: Mr/Mrs/Ms/Miss

Address:

Full Postcode

Telephone in home:	
Yes	1
No	2
Refused/Ex-directory	3
Full tel.no (inc STD code):	4

Age (RECORD EXACT AGE AND CIRCLE AGE/GENDER GROUP

	MALE	FEMALE
18-39 years	1	5
40-64 years	2	6
65-74 years	3	7
75 and over	4	8

Occupation of Chief Income Earner

Position/rank/grade

Industry/type of company

Quals/degree/apprenticeship

Number of staff responsible for

Class

AB	1
C1	2
C2	3
DE	4

REMEMBER TO PROBE FULLY FOR PENSION AND CODE FROM ABOVE

Record weather at time of interview
MULTICODE OK

Windy	1
Cold	2
Sunny	3
Rainy	4
Cloudy/dry	5
Snow/sleet	6

Record Street Name Again:

Property Type:

Detached house	1
Semi-detached house	2
Terraced house	3
Ground floor maisonette	4
Bungalow	5
Ground floor flat	6
Basement flat	7
Mobile home	8
Other (PLEASE SPECIFY)	9

Interview Declaration
I confirm that I have carried out this Interview face-to-face with the above named person and that I asked all the relevant questions fully and recorded the answers in conformance with the survey specification and within the MRS Code of Conduct.

Signature: ....

Interviewer Name (CAPS): ....

....

Interviewer Number: /

Day of Interview 1 2 3 4 5 6 7
(Mon) (Thur) (Sun)

Date of Interview: / /02

Length of Interview: (minutes)

INTERVIEWER RECORD START TIME

Hours		Mins	

INTERVIEWER RECORD END TIME AFTER DEMOGRAPHICS

Hours		Mins	

Q INTERVIEWER **please indicate which showcard version you are using**

Normal	1
Reversed	2

( )

SECTION A - QUESTIONS ABOUT THOSE AT RISK

QA1. **Can I ask you how long you have lived in this property?** WRITE IN. USE LEADING ZEROS.

☐☐ years ☐☐ months

QA2. **Including yourself, how many people in your household are…?**
INTERVIEWER READ OUT A – E. SINGLE CODE ONLY.

A) Children aged 9 and under
B) Children aged 10 to 17
C) Adults aged 18 to 64
D) Adults aged 65 to 74
E) Adults aged 75 and over

	A 0 - 9	B 10 - 17	C 18 - 64	D 65 - 74	E 75+
One	1	1	1	1	1
Two	2	2	2	2	2
Three	3	3	3	3	3
Four	4	4	4	4	4
Five or more	5	5	5	5	5
None	6	6	6	6	6

QA3. **In your property, how many rooms in total do you have for use only by your household?** READ OUT: **Do not count bathrooms, toilets, halls or landings or rooms that can only be used for storage such as cupboards. Do count all other rooms e.g. kitchen, living rooms, bedrooms, utility room and study. Do not count communal rooms you share with other households.** SINGLE CODE ONLY

One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10
Eleven	11
Twelve	12
Thirteen	13
Fourteen	14
Fifteen	15
Sixteen or more (WRITE IN) ❑❑	16

QA4. **Are you aware that this area is defined as a flood risk area?**

Yes	1
No	2

( )

QA5. SHOWCARD A (R) **Have you undertaken any of these flood prevention measures?** MULTICODE OK

A	Take out household insurance against flooding	1	GO TO QA7
B	Keep sand and bags in the property	2	
C	Keep ditches and drains around the property clean	3	
D	Built walls around the property	4	ASK QA6
E	Purchased water pumps	5	
F	Keep alert for flood warnings during high-risk months	6	GO TO QA7
G	Avoid buying expensive downstairs furnishings	7	
H	Avoid keeping irreplaceable items or goods of sentimental value on ground floor of my home at all or certain times	8	
	Other (WRITE IN)	9	
	Did not take preventative actions/None of these	10	

ASK ALL WHO ANSWERED CODES 4 OR 5 AT QA5. OTHERS GO TO QA7.
READ OUT: **The following question asks for financial information. Please be assured that this information will be treated as strictly confidential and that it will not be passed on to anyone outside of MORI in relation with your name.**

QA6. **Please estimate the total cost of your expenditure (in pounds) on these flood prevention measures.** WRITE IN. ROUND UP TO NEAREST POUND. USE LEADING ZEROS.

£☐☐☐,☐☐☐	1
Don't know	99

ASK ALL
QA7. SHOWCARD B (R) **Have you ever done any of the things listed on this card?** MULTICODE OK

A	Been a member of a local community group related to flooding	1
B	Written letters to relevant authorities about the flooding	2
C	Attended meetings related to flooding	3
	None of these	4

QA8. SHOWCARD C (R) **How worried are you about the possibility of your property being flooded during the next 12 months? Please just read out the letter that applies.** SINGLE CODE ONLY

A	Not worried at all	1
B	Not very worried	2
C	Indifferent	3
D	Somewhat worried	4
E	Very worried	5

( )

QA9. SHOWCARD D (R) **This card contains various characteristics of a house flooding. When thinking about your own home, which <u>one</u> worries you most? Please just read out the letter that applies.** SINGLE CODE ONLY

A	Duration of flood	1
B	Depth of water	2
C	Dirtiness of water	3
D	Speed of water rising / flowing	4
E	Time of day / night when it occurs	5
F	Season of the year when it occurs	6
G	Warning time	7
	Other (WRITE IN)	8
	Not worried about any specific flood characteristic	9

READ OUT: **We would now like you to complete a set of questions commonly used in health surveys that are designed to give us more a more detailed picture of your health. Please remember that this survey is completely confidential and the names and addresses of individuals participating will not be revealed to anyone outside MORI.**

INTERVIEWER, NOTE THAT THERE IS NO SECTION B IN THIS VERSION OF THE QUESTIONNAIRE.

PLEASE FOLLOW THESE STEPS:

1) ADMINISTER **SECTION C1 HEALTH QUESTIONNAIRE - GENERAL HEALTH OVER THE LAST FEW WEEKS**. THIS IS A SEPARATE SELF-COMPLETION QUESTIONNAIRE. CHECK WHEN COMPLETED.

2) THEN GO TO **SECTION D**

SECTION D

INTERVIEWER PLEASE ENSURE YOU HAVE REFERRED TO THE INTERVIEWER INSTRUCTIONS AND ARE FULLY AWARE OF HOW THE ROUTING AND VERSIONING FOR SECTION D WORKS.

IT IS VERY IMPORTANT THAT EACH RESPONDENT IS ASKED THE CORRECT VERSION OF EACH SECTION. THE VERSIONING IS DETERMINED BY THE COLOUR OF THE CONTACT SHEET FOR EACH ADDRESS.

PLEASE REMEMBER THAT THERE ARE ROUTING INSTRUCTIONS AS WELL AS THESE VERSIONS.

- ALL RESPONDENTS SHOULD BE ASKED THEIR RELEVANT VERSION OF SCENARIO A.

- RESPONDENTS SHOULD ONLY BE ASKED THEIR RELEVANT VERSION SCENARIO B OR SCENARIO C, DEPENDING ON THEIR RESPONSE AT QDA1.

COLOUR CODING SUMMARY:

CONTACT SHEET COLOUR	SECTION D VALUATION SCENARIO A	SECTION D VALUATION SCENARIO B	OR	SECTION D VALUATION SCENARIO C
YELLOW	QDA (i) – PAGE 7	QDB (i)	OR	QDC (i)
PINK	QDA (ii) – PAGE 9	QDB (ii)	OR	QDC (ii)
BLUE	QDA (iii) – PAGE 11	QDB (i)	OR	QDC (iii)
GREEN	QDA (iv) – PAGE 13	QDB (ii)	OR	QDC (iv)

SECTION D - VALUATION SCENARIO A -VERSION 1

ASK ALL WITH A YELLOW CONTACT SHEET

INTERVIEWER READ OUT: **For the purpose of the following questions, please suppose that, in the event of flooding, all damage to the buildings and contents of your home will be compensated and this will not result in increased insurance premiums for you. Here, we are considering other impacts of flooding such as those shown on this card which may result in stress and hassle for you.**

READ OUT SHOWCARD E (BELOW) - TOP SECTION ONLY

- impacts on physical health: headaches, colds, injuries etc.
- disruption to normal life
- loss of irreplaceable items: photographs, personal letters etc.

INTERVIEWER READ OUT: **Research indicates that the stress and hassle which you may experience may be similar to that described on this card. Please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD E - BOTTOM SECTION - AND KEEP ON SHOW FOR ENTIRE SECTION

You are often reminded of the flood by triggers (such as TV programmes).
You are often overly alert or watchful for no reason.
You sometimes feel nervous, have palpitations or feel tense when reminded of the flood.
You sometimes have recurring memories of the flood.
You sometimes experience flashbacks to the event.
All of these symptoms will cause you a fair amount of distress.

Now suppose that through improved flood defence, such stress and hassle could be avoided. Such an improvement will have to be paid for by all households in the country through increased taxation.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDA (i) 1 **In principle, would you be in favour of paying something towards such an improvement to ensure that you and other members of your household do not experience the effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (i) 2
No	2	GO TO QDC (i) 9 – PAGE 17

ASK ALL WHO ANSWERED YES (CODE 1) AT QDA (i) 1

QDA (i) 2 **It is not yet known how much such an improvement will cost but it will be at least £20 per year (or 40p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (i) 3
No	2	GO TO QDA (i) 5

QDA (i) 3 **It may be that such an improvement will cost £125 per year (or £2.50p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (i) 4
No	2	GO TO QDA (i) 5

QDA (i) 4 **It is possible that the cost of such an improvement could reach £500 per year (or £10 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (i) 5
No	2	

QDA (i) 5 **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?**
WRITE IN. ENTER VALUE TO THE NEAREST POUND. USE LEADING ZEROS.

£☐,☐☐☐ 1

QDA (i) 6 **What is the main reason why you would be willing to pay for improved flood defence?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I would like to avoid the stress effects described	1
I would like to avoid the impacts on my physical health	2
I would like to avoid loss of my irreplaceable items	3
I would like to avoid damage to my property and contents	4
I would like to avoid my property losing its value	5
I would like to avoid stress to my pets	6
I am concerned about others in this area	7
It is a good cause	8
Other (PLEASE SPECIFY)	9

ASK QDB (i) 7 – PAGE 15

SECTION D - VALUATION SCENARIO A – VERSION 2

ASK ALL WITH A PINK CONTACT SHEET

INTERVIEWER READ OUT: **For the purpose of the following questions, please suppose that, in the event of flooding, all damage to the buildings and contents of your home will be compensated and this will not result in increased insurance premiums for you. Here, we are considering other impacts of flooding such as those shown on this card which may result in stress and hassle for you.**

READ OUT SHOWCARD F (BELOW) – TOP SECTION ONLY

- impacts on physical health: headaches, colds, injuries etc.
- disruption to normal life
- loss of irreplaceable items: photographs, personal letters etc.

INTERVIEWER READ OUT: **Research indicates that the stress and hassle which you may experience may be similar to that described on this card. Please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD F – BOTTOM SECTON ONLY - AND KEEP ON SHOW FOR ENTIRE SECTION

You are sometimes reminded of the flood by triggers (such as TV programmes).
You experience rare feelings of nervousness, palpitations or tension, caused by these triggers.
You experience rare occasions of being overtly alert or watchful for no reason.
You experience rare sleeping difficulties.
You experience rare memories of the flood.
All of these symptoms cause you a little distress.

Now suppose that through improved flood defence, such stress and hassle could be avoided. Such an improvement will have to be paid for by all households in the country through increased taxation.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDA (ii) 1 **In principle, would you be in favour of paying something towards such an improvement to ensure that you and other members of your household do not experience the effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (ii) 2
No	2	GO TO QDC (ii) – PAGE 19

ASK ALL WHO ANSWERED YES (CODE 1) AT QDA (ii) 1

QDA (ii) 2 **It is not yet known how much such an improvement will cost but it will be at least £20 per year (or 40p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (ii) 3
No	2	GO TO QDA (ii) 5

QDA (ii) 3 **It may be that such an improvement will cost £125 per year (or £2.50p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (ii) 4
No	2	GO TO QDA (ii) 5

QDA (ii) 4 **It is possible that the cost of such an improvement could reach £500 per year (or £10 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (ii) 5
No	2	

QDA (ii) 5 **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?**
WRITE IN. ENTER VALUE TO THE NEAREST POUND. USE LEADING ZEROS.

£☐,☐☐☐ 1

QDA (ii) 6 **What is the main reason why you would be willing to pay for improved flood defence?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I would like to avoid the stress effects described	1
I would like to avoid the impacts on my physical health	2
I would like to avoid loss of my irreplaceable items	3
I would like to avoid damage to my property and contents	4
I would like to avoid my property losing its value	5
I would like to avoid stress to my pets	6
I am concerned about others in this area	7
It is a good cause	8
Other (PLEASE SPECIFY)	9

ASK QDB (ii) – PAGE 16

SECTION D - VALUATION SCENARIO A – VERSION 3

ASK ALL WITH A BLUE CONTACT SHEET

INTERVIEWER READ OUT: **For the purpose of the following questions, please suppose that, in the event of flooding, all damage to the buildings and contents of your home will be compensated and this will not result in increased insurance premiums for you. Here, we are considering other impacts of flooding such as those shown on this card which may result in stress and hassle for you.**

READ OUT SHOWCARD G (BELOW) – TOP SECTION ONLY

- impacts on physical health: headaches, colds, injuries etc.
- disruption to normal life
- loss of irreplaceable items: photographs, personal letters etc.

INTERVIEWER READ OUT: **Research indicates that the stress and hassle which you may experience may be similar to that described on this card. Please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD G – BOTTOM SECTION ONLY - AND KEEP ON SHOW FOR ENTIRE SECTION

You are often reminded of the flood by triggers (such as TV programmes).
You are often overly alert or watchful for no reason.
You sometimes feel nervous, have palpitations or feel tense when reminded of the flood.
You sometimes have recurring memories of the flood.
You sometimes experience flashbacks to the event.
All of these symptoms will cause you a fair amount of distress.

Now suppose that through improved flood defence, such stress and hassle could be avoided. Such an improvement will have to be paid for by all households in the country through increased taxation.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDA (iii) 1 **In principle, would you be in favour of paying something towards such an improvement to ensure that you and other members of your household do not experience the effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (iii) 2
No	2	GO TO QDC (iii) – PAGE 21

ASK ALL WHO ANSWERED YES (CODE 1) AT QDA (iii) 1

QDA (iii) 2 **It is not yet known how much such an improvement will cost but it will be at least £40 per year (or 80p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (iii) 3
No	2	GO TO QDA (iii) 5

QDA (iii) 3 **It may be that such an improvement will cost £250 per year (or £5 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (iii) 4
No	2	GO TO QDA (iii) 5

QDA (iii) 4 **It is possible that the cost of such an improvement could reach £1,000 per year (or £20 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (iii) 5
No	2	

QDA (iii) 5 **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?**
WRITE IN. ENTER VALUE TO THE NEAREST POUND. USE LEADING ZEROS.

£☐,☐☐☐ 1

QDA (iii) 6 **What is the main reason why you would be willing to pay for improved flood defence?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I would like to avoid the stress effects described	1
I would like to avoid the impacts on my physical health	2
I would like to avoid loss of my irreplaceable items	3
I would like to avoid damage to my property and contents	4
I would like to avoid my property losing its value	5
I would like to avoid stress to my pets	6
I am concerned about others in this area	7
It is a good cause	8
Other (PLEASE SPECIFY)	9

ASK QDB (i) 7 – PAGE 15

SECTION D - VALUATION SCENARIO A – VERSION 4

ASK ALL WITH A GREEN CONTACT SHEET

INTERVIEWER READ OUT: **For the purpose of the following questions, please suppose that, in the event of flooding, all damage to the buildings and contents of your home will be compensated and this will not result in increased insurance premiums for you. Here, we are considering other impacts of flooding such as those shown on this card which may result in stress and hassle for you.**

READ OUT SHOWCARD H (BELOW) – TOP SECTION ONLY

- impacts on physical health: headaches, colds, injuries etc.
- disruption to normal life
- loss of irreplaceable items: photographs, personal letters etc.

INTERVIEWER READ OUT: **Research indicates that the stress and hassle which you may experience may be similar to that described on this card. Please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD H – BOTTOM SECTION ONLY - AND KEEP ON SHOW FOR ENTIRE SECTION

You are sometimes reminded of the flood by triggers (such as TV programmes).
You experience rare feelings of nervousness, palpitations or tension, caused by these triggers.
You experience rare occasions of being overtly alert or watchful for no reason.
You experience rare sleeping difficulties.
You experience rare memories of the flood.
All of these symptoms cause you a little distress.

Now suppose that through improved flood defence, such stress and hassle could be avoided. Such an improvement will have to be paid for by all households in the country through increased taxation.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDA (iv) 1 **In principle, would you be in favour of paying something towards such an improvement to ensure that you and other members of your household do not experience the effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (iv) 2
No	2	GO TO QDC (iv) 9 – PAGE 23

ASK ALL WHO ANSWERED YES (CODE 1) AT QDA (iv) 1

QDA (iv) 2 **It is not yet known how much such an improvement will cost but it will be at least £40 per year (or 80p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (iv) 3
No	2	GO TO QDA (iv) 5

QDA (iv) 3 **It may be that such an improvement will cost £250 per year (or £5 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (iv) 4
No	2	GO TO QDA (iv) 5

QDA (iv) 4 **It is possible that the cost of such an improvement could reach £1,000 per year (or £20 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?** SINGLE CODE ONLY

Yes	1	ASK QDA (iv) 5
No	2	

QDA (iv) 5 **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?**
WRITE IN. ENTER VALUE TO THE NEAREST POUND. USE LEADING ZEROS.

£☐,☐☐☐ 1

QDA (iv) 6 **What is the main reason why you would be willing to pay for improved flood defence?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER 1

None/no answer X

Don't know Y (-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I would like to avoid the stress effects described	1
I would like to avoid the impacts on my physical health	2
I would like to avoid loss of my irreplaceable items	3
I would like to avoid damage to my property and contents	4
I would like to avoid my property losing its value	5
I would like to avoid stress to my pets	6
I am concerned about others in this area	7
It is a good cause	8
Other (PLEASE SPECIFY)	9

ASK QDB (ii) 7 – PAGE 16

SECTION D - VALUATION SCENARIO B – VERSION 1

ASK ALL WITH A YELLOW OR BLUE CONTACT SHEET WHO ANSWERED YES (CODE 1) AT QDA (i) 1 (PAGE 7) OR QDA (iii) 1 (PAGE 11)

INTERVIEWER READ OUT **Now assume that in the event of flooding you experience the stress effects shown on this card. Please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD I AND KEEP ON SHOW FOR ENTIRE SECTION

You always feel nervous, have palpitations or feel tense when reminded of the flood. You always feel emotionally estranged, separated or cut off from others. You are always being reminded of the flood by triggers (such as TV programmes). You always have difficulty concentrating on tasks or completing tasks. You often experience difficulty sleeping. These symptoms will distress you very much.

QDB (i) 7 **Now suppose that through improved flood defence, these effects may be avoided. As before, such an improvement will have to be paid for by all households in the country through increased taxation. Would you be prepared to pay a higher amount to avoid these symptoms than the amount you have just stated as the maximum amount you would be willing to pay to for those listed before?**

Yes (WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS.) £□□,□□□	1	GO TO SECTION E
No	2	ASK QDB (i) 8

QDB (i) 8 **What is main reason why you are not willing to pay more?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I cannot afford to pay any more	1	GO TO SECTION E
I do not believe I/we will suffer from the stress effects described	2	
Other (PLEASE SPECIFY)	3	

INTERVIEWER: GO TO SECTION E

SECTION D - VALUATION SCENARIO B – VERSION 2

ASK ALL WITH A PINK OR GREEN CONTACT SHEET WHO ANSWERED 'YES' (CODE 1) AT QDA (ii) 1 (PAGE 9) OR QDA (iv) 1 (PAGE 13).

INTERVIEWER READ OUT **Now assume that in the event of flooding you experience the stress effects shown on this card. Please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD J AND KEEP ON SHOW FOR ENTIRE SECTION

You often have difficulty concentrating on tasks or completing tasks.
You are often reminded of the flood by triggers (such as TV programmes).
You often feel nervous, have palpitations or feel tense when reminded of the flood.
You often experience strong startled reactions.
You are often overtly alert or watchful for no reason.
These symptoms will cause you quite a lot of distress.

QDB(ii) 7 **Now suppose that through improved flood defence, these effects may be avoided. As before, such an improvement will have to be paid for by all households in the country through increased taxation. Would you be prepared to pay a higher amount to avoid these symptoms than the amount you have just stated as the maximum amount you would be willing to pay to for those listed before?**

Yes (WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS.) £☐☐,☐☐☐	1	GO TO SECTION E
No	2	ASK QDB (ii) 8

QDB (ii) 8 **What is main reason why you are not willing to pay more?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I cannot afford to pay any more	1	GO TO SECTION E
I do not believe I/we will suffer from the stress effects described	2	
Other (PLEASE SPECIFY)	3	

INTERVIEWER: GO TO SECTION E

SECTION D - VALUATION SCENARIO C – VERSION 1

ASK ALL WITH A YELLOW CONTACT SHEET WHO ANSWERED NO (CODE 2) AT QDA (i) 1 (PAGE 7)

INTERVIEWER READ OUT **Now assume that in the event of flooding you experience the stress effects shown on this card. Please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD K AND KEEP ON SHOW FOR ENTIRE SECTION

You always feel nervous, have palpitations or feel tense when reminded of the flood.
You always feel emotionally estranged, separated or cut off from others.
You are always being reminded of the flood by triggers (such as TV programmes).
You always have difficulty concentrating on tasks or completing tasks.
You often experience difficulty sleeping.
These symptoms will distress you very much.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDC (i) 9 **In principle, would you be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?**

Yes	1	ASK QDC (i) 10
No	2	GO TO QDC (i) 14

QDC (i) 10 **It is not yet known how much such an improvement will cost but it will be at least £20 per year (or 40p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC (i) 11
No	2	GO TO QDC (i) 13

QDC (i) 11 **It may be that such an improvement will cost £125 per year (or £2.50p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC (i) 12
No	2	GO TO QDC (i) 13

QDC (i) 12 **It is possible that the cost of such an improvement could reach £500 per year (or £10 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1
No	2

QDC (i) 13 **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?**
WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS.

£❑,❑❑❑ | 1 GO TO SECTION E

ASK ALL WHO ANSWERED 'NO' AT QDC (i) 9

QDC (i) 14 **What is the main reason why you would not be willing to avoid the stress effects shown on the card?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I cannot afford to pay	1	GO TO SECTION E
I do not believe I am at risk of being flooded	2	
I have already taken flood protection measures and hence do not need improvements to flood defence	3	
I do not believe I will suffer from stress in the event of a flood	4	
I do not believe flood defence will be improved	5	
I do not believe flood defence improvements can help me avoid stress effects	6	
I object to paying higher taxes	7	
The government or council should pay for this	8	
Water companies or industry should pay for this	9	
Other people causing flooding should pay	10	
Other (PLEASE SPECIFY)	11	

INTERVIEWER: GO TO SECTION E

SECTION D - VALUATION SCENARIO C – VERSION 2

ASK ALL WITH A PINK CONTACT SHEET WHO ANSWERED 'NO' (CODE 2) AT QDA (ii) 1 (PAGE 9)

INTERVIEWER READ OUT **Now assume that in the event of flooding you experience the stress effects shown on this card. Please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD L AND KEEP ON SHOW FOR ENTIRE SECTION

You often have difficulty concentrating on tasks or completing tasks. You are often reminded of the flood by triggers (such as TV programmes). You often feel nervous, have palpitations or feel tense when reminded of the flood. You often experience strong startled reactions. You are often overtly alert or watchful for no reason. These symptoms will cause you quite a lot of distress.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDC (ii) 9 **In principle, would you be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?**

Yes	1	ASK QDC (ii) 10
No	2	GO TO QDC (ii) 14

QDC (ii) 10 **It is not yet known how much such an improvement will cost but it will be at least £20 per year (or 40p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC (ii) 11
No	2	GO TO QDC (ii) 13

QDC (ii) 11 **It may be that such an improvement will cost £125 per year (or £2.50p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC (ii) 12
No	2	GO TO QDC (ii) 13

QDC (ii) 12 **It is possible that the cost of such an improvement could reach £500 per year (or £10 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1
No	2

QDC (ii) 13 **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?**
WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS.

£❑,❑❑❑	1	GO TO SECTION E

ASK ALL WHO ANSWERED 'NO' AT QDC (ii) 9

QDC (ii) 14 **What is the main reason why you would not be willing to avoid the stress effects shown on the card?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I cannot afford to pay	1	GO TO SECTION E
I do not believe I am at risk of being flooded	2	
I have already taken flood protection measures and hence do not need improvements to flood defence	3	
I do not believe I will suffer from stress in the event of a flood	4	
I do not believe flood defence will be improved	5	
I do not believe flood defence improvements can help me avoid stress effects	6	
I object to paying higher taxes	7	
The government or council should pay for this	8	
Water companies or industry should pay for this	9	
Other people causing flooding should pay	10	
Other (PLEASE SPECIFY)	11	

INTERVIEWER: GO TO SECTION E

SECTION D - VALUATION SCENARIO C – VERSION 3

ASK ALL WITH A BLUE CONTACT SHEET WHO ANSWERED 'NO' (CODE 2) AT QDA (iii) 1 (PAGE 11)

INTERVIEWER READ OUT **Now assume that in the event of flooding you experience the stress effects shown on this card. Please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD M AND KEEP ON SHOW FOR ENTIRE SECTION

You always feel nervous, have palpitations or feel tense when reminded of the flood. You always feel emotionally estranged, separated or cut off from others. You are always being reminded of the flood by triggers (such as TV programmes). You always have difficulty concentrating on tasks or completing tasks. You often experience difficulty sleeping. These symptoms will distress you very much.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDC (iii) 9 **In principle, would you be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?**

Yes	1	ASK QDC (iii) 10
No	2	GO TO QDC (iii) 14

QDC (iii) 10 **It is not yet known how much such an improvement will cost but it will be at least £40 per year (or 80p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC (iii) 11
No	2	GO TO QDC (iii) 13

QDC (iii) 11 **It may be that such an improvement will cost £250 per year (or £5 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC (iii) 12
No	2	GO TO QDC (iii) 13

QDC (iii) 12 **It is possible that the cost of such an improvement could reach £1,000 per year (or £20 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1
No	2

QDC (iii) 13 **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?**
WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS.

£❑,❑❑❑	1	GO TO SECTION E

ASK ALL WHO ANSWERED 'NO' AT QDC (iii) 9

QDC (iii) 14 **What is the main reason why you would not be willing to avoid the stress effects shown on the card?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY .

I cannot afford to pay	1	GO TO SECTION E
I do not believe I am at risk of being flooded	2	
I have already taken flood protection measures and hence do not need improvements to flood defence	3	
I do not believe I will suffer from stress in the event of a flood	4	
I do not believe flood defence will be improved	5	
I do not believe flood defence improvements can help me avoid stress effects	6	
I object to paying higher taxes	7	
The government or council should pay for this	8	
Water companies or industry should pay for this	9	
Other people causing flooding should pay	10	
Other (PLEASE SPECIFY)	11	

INTERVIEWER: GO TO SECTION E

SECTION D - VALUATION SCENARIO C – VERSION 4

ASK ALL WITH A GREEN CONTACT SHEET WHO ANSWERED 'NO' (CODE 2) AT QDA (iv) 1 (PAGE 13)

INTERVIEWER READ OUT **Now assume that in the event of flooding you experience the stress effects shown on this card. Please think about how you would feel if you experienced the effects shown.**

READ OUT SHOWCARD N AND KEEP ON SHOW FOR ENTIRE SECTION

You often have difficulty concentrating on tasks or completing tasks. You are often reminded of the flood by triggers (such as TV programmes). You often feel nervous, have palpitations or feel tense when reminded of the flood. You often experience strong startled reactions. You are often overtly alert or watchful for no reason. These symptoms will cause you quite a lot of distress.

Before you answer this question, I would like you to think about the following:

- **Flood defence is currently financed through taxation**
- **Any money you would pay towards this improvement would not be available for your other household spending or for other public spending**

QDC (iv) 9 **In principle, would you be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?**

Yes	1	ASK QDC (iv) 10
No	2	GO TO QDC (iv) 14

QDA (iv) 10 **It is not yet known how much such an improvement will cost but it will be at least £40 per year (or 80p per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC (iv) 11
No	2	GO TO QDC (iv) 13

QDC (iv) 11 **It may be that such an improvement will cost £250 per year (or £5 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1	ASK QDC (iv) 12
No	2	GO TO QDC (iv) 13

QDC (iv) 12 **It is possible that the cost of such an improvement could reach £1,000 per year (or £20 per week) per household. Would you be willing to pay this amount to avoid the stress effects shown on the card?**

Yes	1
No	2

QDC (iv) 13 **What is the maximum amount you would be willing to pay per year for your household to avoid the stress effects shown on the card?**
WRITE IN TO THE NEAREST POUND. USE LEADING ZEROS.

£❑,❑❑❑	1	GO TO SECTION E

ASK ALL WHO ANSWERED 'NO' AT QDC (iv) 9

QDC (iv) 14 **What is the main reason why you would not be willing to avoid the stress effects shown on the card?** PROBE FULLY AND WRITE IN, THEN CODE RESPONSE IN TABLE BELOW

ANY ANSWER	1
None/no answer	X
Don't know	Y

(-)

CODE RESPONSE HERE. SINGLE CODE ONLY.

I cannot afford to pay	1	GO TO SECTION E
I do not believe I am at risk of being flooded	2	
I have already taken flood protection measures and hence do not need improvements to flood defence	3	
I do not believe I will suffer from stress in the event of a flood	4	
I do not believe flood defence will be improved	5	
I do not believe flood defence improvements can help me avoid stress effects	6	
I object to paying higher taxes	7	
The government or council should pay for this	8	
Water companies or industry should pay for this	9	
Other people causing flooding should pay	10	
Other (PLEASE SPECIFY)	11	

INTERVIEWER: GO TO SECTION E

SECTION E - STANDARD DEMOGRAPHIC QUESTIONS

ASK ALL

QE1. SHOWCARD O (R) **Using this card, please tell me which, if any, is the highest educational or professional qualification you have obtained. Just read out the letter or letters which apply.** (IF STILL STUDYING, CHECK FOR HIGHEST ACHIEVED SO FAR). SINGLE CODE ONLY.

A	GCSE/O-Level/CSE	1
B	Vocational qualifications (=NVQ1+2)	2
C	A-Level or equivalent (=NVQ3)	3
D	Bachelor Degree or equivalent (=NVQ4)	4
E	Masters/PhD or equivalent	5
F	Other	6
G	No formal qualifications	7
H	Still studying	8
	Don't know	9

QE2. SHOWCARD P (R) **What is your current employment situation?** SINGLE CODE ONLY.

A	Working full time (30hrs/wk+)	1
B	Working part time (8-29 hrs/wk)	2
C	Not working (ie under 8hrs/week)- housewife	3
D	Not working (ie under 8hrs/week)- retired	4
E	Not working (ie under 8 hrs/week)- unemployed (registered)	5
F	Not working (ie under 8 hrs/week)- unemployed (not registered but looking for work)	6
G	Not working (ie under 8hrs/week)- student	7
H	Not working (ie under 8hrs/week)- other (incl disabled)	8
	Refused/don't know	9

QE3. SHOWCARD Q (R) **Which of these ethnic groups, if any, most accurately describes your own? Just read out the letter that applies.** SINGLE CODE ONLY.

A	White	1
B	Mixed (e.g. white/black, white/Asian)	2
C	Asian / Asian British	3
D	Black / Black British	4
E	Chinese or other ethnic group	5

QE4. SHOWCARD R (R) **What is your marital status? Just read out the letter that applies.** SINGLE CODE ONLY.

A	Married	1
B	Living together	2
C	Single	3
D	Widowed	4
E	Divorced	5
F	Separated	6
	Refused/don't know	7

QE5. **How many cars or light vans are owned or available for use by one or more members of your household? Include company cars or vans if they are available for your private use.** SINGLE CODE ONLY.

1 car or light van	1
2 cars/light vans	2
3+ cars/light vans	3
None	4
Refused/don't know	5

QE6. SHOWCARD S (R) **Which of these, if any, most accurately describes your housing situation? Just read out the letter that applies.** SINGLE CODE ONLY.

A	Being bought on mortgage	1
B	Owned outright by household	2
C	Rented from Local Authority	3
D	Rented from Housing Association/Trust	4
E	Rented from private landlord	5
F	Other	6
	Refused /don't know	7

QE7. SHOWCARD T **Can you please indicate which one of the following letters represents your gross household income per week, month, or year? Just read out the letter that applies.**

	Gross income per week	Gross income per month	Gross income per year	
A	Under £100	Under £400	Under £5,000	1
B	£100-£199	£400-£799	£5,000-£9,999	2
C	£200-£399	£800-£1,599	£10,000-£19,999	3
D	£400-£599	£1,600-£2,399	£20,000-£29,999	4
E	£600-£799	£2,400-£3,199	£31,150-£41,550	5
F	£800-£999	£3,200-£3,999	£41,550-£51,999	6
G	£1,000 or more	£4,000 or more	£52,000 or more	7
	Don’t know/Refused			8

QE8. SHOWCARD U (R) **Here is a list of daily newspapers. Which of these do you read or look at regularly? By regularly I mean on average at least three out of four issues.** MULTICODE OK

A	Daily Express	1
B	Daily Mail	2
C	The Mirror	3
D	Daily Record	4
E	Daily Telegraph	5
F	Financial Times	6
G	The Guardian	7
H	The Herald (Glasgow)	8
I	The Independent	9
J	Metro	10
K	The Scotsman	11
L	Daily Star	12
M	The Sun	13
N	The Times	14
O	Evening Standard	15
	Other	16
	None of these	17

QE9. SHOWCARD V (R) **Last of all, what did you think of this questionnaire?**

Interesting	1
Too long	2
Difficult to understand (WRITE IN WHICH SECTION/QUESTION)	3
Educational	4
Unrealistic/ not credible	5
Other (PLEASE SPECIFY)	6

GO TO DEMOGRAPHICS ON THE FRONT PAGE

SECTION C1 - HEALTH QUESTIONNAIRE

GENERAL HEALTH OVER THE LAST FEW WEEKS

FOR OFFICE USE ONLY
RESPONDENT ID – COPY OVER FROM CONTACT SHEET. USE LEADING ZEROS.
❑❑❑❑

SECTION C1 - HEALTH QUESTIONNAIRE

GENERAL HEALTH OVER THE LAST FEW WEEKS

Please read this carefully:

We would like to know how your health has been in general **over the past few weeks.**

Please answer ALL the questions by ticking the box below the answer which you think most applies to you.

Have you recently…

		Better than usual	Same as usual	Less than usual	Much less than usual
QC1.	…been able to concentrate on whatever you're doing? **(Tick one box)**	❑ (1)	❑ (2)	❑ (3)	❑ (4)
		Not at all	No more than usual	Rather more than usual	Much more than usual
QC2.	…lost much sleep over worry? **(Tick one box)**	❑ (1)	❑ (2)	❑ (3)	❑ (4)
		More So than usual	Same as usual	Less useful than usual	Much less useful
QC3.	…felt you were playing a useful part in things? **(Tick one box)**	❑ (1)	❑ (2)	❑ (3)	❑ (4)
		More so than usual	Same as usual	Less so than usual	Much less capable
QC4.	…felt capable of making decisions about things? **(Tick one box**	❑ (1)	❑ (2)	❑ (3)	❑ (4)
		Not at all	No more than usual	Rather more than usual	Much more than usual
QC5.	…felt constantly under strain? **(Tick one box)**	❑ (1)	❑ (2)	❑ (3)	❑ (4)
		Not at all	No more than usual	Rather more than usual	Much more than usual
QC6.	…felt you couldn't overcome your difficulties? **(Tick one box)**	❑ (1)	❑ (2)	❑ (3)	❑ (4)

Have you recently…

		More so than usual	Same as usual	Less so than usual	Much less than usual
QC7.	…been able to enjoy your normal day-to-day activities? **(Tick one box)**	❑(1)	❑(2)	❑(3)	❑(4)

		More so than usual	Same as usual	Less able than usual	Much less able
QC8.	…been able to face up to your problems? **(Tick one box)**	❑(1)	❑(2)	❑(3)	❑(4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QC9.	…been feeling unhappy and depressed? **(Tick one box)**	❑(1)	❑(2)	❑(3)	❑(4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QC10.	…been losing confidence in yourself? **(Tick one box)**	❑(1)	❑(2)	❑(3)	❑(4)

		Not at all	No more than usual	Rather more than usual	Much more than usual
QC11.	…been thinking of your self as a worthless person? **(Tick one box)**	❑(1)	❑(2)	❑(3)	❑(4)

		More so than usual	About same as usual	Less so than usual	Much less than usual
QC12.	…been feeling reasonably happy, all things considered? **(Tick one box)**	❑(1)	❑(2)	❑(3)	❑(4)

THANK YOU. PLEASE INFORM THE INTERVIEWER THAT YOU HAVE FINISHED.

THIS PAGE HAS BEEN LEFT INTENTIONALLY BLANK

ANNEX 4

FURTHER DETAIL ON RESULTS FROM MAIN SURVEY

A4.1 Overview of questionnaire responses

A4.1.1 The questionnaires

For the main surveys, two questionnaires were used - one for those that had been flooded and one for those at risk of flooding. The questionnaire components of each may be summarised as:

For those that had been flooded:

- questions about the property, household members and nature of flooding and associated damages;
- questions about the health impacts of flooding (including check-lists);
- self-completion health questionnaires (GHQ-12 and PTSS);
- valuation questions; and
- standard socio-demographic questions.

For those at risk of flooding:

- questions about the property, household members and awareness of flooding (i.e. similar questions to above but reflecting that respondents have not been flooded);
- self-completion health questionnaires (GHQ-12 only to provide a comparison with 'flooded' respondents);
- valuation questions; and
- standard socio-demographic questions.

A4.1.2 Summary of responses

In total, 1,510 responses were received from interviews carried out in autumn 2002, consisting of:

- 983 responses to the 'flooded' questionnaire; and
- 527 responses to the 'at risk' questionnaire.

The respondents were drawn from 30 locations across England and Wales, all of which had been subject to flooding since January 1998. The numbers of respondents are shown in Table A4.1 (overleaf).

The 'flooded' questionnaire took an average of 48 minutes to complete, ranging from 19 to 106 minutes. The 'at risk' questionnaire took an average of 23 minutes to complete, ranging from 10 to 65 minutes.

These durations were as expected based on the experience of the interviews undertaken during the developmental phases.

Table A4.1 Summary of responses

Area	Overall		Flooded		At risk	
	Target	*Achieved*	Target	*Achieved*	Target	*Achieved*
Alconbury, Cambs	39	*43*	26	*28*	13	*15*
Banbury, Oxon	56	*57*	37	*27*	19	*30*
Barlby/Selby, N Yorks	72	*72*	48	*48*	24	*24*
Bollington, Cheshire	26	*25*	17	*16*	9	*9*
Congleton, Cheshire	10	*9*	7	*7*	3	*2*
Evesham, Worcs	32	*32*	21	*21*	11	*11*
Five Oak Green, Kent	27	*27*	18	*12*	9	*15*
Gowdall, E Yorks	48	*49*	32	*36*	16	*13*
Hatton, Derbys	60	*58*	40	*39*	20	*19*
Hemingford Grey, Cambs	16	*14*	11	*10*	5	*4*
Kendal, Cumbria	23	*33*	15	*16*	8	*17*
Leamington Spa, Warks	155	*156*	104	*101*	51	*55*
Lewes, E Sussex	239	*239*	161	*159*	78	*80*
London Colney, Herts	18	*16*	12	*10*	6	*6*
Macclesfield, Cheshire	34	*35*	23	*24*	11	*11*
Malton, N Yorks	68	*70*	45	*45*	23	*25*
Melton Mowbray, Leics	41	*41*	27	*18*	14	*23*
Newport Pagnell, Bucks	26	*29*	17	*19*	9	*10*
Newport, Gwent	63	*67*	42	*52*	21	*15*
Ponteland, Northumberland	14	*14*	9	*9*	5	*5*
Rhydymwyn, Flints	32	*34*	21	*29*	11	*5*
Ruthin, Denbighshire	87	*92*	58	*62*	29	*30*
Ryde, IOW	36	*23*	24	*17*	12	*6*
South Church/West Auckland, Co.Durham	75	*77*	50	*53*	25	*24*
Todmorden, Lancs	48	*48*	32	*35*	16	*13*
Waltham Abbey, Essex	52	*48*	35	*30*	17	*18*
Weybridge, Surrey	27	*25*	18	*6*	9	*19*
Woking, Surrey	15	*16*	10	*10*	5	*6*
Worcester, Worcs	22	*22*	15	*15*	7	*7*
York, N Yorks	39	*39*	25	*29*	14	*10*
Total	1500	*1510*	1000	*983*	500	*527*

A4.2 Characteristics of respondents

A4.2.1 Gender and age

The distribution of respondents by gender is shown in Table A4.2. As can be seen, about 60% of both flooded and at risk respondents were female. This compares with the Census 2001 figure[1] of 52% of adults (18 and over) being female in England and Wales.

The imbalance was particularly marked in 12 of the 30 areas where a third or less of those interviewed were men. This may be the result of interviewers working on weekdays, mornings and afternoons rather than at weekends and evenings when more men may be at home to be interviewed. It is unlikely to reflect a true difference in the flooded or at risk populations from the country at large.

Table A4.2 Distribution of respondents by gender

Gender	Flooded respondents	At risk respondents	All respondents
Male	381 (39%)	225 (43%)	606 (40%)
Female	602 (61%)	302 (57%)	904 (60%)
All	983	527	1510

The distribution of respondents by age is shown in Table A4.3 below. As can be seen, flooded respondents tended to be slightly older with about 28% being 65 or over compared to 18% for the at risk respondents. The mean ages of 54.5 and 45.4 for flooded and at risk respondents may be compared with the Census 2001 figure of 47.5 for adults (18 and over) in England and Wales.

Table A4.3 Distribution of respondents by age

Age	Flooded respondents[1]	At risk respondents[2]	All respondents[3]
18-39	201 (20%)	233 (45%)	434 (29%)
40-64	504 (51%)	191 (37%)	695 (46%)
65-74	129 (13%)	53 (10%)	182 (12%)
75+	148 (15%)	40 (8%)	188 (13%)
N respondents	982	517	1499
Mean Age	54.5	45.4	51.4

Notes: [1] One flooded respondent did not provide an indication of age
[2] Ten at risk respondents did not provide an indication of age
[3] There were no significant variations in the age distributions by gender

[1] Census data are available from www.statistics.gov.uk.

A4.2.2 Prior health

The state of health of the respondent prior to flooding has been shown to be associated with the subjective severity of the health effects of flooding, although the subjective rating of the stress of the flood event itself has been found to be a more important factor (Green *et al.* 1994). The flooded survey included a measure of the respondents' prior health. Respondents were also asked whether they or any member of their household prior to the flooding had any long-term illness, health problems or disability which limited daily activities or the work they could do (including problems which were associated with old age). The results are summarised in Table A4.4.

Table A4.4 Prior health status and long-term illness (flooded respondents only)

Prior health	Men %	Women %	All %
Poor	4	5	4
Fair	9	10	10
Good	33	35	34
Very good	27	32	30
Excellent	27	19	22
Long term illness etc.			
Respondent	15	17	16
Others in household	13	13	13
Any in household	22	25	24
N respondents	381	601	982

Prior health and incidence of long-term illness varied significantly with age as shown in Table A4.5.

Table A4.5 Prior health and long-term illness by age (flooded respondents only)

Age of respondent	18-39 %	40-49 %	50-59 %	60-64 %	65-74 %	75+ %	All %
Prior health							
Poor	1	3	5	4	7	6	4
Fair	4	7	7	7	15	24	10
Good	29	28	34	36	40	43	34
Very good	35	32	30	33	26	21	30
Excellent	32	29	24	20	12	7	22*
Long term illness etc.							
Respondent	5	11	15	22	23	32	16**
Others in h/h	10	11	12	19	19	13	13
Any in h/h	14	18	22	32	33	37	24***
N respondents	201	211	205	88	129	148	982

Notes: * Chi-square = 102.8; df = 20; $p<0.001$;
** Chi-square =56.54; df = 5; $p<0.001$; and
*** Chi-square =37.98; df = 5; $p<0.001$.

There was also a significant relationship between social class and prior health and long term illness as shown in Table A4.6 with a striking difference in the proportions of the semi-skilled and unskilled group (DE) experiencing poor health and long term illness prior to the flooding compared with other groups.

Table A4.6 Prior health and illness by social grade

	Social grade of chief income earner			
Prior health	AB %	C1 %	C2 %	DE %
Poor	2	3	3	8
Fair	8	7	8	15
Good	30	33	28	41
Very good	35	31	35	22
Excellent	25	26	26	13*
Long term illness etc.				
Respondent	11	14	11	28**
Others in h/h	10	11	11	20***
Any in h/h	18	21	18	38****
N respondents	204	263	226	273

Notes: * Chi-square = 56.82: df = 12; p<0.001;
** Chi-square =36.67; df = 3; p<0.001;
*** Chi-square = 15.89; df = 3; p<0.01; and
**** Chi-square = 39.64; df=3; p<0.001

A4.2.3 Nature of household

The distribution of respondents by nature of household is shown in Table A4.7. The distributions are very similar for flooded and at risk respondents with about 44% of households comprising two or more adults with no children and about 26% of households having single occupancy.

Table A4.7 Distribution of respondents by nature of household

Nature of Household	Flooded respondents	At risk respondents	All respondents
One parent families	45 (5%)	37 (7%)	82 (5%)
Single adult	274 (28%)	122 (23%)	396 (26%)
Two or more adults with no children	438 (45%)	224 (43%)	662 (44%)
Two or more adults with child(ren)	226 (23%)	144 (27%)	370 (25%)
N respondents	983	527	1510

Although the nature of the household was similar for both sets of respondents, the at risk households tended to have younger children and fewer senior citizens (as would be expected given the age distribution discussed above). This is further illustrated in Table A4.8.

Table A4.8 Composition of households

Household containing:	Flooded respondents	At risk respondents	All respondents
Children aged 9 and under	158 (16%)	130 (25%)	288 (19%)
Children aged 10 to 17	168 (17%)	83 (16%)	251 (17%)
Adults aged 18 to 64	736 (75%)	453 (86%)	1189 (79%)
Adults aged 65 to 74	173 (18%)	62 (12%)	235 (16%)
Adults aged 75 and over	163 (17%)	44 (8%)	207 (14%)
Total no. of households	983	527	1510

A4.2.4 Social grade and education

The distribution of respondents by social grade and educational level are shown in Table A4.9 and A4.10 respectively. In both cases, the distributions of both flooded and at risk respondents are very similar.

Table A4.9 Distribution of respondents by social grade

Social grade	Flooded respondents	At risk respondents	All respondents
AB - professional and managerial	204 (21%)	96 (18%)	300 (20%)
C1 - clerical and other white collar	263 (27%)	157 (30%)	420 (28%)
C2 - skilled manual	226 (23%)	113 (21%)	339 (22%)
DE - semi skilled/ unskilled manual	273 (28%)	155 (29%)	428 (28%)
Not known	17 (2%)	6 (1%)	23 (2%)
N respondents	983	527	1510

Table A4.10 Distribution of respondents by education

Highest education level	Flooded respondents	At risk respondents	All respondents
No formal qualifications	295 (30%)	140 (27%)	435 (29%)
GCSE/O Level/CSE	151 (15%)	77 (15%)	228 (15%)
Vocational qualifications (NVQ1/2)	87 (9%)	50 (10%)	137 (9%)
A Level or equivalent (NVQ3)	121 (12%)	77 (15%)	198 (13%)
First degree or equivalent (NVQ4)	149 (15%)	102 (19%)	251 (17%)
Postgraduate qualification	56 (6%)	24 (5%)	80 (5%)
Other	109 (11%)	44 (8%)	153 (10%)
Still studying/don't know/no answer	15 (1.5%)	13 (2.5%)	28 (2%)
N respondents	983	527	1510

A4.2.5 House type and ownership

The distributions of both flooded and at risk respondents are very similar (see Table A4.11) with about 50% of respondents living in terraced houses and about 25% in semi-detached houses. Note that the order of house types represents an indicative measure of vulnerability to flooding (mobile homes and basement/ground floor flats are much more vulnerable to flooding than detached or semi-detached houses).

Table A4.11 Distribution of respondents by house type

House type	Flooded respondents	At risk respondents	All respondents
1. Detached	139 (14%)	59 (11%)	198 (13%)
2. Semi-detached	238 (24%)	129 (25%)	367 (24%)
3. Terraced	503 (51%)	245 (46%)	748 (49%)
4. Ground floor maisonette	9 (0.9%)	4 (0.8%)	13 (0.9%)
5. Bungalow	51 (5%)	20 (4%)	71 (5%)
6. Ground floor flat	21 (2%)	28 (5%)	49 (3%)
7. Basement flat	2 (0.2%)	3 (0.6%)	5 (0.3%)
8. Mobile home	0 (0%)	10 (2%)	10 (0.7%)
9. Other/Not known	20 (2%)	29 (5%)	49 (3%)
N respondents	983	527	1510

It is worth noting that few respondents lived in accommodation lacking an upstairs floor to offer a retreat in time of flood: 74 (8%) of the flooded respondents and 61 (12%) of those at risk.

Almost all the flooded households were owner occupiers (88%) and, since many were older people, a high proportion owned their homes outright (see Table A4.12). There were markedly more tenants, particularly private tenants, among those at risk. It is possible that these were people renting properties which their owners no longer wished to live in because they had been flooded.

Table A4.12 Number and percentage of respondents by tenure

Tenure and property	Flooded respondents		At risk respondents	
	No.	%	No.	%
Own outright	448	46	138	26
Own on mortgage	416	42	216	41
LA tenant	66	7	45	9
Housing Association tenant	14	1	19	4
Private landlord	30	3	98	19
Other/refused/don't know	9	1	11	1
N respondents	983		527	

A4.2.6 Income, employment and car ownership

Household income (Table A4.13) and car ownership (Table A4.14) were similar in the two samples. More of the flooded respondents than those at risk were retired (Table A4.15) reflecting the older ages of the flood victims. Very few respondents in either sample were unemployed so it was not possible to take unemployment as a factor into account in the analysis.

Table A4.13 Distribution of respondents by household income

Household income	Flooded		At risk	
	No.	%	No.	%
Under £100	52	5	49	9
£100-199	151	15	51	10
£200-399	177	18	111	21
£400-599	165	17	92	17
£600-799	103	10	55	10
£600-£999	43	4	24	5
£1,000 or more	63	6	39	7
Don't know/refused	224	23	102	19
No answer	5	1	4	1
Total	983	100	527	100

Table A4.14 Car ownership

Vehicles owned	Flooded respondents		At risk respondents	
	No.	%	No.	%
3 (or more) cars/vans	60	6	24	5
2 cars/vans	246	25	123	23
1 car/van	445	45	268	51
None	229	23	111	21
Refused/don't know/no answer	3	0.3	1	0.2
Total	983	100	527	100

Table A4.15 Percentage of respondents by employment status

Employment status	% Flooded	% At risk
Working full-time (30 hrs plus pw)	38	44
Working part-time	16	13
Housewife	8	12
Retired	31	20
Unemployed	1	3
Student	1	2
Disabled	4	5
Don't know/refused	1	1
N respondents	983	527

A4.2.7 Time in residence

The distribution of respondents by residence time is shown in Table A4.16. There are major differences between flooded and at risk respondents - with the mean residence time for the flooded respondents being twice as long as for the at risk respondents (which is also reflected in the differing age distributions). Over 60% of flooded respondents had been resident in their house for over ten years whilst the corresponding figure for at risk respondents was less than 30%.

Table A4.16 Distribution of respondents by time of residence

Time of Residence	Flooded	At risk	All respondents
<2 years	10 (1%)	222 (42%)	232 (15%)
2 - 5 years	132 (13%)	94 (18%)	226 (15%)
5 - 10 years	220 (22%)	56 (11%)	276 (18%)
10 - 20 years	279 (28%)	80 (15%)	359 (24%)
>20 years	342 (35%)	75 (14%)	417 (28%)
Mean	17.7 years	8.4 years	14.4 years
N respondents	983	527	1510

By contrast over 40% of the at risk respondents had been resident for less than two years whilst the corresponding figure for flooded respondents was 1%. Of course, such differences are explained, in part at least, by the requirements of the flooded questionnaire. For most areas, the floods of concern occurred in Easter 1998 or autumn 2000, at least two years before the interviews (autumn 2002).

As already indicated, it was noticeable that the flooded respondents tended to be also older. This may reflect the age of the housing in the flooded areas with younger people moving into more recently built housing constructed where the risk was lower. It may also reflect younger people moving into (and perhaps renting) properties that were flooded in the recent events after those events.

There may, however, be other explanatory factors such as the perceived benefits of living close to a river which tend to lead to longer residence times.

A4.2.8 Location and house price

The respondents are drawn from 30 locations across England and Wales. It was considered that it may be necessary to include a factor which may reflect, in part, variations from one location to another. As a surrogate for a set of locational characteristics, local house prices were used.

Typical house prices (for 2001) for individual wards are readily available from National Statistics Online (www.neighbourhood.statistics.gov.uk) by entering a postcode. For each of the 30 locations, typical house prices for both terraced and semi-detached houses were obtained by entering a range of sample postcodes (from the address lists supplied to MORI). For some locations, all the addresses were within a single ward, whilst, in others, the location under study covered several wards. The prices were then compared to the national averages and assigned a simple rating value on a scale 1 to 5

(1 equates to areas where house prices are more than 1.4 times the national average whilst a 5 equates to areas where house prices are up to 60% of the national average).

The results are summarised in Table A4.17.

Table A4.17 Derivation of house price rating

Location	House price (£k)		Relative house price[1]			House price rating[2]
	Terrace	Semi-d'ched	Terrace	Semi-d'ched	Mean	
Alconbury, Cambs	123.0	101.0	1.37	0.99	1.18	2
Banbury, Oxon	87.6	103.8	0.98	1.02	1.00	3
Barlby/Selby, N Yorks	48.2	61.3	0.54	0.60	0.57	5
Bollington, Cheshire	82.1	97.3	0.92	0.96	0.94	3
Congleton, Cheshire	68.2	82.3	0.76	0.81	0.79	4
Evesham, Worcs	79.6	97.4	0.89	0.96	0.92	3
Five Oak Green, Kent	115.3	133.8	1.29	1.32	1.30	2
Gowdall, E Yorks	45.3	53.8	0.51	0.53	0.52	5
Hatton, Derbys	55.3	57.9	0.62	0.57	0.59	5
Hemingford Grey, Cambs	107.5	153.3	1.20	1.51	1.35	2
Kendal, Cumbria	64.9	79.2	0.73	0.78	0.75	4
Leamington Spa, Warks	123.0	127.7	1.37	1.26	1.32	2
Lewes, E Sussex	149.1	147.8	1.67	1.45	1.56	1
London Colney, Herts	135.6	170.2	1.52	1.67	1.59	1
Macclesfield, Cheshire	72.9	99.3	0.81	0.98	0.90	4
Malton, N Yorks	64.2	80.9	0.72	0.80	0.76	4
Melton Mowbray, Leics	55.5	67.3	0.62	0.66	0.64	4
Newport Pagnell, Bucks	87.5	100.6	0.98	0.99	0.98	3
Newport, Gwent	41.5	54.6	0.46	0.54	0.50	5
Ponteland, N'thumberland	143.6	130.3	1.60	1.28	1.44	1
Rhydymwyn, Flints	87.2	99.1	0.97	0.97	0.97	3
Ruthin, Denbighshire	44.3	65.7	0.49	0.65	0.57	5
Ryde, IOW	70.9	84.3	0.79	0.83	0.81	4
South Church/West Auckland, Co. Durham	33.8	53.1	0.38	0.52	0.45	5
Todmorden, Lancs	35.7	67.2	0.40	0.66	0.53	5
Waltham Abbey, Essex	114.6	147.4	1.28	1.45	1.37	2
Weybridge, Surrey	163.3	159.1	1.82	1.56	1.69	1
Woking, Surrey	139.9	167.5	1.56	1.65	1.61	1
Worcester, Worcs	83.7	100.9	0.93	0.99	0.96	3
York, N Yorks	86.8	89.6	0.97	0.88	0.93	3

Notes: [1] The average price of a terraced house in England and Wales was £89,500 in 2001, whilst that of a semi-detached house was £101,700.

[2] Rating Scale as follows: Relative house price >1.40, 1.01-1.40, 0.91-1.00, 0.61-0.90, <0.61 rated 1, 2, 3, 4 and 5 respectively.

A4.3 Awareness and worry over flooding

A4.3.1 Flood risk awareness

Of the 983 flooded respondents, 238 (24%) reported that they were aware of the flood risk in the area before the flooding. For those at risk, the awareness of being within a flood risk area was found to be much higher at 86% (454 of the 527 respondents). It is likely that this increased awareness is the result not only of flooding events in the area but also of the Environment Agency campaigns to raise awareness. There was significant variation by area with some areas scoring 100% awareness as shown in Table A4.18.

Table A4.18 Awareness of flood risk by area (amongst at risk respondents)

Criteria	Areas meeting criteria
100% awareness in areas with >5 respondents	Barlby/Selby, London Colney, Ryde, Todmorden
<50% awareness in areas with >5 respondents	Newport, Banbury, Macclesfield, York

This variation by area may reflect other variables such as length of residence and tenure and these (and other) variables were examined in more detail for the flooded respondents. Those who owned their property outright were more likely to be aware than those still buying their property and they, in turn, were more likely to have prior knowledge of the flood risk than those renting property or in other forms of tenure. Awareness also differed according to length of residence. Long term (30 years or more) and short term (less than five years) residents were most likely to have prior knowledge. Awareness did not differ significantly according to gender, age or social class or the type of property occupied.

A4.3.2 Worry about future flooding

Both flooded and at risk respondents were asked how worried they were about the possibility of being flooded during the next twelve months. The results are shown in Table A4.19.

Table A4.19 Degree of worry of flooding within next 12 months

Degree of worry	Worry 'score'	Flooded	At risk
Not worried at all	1	97 (10%)	107 (20%)
Not very worried	2	180 (18%)	160 (30%)
Indifferent	3	56 (6%)	39 (7%)
Somewhat worried	4	384 (39%)	172 (33%)
Very worried	5	261 (27%)	49 (9%)
Mean score		3.5	2.8
N respondents		978	527

As can be seen, people who have been flooded worry more than those who have not been flooded. 66% of flooded respondents were either somewhat or very worried compared to the corresponding figure of 42% for at risk respondents.

As would be expected, the degree of worry does vary by area as illustrated in Table A4.20.

Table A4.20 Degree of worry by area

Criteria	Areas meeting criteria amongst 978 flooded respondents	Areas meeting criteria amongst 527 at risk respondents
Areas with >5 respondents reporting greatest worry (mean score for area in brackets)	Waltham Abbey (4.5) York (4.5) London Colney (4.3) Newport (4.1) Ponteland (4.0)	Waltham Abbey (3.4) Woking (3.3) York (3.3) Melton Mowbray (3.3) Todmorden (3.2)
Areas with >5 respondents reporting least worry (mean score for area in brackets)	Gowdall (2.9) Hemingford Grey (2.9) Newport Pagnell (2.9) Congleton (2.7) Evesham (2.6)	Worcester (2.3) Kendal (2.2) Bollington (2.2) Weybridge (2.0) Evesham (1.9)

There is some consistency between the flooded and at risk respondents. Clearly, the residents of Waltham Abbey and the Rawcliffe area of York are very worried about the prospect of further flooding. Such worries may be fuelled by local issues. By way of example, concern was expressed in York about the potential impact of surface water runoff from a major new commercial development and associated park and ride scheme. By contrast, in some areas where works have been undertaken since the last major flooding event, there is very little worry as demonstrated by the scores for Gowdall, Newport Pagnell, Congleton and Evesham.

In addition, respondents were asked which flood characteristic concerned them most as shown in Table A4.21.

Table A4.21 Flood characteristic of most concern amongst respondents

Flood characteristic	Flooded	At risk
Speed of water rising/flowing	224 (23%)	117 (22%)
Dirtiness of water	218 (22%)	115 (22%)
Depth of water	166 (17%)	94 (18%)
Warning time	105 (11%)	63 (12%)
Time of day/night when it occurs	92 (9%)	50 (9%)
Duration of flood	59 (6%)	42 (8%)
Season of year when it occurs	55 (6%)	16 (3%)
Other	27 (3%)	8 (2%)
Not worried about any specific flood characteristic	33 (3%)	22 (4%)
N respondents	979	527

The results show a surprising degree of consistency between those that are at risk of flooding and those that have been flooded. Those characteristics causing the greatest concern were found to be speed of onset, dirtiness of water, depth and warning time.

Most respondents had taken one or more flood prevention measures as illustrated in Table A4.22.

Table A4.22 Flood protection measures taken by respondents

Measure	Flooded	At risk
Take out household insurance against flooding	585 (60%)	234 (44%)
Keep alert for flood warnings during high-risk months	603 (51%)	251 (48%)
Avoid keeping irreplaceable items or goods of sentimental value on ground floor of my home at all or certain times	352 (36%)	94 (18%)
Keep sand and bags in the property	250 (25%)	81 (15%)
Keep ditches and drains around the property clean	219 (22%)	111 (21%)
Avoid buying expensive downstairs furnishings	117 (12%)	42 (8%)
Other (particularly provision of flood guards and boards across doors, etc.)	98 (10%)	19 (4%)
Built walls around the property	42 (4%)	13 (2%)
Purchased water pumps	45 (5%)	8 (2%)
Did not take preventative actions/None of these	90 (9%)	144 (27%)

It is interesting to note that measures taken by those that have been flooded are very similar to those for the at risk respondents - except that the degree of 'take up' is significantly higher amongst those that have been flooded.

Of the 78 flooded respondents who had built walls and/or purchased water pumps, 62 provided cost estimates and for these respondents, the average expenditure was about £1,750.

Of the 19 at risk respondents who had built walls and/or purchased water pumps, 13 provided cost estimates and for these respondents, the average expenditure was about £2,050.

A4.4 Flood characteristics

A4.4.1 Overview

A flood event at a given location is usually unique in its combination of flood characteristics. Many of the 30 locations surveyed were represented by a small number (under 30) of respondents. This must be borne in mind when these data are considered.

In most of the interview areas, there was a reasonable consensus on the date of the worst or only flood that had occurred. Where different dates were offered for the worst flood, in some instances this was because respondents had experienced more than one flood and differed on which was the worst for them. In others, respondents differed by a month only in the dating of the flood. However, there may have been some instances in which respondents misremembered the month and/or the year of the flooding or interviewers, coders or data processors mis-recorded it. Although efforts had been made to brief interviewers on the likely timing of the major flood events (see Annex 2), these were not entirely effective.

Nevertheless, flooding for those that have been flooded is usually a salient event, details of which are easily recalled, but the actual date of the flooding may not be as memorable.

A4.4.2 Timing and frequency of flooding

Most of the 30 locations had been flooded just once since January 1998. As would be expected, many locations were flooded in either Easter 1998 or autumn 2000. A summary of frequency of flooding experienced by respondents is presented in Table A4.23.

Table A4.23 Number of flood events experienced

Number of floods experienced	Since living at this address		Since January 1998	
	No	%	No	%
One flood	786	80	848	86
Two	128	13	104	11
Three	21	2	14	1
Four	19	2	5	<1
Five	12	1	7	1
Six or more	16	2	5	<1
Total	982	100	983	100

An overview of the timing and frequency of flooding in each of the 30 locations is presented in Table A4.24.

Table A4.24 Timing and frequency of flooding by location

Description	Applicable Areas (N respondents)
Respondents flooded in Easter 1998 only	Alconbury (28), Banbury (27), Evesham[1] (21), Hemingford Grey (10), Leamington Spa[2] (101), Melton Mowbray (18), Newport Pagnell (19)
Respondents flooded in autumn 2000 only	Barlby/Selby (48), Gowdall (36), Hatton (39), Lewes[3] (159), London Colney (10), Newport (52), Ponteland (9), Rhydymwyn (29), Waltham Abbey (30), Weybridge (6), Woking (10), York (29)
Respondents flooded just once at other times	Bollington (16) - Oct 98, Congleton (16) - various, Kendal (16) - Jan 99, South Church/West Auckland (53) - June 2000
>10% respondents flooded twice	Macclesfield[4] (24) - summer 98, Malton (45) - March 99 and autumn 2000 (worst), Ryde (17) - Dec 99 (worst) and autumn 2000, Worcester (15) - various reports but worst: autumn 2000
>10% respondents flooded three times or more	Five Oak Green (12) - worst: Dec 99, Ruthin (62) - worst: autumn 2000, Todmorden (35) - worst: June 2000

Notes: [1] Four respondents in Evesham reported being only flooded in April 2000.
[2] Two respondents in Leamington Spa reported being flooded twice.
[3] One respondent in Lewes reported being flooded ten times, one five times and one twice.
[4] Most respondents (21) had been flooded twice during the summer of 1998, one reported being flooded 5 times and another 3 times.

A4.4.3 Flood warning

Of the 983 flooded respondents, only 229 (23%) received a flood warning. 717 respondents (73%) did not receive a warning and the remaining 37 did not know (or did not respond). A possible reason for those that did not know was that they were not at home at the time.

Of the 229 who did receive a flood warning, 204 were able to provide an estimate of the warning time. The mean warning time (for those that did receive a warning and were able to provide an estimate of the warning time) was 16 hours.

Whether or not a warning was received was, as would be expected, area specific. In ten areas, none of the flooded respondents received a warning. These areas included those with over 20 flooded respondents - Banbury (27), Macclesfield (24), Waltham Abbey (30) and York (20). In five areas, over 50% of respondents received a warning - Gowdall (78% of 36), Hemingford Grey (70% of 10), Ryde (53% of 17), Weybridge (83% of 6) and Worcester (93% of 15).

There is some indication that more flood warnings are being received now than before as illustrated for data from the years 1998, 1999 and 2000 shown in Table A4.25.

Table A4.25 Flood warnings received by year of flood event

Flood warning received?	1998	1999	2000
Yes	10%	29%	28%
No	88%	62%	68%
Don't know/no answer	2%	9%	4%
N respondents	252	55	655

The Environment Agency is a major source of flood warnings accounting for about 40% of flood warnings received by the respondents.

A4.4.4 Speed of onset of flooding

627 (64%) flooded respondents reported that the floodwaters rose so quickly that you could see them rising. This and other observations are summarised in Table A4.26.

Table A4.26 Speed of onset of flooding

Speed of onset	No (%) of respondents
So quickly that you could see them rising	627 (64%)
Slowly over many hours	156 (16%)
Somewhere in between the above	97 (10%)
Don't know/no answer	103 (10%)

A4.4.5 Flood warning and speed of onset

Whether or not respondents received a warning varied significantly according to the perceived speed of onset of the flooding. The length of warning lead time also varied significantly with this variable suggesting that it is harder to provide long flood warning lead times for rapid flood events as illustrated in Table A4.27.

Table A4.27 Receipt of flood warning according to speed of onset of flooding

Receipt of warning	Waters rose quickly	Speed of onset in between	Waters rose slowly	All
% warned	17	37	51	23*
Lead time: those in receipt of a warning and aware of the warning lead time (%)				
Under 2 hours	34	16	5	21
2 hours < 4 hours	25	19	8	18
4 hours < 8 hours	19	29	22	22
8 hours or more	21	36	66	39
N respondents	91	31	65	187**

Notes: * Chi-square =81.80; df = 2; p<0.001
** Chi-square = 43.58; df = 6; p<0.001

A4.4.6 Flood depth

Flooded respondents were asked to provide estimates of the maximum flood depth in various rooms within the house, within the cellar and in the garage.

Some difficulties were experienced in recording and coding these data. As an extreme example, 18 ins was entered on the questionnaire as 1.6 ft which was coded as 1ft =12 ins + 60 ins = 72 ins x 2.54 = 183cm! All extreme flood depths (about 30 in number) together with a further 10% random sample were checked against the paper questionnaires. Although many of the extreme results were found to be in error (and were corrected), the vast majority of the random sample were found to be correct.

For the purpose of the analysis which follows, attention is focused on two depth variables:

- maximum flood depth within one or more of the living room(s), bedrooms, kitchen and bathroom(s); and
- depth in cellar.

It should be noted that where data were provided for the living room and/or kitchen and no data were provided for the bedrooms and/or bathrooms, it was assumed that the flooding depth would be no greater than in the living room/kitchen.

980 flooded respondents reported flood depths within one (or more) of the main rooms within the house with depths ranging from zero (86 respondents) to over 5m. The mean and median values were 55 cm (1ft 9 ins) and 46cm (18 ins) respectively.

144 respondents reported flood depths for the cellar with values ranging from zero (one respondent) to over 4m. Both the mean and median values were about 160 cm (about 5 ft). It is worth noting that cellars tended to be concentrated in a few locations - most noticeably in Todmorden where nearly 90% of the respondents had flooded cellars. Other locations with a significant proportion of flooded cellars were Bollington, Leamington Spa, Lewes and Melton Mowbray.

An indication of flood depths is provided in Table A4.28.

Table A4.28 Depth of flooding

Room(s) flooded	No flooding	< 25cm	25-99 cm	>100 cm
Main room[1]	86 (9%)	277 (28%)	461 (47%)	156 (16%)
Cellar	1 (1%)	11 (8%)	23 (16%)	109 (76%)

Notes: [1] Main room taken as one or more of living room(s), bedrooms, kitchen and bathroom(s)

The most commonly affected parts of the dwelling were the living room (87%) and the kitchen (86%) followed by halls and landings (61%). A minority of the respondents (11%) had floodwaters in all the main types of rooms in their home: kitchen, living room, bedroom and bathroom. Not surprisingly more than half of these (55%) were residents in ground floor only properties. It was most common for respondents to have two out of the four types of main room affected. The more parts of the home affected the greater the depth of flooding as illustrated in Table A4.29.

Table A4.29 Flooding of main parts[1] and associated depths

Flooding in:	N respondents	% flooded	Mean depth (cms)	Median depth (cms)
4 main parts	104	11	83	61
3 main parts	162	17	66	46
2 main parts	554	56	58	46
1 main parts	82	8	41	23
No main rooms	81	8	0	0

Notes: [1] 4 main parts are living room, bedroom, kitchen and bathroom.

A4.4.7 Numbers of rooms flooded

The number of rooms flooded will reflect not only the extent of the flooding in the home but also the size of the property and thence most probably the income and social class of the respondents. The total number of rooms including basements and hallways but excluding garages reported as flooded ranged from 0 (13 respondents had their integral garage flooded) to 13 rooms. The average number of rooms flooded was 3.4 and the median was 3. The distribution of responses is shown in Table A4.30.

Table A4.30 Total number of rooms flooded

Number of rooms	Number	%
None	13	1
1 room	91	10
2 rooms	152	16
3 rooms	287	30
4 rooms	238	25
5 rooms	88	9
6 or more rooms	89	9
N respondents	958	100

A4.4.8 Contamination

Flooded respondents were asked whether the floodwater contained sewage or other pollution. The results are summarised in Table A4.31.

Table A4.31 Contaminated floodwater

Did floodwater contain sewage or other pollution?	No (%) of respondents
Yes	755 (77%)
No	152 (15%)
Don't know/no answer	76 (8%)

A4.4.9 Flood duration

Of the 983 flooded respondents, 934 were able to provide an estimate of the flood duration. The mean flood duration (for those that were able to provide an estimate) was 50 hours with a median of 24 hours.

The areas with the longest mean flood durations were Gowdall and Worcester (both over 12 days), Hemingford Grey (9 days) and Malton (7 days).

By contrast, eight areas had mean flood durations of about 12 hours or less. Those with the shortest mean flood duration were Bollington (6 hours), Waltham Abbey (7 hours), Newport (9 hours) and Ponteland (10 hours).

Apart from Hemingford Grey and Bollington, these locations all suffered their worst floods in autumn 2000. Clearly, the nature and location of major flood events (such as autumn 2000) affects the distribution of flood duration against other factors. By way of example, there were significant variations in the duration of the flooding according to the time since the worst flood as illustrated in Table A4.32

Table A4.32 Duration of worst flood by time of worst flood and main event

Time since flood	Up to 2.5yrs	2.5 - 3yrs	3 - 4yrs	4 - 5 yrs	All
Main flood event	Autumn 2000	June 2000	Dec 99	Easter 98	
Mean duration	67 hrs	20 hrs	37 hrs	27 hrs	51 hrs
Median duration	29 hrs	12 hrs	24 hrs	12 hrs	24 hrs
N respondents	546	86	54	237	923

Notes: Chi-square = 86.73; df = 18; $p<0.001$

A4.4.10 Time to get home back to normal

977 flooded respondents reported on the time taken to get back to normal. This figure included 25 respondents who reported that they had still to get back to normal (for the purpose of the further analysis, it was assumed that this period was 52, 104, 156, etc. weeks for those flooded in 2002, 2001, 2000, etc.). The mean and median values were found to be 31 and 26 weeks respectively.

In most cases of flooding, members of the household are forced to move out, sometimes for many weeks. 634 respondents (64% of the total) reported that this had occurred following their worst flood. The proportion evacuating was high compared with the proportions found in other flood surveys. For example, in the FHRC survey data set reported in the Full Flood Impacts Study (Green *et al.* 1994), only 28% reported that someone had left home at some point. In that study, whether or not someone evacuated was found to be a function of the depth of flooding in the house, the time of year at which the water entered the property (homes in winter being less habitable because of the cold and absence of heating in flood conditions), the degree to which telephone services were lost; and the susceptibility of individuals in the household (for example, the elderly and very young). In this survey, there was a significant but moderately weak correlation between maximum depth of flooding in the main rooms and someone leaving home (Pearson Correlation 0.26). The presence of someone in the household with a long term illness or disability was not associated with evacuation but households consisting of older people aged 65 and over only, and more particularly, those aged 65 and over living alone were more likely to evacuate than other households.

The mean time taken for all members of the household to be back in the property was found to be 23 weeks. Further detail is provided in Table A4.33. As might be expected, the duration of the evacuations was moderately but significantly correlated with the maximum depth of flooding in the main rooms (Pearson Correlation 0.32). The extent of flooding within the dwelling was also a factor (Pearson Correlation: extent of main parts of dwelling flooded 0.36; total number of rooms flooded 0.25). Other factors that might further explain evacuations and their length such as the amount of structural and contents damage and the vulnerability of the households have not been explored further.

Table A4.33 Time for members of household to return

Time Period	N (%) respondents	% ALL respondents
More than a few days	634 (100%)	64%
Two weeks or more	586 (92%)	60%
Six weeks or more	510 (80%)	52%
Six months or more	282 (44%)	29%
One year or more	44 (7%)	4%

A4.4.11 Support available from family and community

It has been argued that social support potentially offers a way of mobilising additional resources to meet the challenge posed by a flood. Thus, it follows that where social support is mobilised the effects of the flood including the health effects might be mitigated. Yet, previous studies of the impact of flooding have not shown any effects upon the specific subjective severity ratings of a flood or the overall rating of its effects upon households when the characteristics of the flood and the magnitude of its impacts were taken into account (Green *et al.* 1994).

In the survey of flooded households, respondents were asked whether they received any help during or after a flood episode from ten different sources. Those who received help were asked to rate the level of help they received on a scale: 1, received very little help to 5, received all the help I needed. Not surprisingly, neighbours, friends and family outside the household were the most common sources of help for the flood victims. They were also rated the most highly in terms of the amount of help received. Local authorities and emergency services were the next most common source of help but they received rather lower ratings for what they offered than the informal sources of help. Other sources were drawn upon by small minorities of the flooded as shown in Table A4.34.

Table A4.34 Help received from different sources during and/or after a flood episode

Source of help	% helped	% respondents rating help received as:					Mean rating	N rating
		1 Very little	2	3	4	5 All needed		
Neighbours/ friends	67%	4	5	13	15	62	4.3	655
Family outside h/h	60%	1	3	6	13	77	4.6	588
Local Authority	35%	21	16	24	15	24	3.0	81
Fire Brigade	33%	12	8	17	37	52	3.8	318
Police	20%	12	10	18	15	45	3.7	197
Church	12%	7	17	31	16	28	3.1	116
Environment Agency	11%	30	20	21	10	18	2.7	109
Charities	10%	12	14	19	28	27	3.4	93
Community groups	8%	9	5	38	19	30	3.6	80
Local Businesses	6%	15	21	27	15	23	3.1	62
N respondents	983							

The level of support in relation to need was summarised in a social support scale by adding together the rating of help from each of the ten sources with those receiving no help from a source as zero. This is to assume that those receiving no help, had a need of help from the source, which may not be the case. It also assumes that help from each source is of equal importance as each is given the same numerical rating. The social support scale could and did range from 0 to 50. Overall, the mean help rating was 10.2. Vulnerable households might be expected to attract more support from neighbours, families and local services and this help might serve to mitigate the effects of the flooding on those most at risk. Among the minorities, respondents in households consisting only of people aged 65 and over, those living alone, including respondents aged 65 and over living alone, did not receive significantly more social support as measured by the scale than those in seemingly less vulnerable households. Households containing a person with long term disability or illness and those whose prior health was only fair or poor had higher scores for social support but the differences between these minorities and other households were not statistically significant.

Although qualitative research has indicted that owner occupiers and tenants sometimes feel that they are treated differently by local authorities and others, in this study owner occupiers were similar in the support they received from all sources and from local authorities compared with those in rented and other forms of accommodation.

Women reported receiving significantly more help than men. Households containing children, and more particularly households containing young children, also attracted more support than other households. These findings are summarised in Table A4.35.

Table A4.35 Mean social support rating according to respondent characteristics

	Those with characteristic: Mean help rating		Those without: Mean help rating	
Men	Yes	9.2	No	10.9 **
65+ only in household (h/h)	Yes	10.0	No	10.3
Living alone all ages	Yes	9.9	No	10.3
Living alone aged 65+	Yes	9.8	No	10.3
Long term illness in h/h	Yes	10.9	No	10.0
Prior health: Fair or poor	Yes	10.5	No	10.0
Children any age in h/h	Yes	11.0	No	9.7 *
Children aged 9 and under in h/h	Yes	11.3	No	10.0 *
Owner occupier	Yes	10.2	No	10.2

Notes: **t-test $p<0.01$; * t-test $p<0.05$

A4.5 Measures of health impacts

A4.5.1 Introduction

Three main measures of health impacts of flooding were used in the survey of the flooded respondents.

- GHQ-12 scale (for current health and health when the effects of the flood were at their worst);
- PTSS scale; and
- Self-reported health effects of flooding.

The health measures therefore cover two different periods of time:

- current health status (GHQ current and PTSS) which may be taken as an indicator of the long-term (years) effects of flooding; and
- health at the time of the flooding (GHQ at worst time and self-reported health effects) which may be taken as an indicator of the short-term (weeks/months) effects of flooding.

The at risk respondents only completed one scale - the GHQ-12 in relation to their current health.

A4.5.2 The General Health Questionnaire (GHQ-12)

Scoring the GHQ-12

This instrument was administered to respondents as a self completion questionnaire although interviewers may have chosen to 'help' some respondents by asking the questions and filling the responses for the respondents.

Respondents were asked to complete the GHQ-12 in terms of their current health 'over the past few weeks' (GHQ Current) and later in the interview, the flooded sample were asked to answer the questions again 'with reference to their health at the time when flooding was most severe for them' (GHQ Worst time).

As in the pilots, the GHQ-12 was scored in two ways:

- GHQ Method in which the first two response categories (no symptoms) are both given a zero score and the third and fourth categories (some symptoms) are both given a score of 1. This simply differentiates between those with and without symptoms without taking the degree of effect into account. It avoids the problems due to middle users. It produces a GHQ Method score from 0 to 12; and
- GHQ Likert in which the response categories are scored 0,1,2,3 to produce a GHQ Likert score from 0 to 36.

A GHQ Method score of 4 or more on the scale 0-12 is conventionally regarded as 'high' and as a threshold indicative of the presence of some degree of mental health problems (Goldberg and Williams, 1988; Health Survey for England 1998 - Erens and

Primatesta, 1999[2]). Although there is no established threshold level given in the literature for the Likert scoring, research suggests that a Likert score of 11/12 is the most effective threshold. However, the score of 12 was quite common amongst the flooded households for which respondents reported that their health was the same as usual on all the items and therefore it appears that it would be better to take 15 as a threshhold with those scoring 16 and over as 'cases'.

The worst time for flooded respondents

The 983 flooded respondents were asked 'At what stage during or after the flooding were the health impacts the most severe or worst for you personally' (QB10). Responses to this question (see Table A4.36) were varied highlighting how individuals differ in how they experience different flood events and their contexts (although there was no significant difference between men and women). It was most common for the worst health effects to occur early on in the immediate aftermath: in the first week or two after the flood. However, another common feeling was that the effects were worst one to three months after the flood. The flood event itself was the most severe time for a third significant minority. A substantial number of respondents were unable to answer this question or gave answers other than one of the specific time periods they were presented with, indicating that this was a difficult question for them to answer in a straightforward way.

Table A4.36 Stage at which health effects were most severe

Stage	Number	%
During the flood event	136	15
In the first week or two after the flood	192	21
In the first month after the flood	125	14
1-3 months after the flood	150	17
3-6 months after the flood	96	11
More than 6 months after the flood	95	10
Other	113	12
Total	907	100

724 (74%) of the flooded respondents were able to make an estimate of the duration of the 'worst time' (QB12) as shown in Table A4.37 (overleaf). The average duration was 10.5 weeks (with values ranging from less than a week to nearly two years) with a median of 4 weeks. As with the timing of the worst period, there was no significant difference between men and women.

2 Data on this and other annual health surveys undertaken for the Department of Health are available from www.doh.gov.uk/public/summary1.htm.

Table A4.37 Duration of the worst period

Time	Number	%
0-2 weeks	224	31
3-4 weeks	172	24
5-12 weeks	162	22
13-26 weeks	99	14
6 months to a year	56	8
More than a year	11	2
N respondents	724	100

Current GHQ Method scores

Both flooded and at risk respondents were asked to complete the GHQ-12 for their current health. The results (using GHQ Method scores) are shown in Table A4.38.

Table A4.38 Current GHQ Method scores

GHQ Method score (0-12)	Flooded		At risk	
	No	%	No	%
0 score	423	52	318	66
Low score 1-3	193	24	118	24
High score 4-8	134	16	33	7
Very high score 9-12	64	8	16	3
Total	814	100	485	100

The most striking feature of Table A4.38 is that flooded respondents score more highly than at risk respondents. However the differences in age and stage in the life cycle of the two samples had to be considered and could partially explain the difference. Furthermore, some of those at risk were not resident when the last flood took place and therefore had not witnessed at first hand the effects of a flood.

About a quarter of the respondents who had experienced flooding at or since Easter 1998 (24%) were currently registering GHQ Method scores of four or more and thus could be regarded as potential mental health ‘cases’. This corresponding figure for at risk respondents was 10%.

Significant minorities had very high scores (particularly amongst flooded respondents). Note that there is nothing in the literature to support the breaking down of the scores into high and very high categories as shown in Table A4.38. The data are presented here in this way for descriptive purposes to show the range of scores and because the scores obtained for ‘the worst time’ were so high that comparison required a further category above the 4 + category.

For both flooded and at risk respondents, the current GHQ Method scores are similar for men and women as illustrated in Table A4.39.

Table A4.39 Current GHQ Method scores by gender

Current GHQ Method score (0-12)	Flooded				At risk			
	Men		Women		Men		Women	
	No	%	No	%	No	%	No	%
0 score	178	56	245	49	136	66	182	65
Low score 1-3	70	22	123	25	55	27	63	23
High score 4-8	50	16	84	17	11	5	22	8
Very high score 9-12	19	6	45	9	4	2	12	4
Total	317	100	497	100	206	100	279	100

In the Health Survey for England 1998 (HSE - Erens and Primatesta, 1999), the proportions of men and women with high GHQ Method scores (scoring 4 or more) were 13% and 18% respectively. Direct comparison is not possible because the geographical areas covered, social class and the age structure and age limits in the survey populations were different (the HSE covered the 16+ age group compared with 18+ in this survey). Nonetheless the results suggest that flood victims currently experienced more mental health problems than would be expected on the basis of the HSE. There were variations with age among men and women in the proportions with high GHQ Method scores in the HSE but these would not be sufficient to explain the high scores in the flooded survey. Further comparative analysis of the high GHQ Method scores (4 or more) is presented in Table A4.40.

Table A4.40 Percentage of respondents with a GHQ Method score of four or more by nature of respondent, gender and age

Respondents	<25[4]	25-34	35-44	45-54	55-64	65-74	75+	Total
Men - flooded[1]	0	17	24	23	29	16	15	22
Men - HSE 98[2]	10	12	14	13	13	11	16	13
Men - at risk[3]	4	2	12	9	9	13	0	7
Women - flooded[1]	29	27	23	23	32	25	26	26
Women - HSE[2]	22	18	20	19	14	15	18	18
Women - at risk[3]	5	11	14	11	14	24	14	12

Notes: [1] The total numbers of male and female flooded respondents were 317 and 496 respectively. Note that sub-group sizes ranged from 7 (women under 25) to 106 (women aged 35-44 and 55-64) - and it is these on which the % figures are based.

[2] The total numbers of male and female HSE respondents were 6802 and 8254 respectively.

[3] The total numbers of male and female at risk respondents were 206 and 279 respectively. Note that sub-group sizes ranged from 10 (men over 75) to 70 (women aged 25-34).

[4] For the flooded/at risk respondents, the minimum age was 18 while that for the HSE was 16.

Although some of the data sub-groups are small, it can be seen that there is a significantly greater proportion of flooded respondents with high GHQ Method scores than amongst HSE and at risk respondents. By contrast, the at risk respondents tended to have a lower proportion with high scores when compared to the HSE results.

Although GHQ Method scores varied with income: the lower the income, the higher the proportion with a high GHQ Method score, the differences could not account for the flooded survey results since even in the lowest income quintiles the proportions with high scores were no greater than 20% for men and 21% for women. There were variations in the proportions with high GHQ Method scores according to social class but these did not form a clear pattern in the HSE.

GHQ Method scores - current and at worst time

The 'worst time' responses may be affected by difficulties in recalling feelings over varying periods of a year or more and by tendencies to exaggerate the feelings experienced at the time of the flood. However, the exploratory qualitative focus group research did not suggest that these were major problems: respondents appeared to try to represent their state of mind at the worst time of the flood accurately. The respondents answered in terms of their current state of health first and were therefore able to anchor their responses about the worst time onto those for their current state. This retrospective use of the GHQ is a novel approach. The reliability of this approach has not been tested. However, Power's (1988) use of the GHQ-28 to examine a 'worst ever' episode provides a precedent for this procedure. Table A4.41 compares the GHQ Method scores for the worst time of the flood as compared with the current scores.

Table A4.41 GHQ Method current and worst time scores for flooded respondents

	Current			Worst time		
GHQ Method score	Men %	Women %	All %	Men %	Women %	All %
0 score	56	49	52	31	15	21
Low score 1-3	22	25	24	14	17	16
High score 4-8	16	17	17	30	31	31
Very high score 9-12	6	9	8	25	37	33
N respondents	317	497	814	312	498	810

The GHQ Method scores given in the survey were very much higher for the worst time of the flood as compared with the current scores. This was true of both men and women but the difference in scores was more marked for women than for men. Among the women, 68% had a high GHQ score at the 'worst time' compared with 26% at the current time. For men, the proportions were 55% for the 'worst time' and 24% for their current health. There were no statistically significant differences in the current GHQ scores of the men and women but for the worst time differences between men and women were significant (Chi-square =34.22: df = 3: p <0.001).

GHQ Likert scores - current and at worst time

The GHQ-12 responses from both the flooded and at risk respondents were also scored to produce a GHQ Likert score ranging from 0 to 36 as shown in Table A4.42.

As would be expected, a similar pattern of results emerged with the GHQ Likert scores. For flooded respondents, the scores were significantly higher at the worst time than for the (then) current period. The current GHQ Likert scores for at risk respondents were slightly lower than those for the flooded respondents.

Table A4.42 GHQ Likert scores for current and worst times

GHQ Likert Score (0-36)	Flooded				At risk	
	Current		Worst time		Current	
	No	%	No	%	No	%
Very low score 0-6	71	9	44	5	71	15
Low score 7-11	297	36	124	15	249	51
Low to moderate 12-15	278	34	181	22	124	26
Moderate to high 16-18	66	8	90	11	17	4
High score 19-24	64	8	180	22	13	3
Very high score 25-36	38	5	191	24	11	2
Total	814	100	810	100	485	100
Mean GHQ Likert score	12.6		18.3		10.7	

The current Likert method of scoring would identify a markedly higher proportion of flooded respondents (current health) as 'cases' using the 11/12 threshold than would the GHQ Method (55% compared with 24%). This is because there were 160 respondents or 20% who had a GHQ Likert score of 12, just over the proposed threshold of 'caseness'. For those at risk this effect was less pronounced with 73 or 9% at the 12 score. If a more conservative threshold of 16 and over is used then the proportions identified by the Likert scoring as potential 'cases' is closer to that found using the GHQ scoring method.

The GHQ Likert scores for the worst time are markedly higher than the current scores for both men and women (see Table A4.43). Again this scoring identified significant differences between men's and women's worst time scores (Chi-square = 24.98; df: 5; $p<0.001$) but not in their current Likert scores.

Table A4.43 GHQ Likert scores for current and worst times by gender

GHQ Likert score	Current		Worst time	
	Men	Women	Men	Women
Mean score	12.3	12.9	16.6	19.4
Median score	12	12	15	19
N respondents	317	497	312	498

A4.5.3 Post Traumatic Stress Scale (PTSS)

PTSS results

The PTSS is a self completion questionnaire and flooded respondents were asked to fill out a slightly modified version of the questionnaire after they had completed the GHQ-12 forms. The PTSS questions refer to the respondent's current state of mind and health and respondents completed this questionnaire only once. The PTSS questionnaire is reproduced at the end of the flooded questionnaire presented in Annex 3.

Flooded respondents were asked about a number of symptoms with particular regard to their frequency of experiencing the symptom and the associated distress that the symptom produced. In order to shorten the questioning involved, the flooded respondents were not asked about the duration of each symptom as is the case in the full PTSS questionnaire[3]. This means that the PTSS scores cannot be used to diagnose PTSD in the flooded sample since this requires that the duration of certain symptoms should be determined as for a month or more.

However, the PTSS Intensity score is suggested as the best method for interpreting symptoms because it takes into account both the frequency of symptoms and the distress caused by symptoms (Scott and Dua, 1999). Therefore, this has been used as the main measure in this analysis. The PTSS Intensity score can range from 0 to 272.

747 flooded respondents (76% of all flooded respondents) completed the PTSS forms and values ranged from 0 to 221 with a mean of 21.1. These values were lower than those obtained in the first two rounds of pilots (in Phase 1) but higher than those for the third round of pilots (Phase 1A).

As discussed in the main text (see Section 3.5.2), the PTSS is a relatively new scale and there are few studies using the scale available and no UK studies, with which to compare the results. Therefore, the PTSS Intensity scores of the flooded respondents are shown in Table A4.44 alongside the results obtained by Scott and Dua (1999) in their research to establish the reliability and validity of the scale as well as with those of the pilot studies.

Table A4.44 illustrates that the main survey findings are consistent with those found in the earlier pilots and with the work of Scott and Dua (1999). Whilst the general level of stress amongst flood victims may not be as high as in other trauma groups, it is clear that some people are severely affected.

For the flooded respondents (in the main survey), and as would be expected, there is a moderately strong correlation between the PTSS Intensity score and GHQ Likert score (Pearson Correlation 0.65, $p<0.01$) which is very close to the values derived by Scott and Dua. For the simpler current GHQ Method score (0-12 scale), the correlation with the PTSS Intensity score was 0.64, $p<0.01$.

---

[3] As noted in the main text, the full PTSS questionnaire has undergone further revision since the development of the questionnaire used in this study.

Table A4.44 Comparison of PTSS and GHQ-12 scores

Sample	PTSS Mean Intensity score	PTSS Number of subjects	GHQ-12 Likert score mean[1]	GHQ-12 Number of subjects
PTSD group[2]	222.6	52	35.6	52
Trauma group[3]	73.1	64	31.7	64
Phase 1 Pilots	*43.4*	*69*	*15.0*	*70*
Main Survey	*21.1*	*747*	*12.6*	*814*
Phase 1A Pilots	*14.7*	*37*	*10.0*	*37*
Non-trauma group[4]	11.0	176	21.1	176

Notes: [1] The GHQ Likert score is based on the results for 'current' health (for those assessed in this study.

[2] Vietnam war veterans suffering PTSD (Scott and Dua).

[3] Those attending professional counselling for a variety of traumas (Scott and Dua).

[4] People not suffering PTSD nor receiving counselling but group contains people who have to deal with trauma (such as emergency service personnel and accident victims) (Scott and Dua).

Use of stress characteristics for WTP questions

The flooded and at risk respondents in the main Phase 2 survey (and in the Phase 1A pilots) were asked to value the benefits of avoiding specified stress effects. The stress effects used were based on an analysis of the PTSS results from the 72 respondents in the Phase 1 pilots. As indicated in the PTSS Manual, the level of stress may be characterised as 'low', 'mild', 'moderate', 'high' and 'extreme' with reference to the PTSS Intensity score. For each category, the responses to each of the PTSS questions were analysed to identify the five most significant symptoms to the overall scores and the associated frequency of occurrence and level of distress that such symptoms caused.

This approach provided a means to identify the most typical manifestations of different levels of stress associated with past flood events. It was recognised that there would be some uncertainties, including:

- relatively small sample sizes (from the Phase 1 results), particularly for the higher levels of stress; and
- the potential for the sampled areas (Leamington Spa, Northfield, Lewes and Waltham Abbey) not to be representative of the 'flooded' population as a whole.

As outlined above, the flooded respondents in the main Phase 2 survey generally showed a lower level of stress than that found in Phase 1. This is reflected by the fact that 84% of respondents in Phase 2 had PTSS scores within the 'low' category. However, in Phase 2, the range of scores was broader (with a maximum score of 221) showing that four respondents had experienced extreme stress caused by a flood event.

Table A4.45 compares the proportion of respondents falling into each stress category in Phases 1 and 2 and the average scores.

Table A4.45 Variation of PTSS Intensity scores

PTSS Intensity score	Level	Phase 1		Phase 2	
		% of respondents	Average score	% of respondents	Average score
0-41	Low	64	15.0	84	9.8
42-82	Mild	19	58.6	10	56.3
83-147	Moderate	11	109.9	3	103.4
148-209	High	6	175.3	1	178.3
210-272 (max)	Extreme	0	0	0.5	214.5

It should be noted that although the overall average PTSS score is lower in Phase 2, there is less difference between the average category scores from Phase 1 and Phase 2. This means that the stress characterisation, in terms of the frequency of occurrence and level of distress that such symptoms caused, would not be very different if based on the Phase 2 results rather than those of Phase 1. In other words, symptoms experienced by those scoring in the low category would still be felt rarely, those scoring in the high category would still be felt always, and so on.

Comparison of the responses for individual symptoms from Phase 1 and Phase 2 suggests that the characterisation of stress levels based on Phase 2 responses would have produced broadly similar descriptions to those actually used. Table A4.46 shows the descriptions actually used (i.e. the top five symptoms based on Phase 1 responses) and indicates the appropriate ranking of the symptoms based on the Phase 2 responses[4].

In three out of the four stress categories, the top three symptoms from Phase 2 were included in the description (albeit in a different order). In the moderate category, the top scoring symptom, B1-recurring memories of the flood was missing. In the Phase 2 responses, five symptoms featured very strongly, contributing to the top five scores in at least three of the categories:

- B4 – reminded of the flood by triggers
- B5 – feeling nervous, having palpitations or feeling tense
- B1 – recurring memories of the flood
- D1 – difficulty falling or staying asleep
- D4 – being overtly alert or watchful for no reason.

Overall, it can be concluded that the stress characterisations presented to the Phase 2 respondents broadly matched their experiences and provided valid descriptions of the stress resulting from flooding.

---

4 For the purposes of this analysis the 'high' and 'extreme' scores have been grouped together.

Table A4.46 Ranking of stress symptoms

Stress Level	Top Five Symptoms According to Phase 1 Results	Phase 2 Ranking
Low	You are sometimes reminded of the flood by triggers (such as TV programmes).	1
	You experience rare feelings of nervousness, palpitations or tension, caused by these triggers.	4
	You experience rare occasions of being overtly alert or watchful for no reason.	3
	You experience rare sleeping difficulties.	6
	You experience rare memories of the flood.	2
Mild	You are often reminded of the flood by triggers (such as TV programmes).	1
	You are often overtly alert or watchful for no reason.	5
	You sometimes feel nervous, have palpitations or feel tense when reminded of the flood.	3
	You sometimes have recurring memories of the flood.	2
	You sometimes experience flashbacks to the event.	10
Moderate	You often have difficulty concentrating on tasks or completing tasks.	7
	You are often reminded of the flood by triggers (such as TV programmes).	2
	You often feel nervous, have palpitations or feel tense when reminded of the flood.	3
	You often experience strong startled reactions.	6
	You are often overtly alert or watchful for no reason.	5
High	You always feel nervous, have palpitations or feel tense when reminded of the flood.	1
	You always feel emotionally estranged, separated or cut off from others.	8
	You are always being reminded of the flood by triggers (such as TV programmes).	3
	You always have difficulty concentrating on tasks or completing tasks.	2
	You often experience difficulty sleeping.	4

A4.5.4 Self-reported health effects of flooding

As in the pilots (see Section 3.1 of the main text), flooded respondents were asked about three categories of health effects that they or other members of their household might have experienced:

- physical health effects during or immediately after flooding;
- physical health effects in the weeks or months after the flooding; and
- psychological health.

Immediate physical health effects

A majority of the respondents (54%) experienced at least one immediate physical health effect from the flooding. Thus, the survey confirms that the flood event had an impact on physical health as perceived by the respondents themselves. However, of the nine listed effects, only three were reported by significant minorities. The most common response was shock experienced by a third of the respondents (33%), followed by colds, coughs, sore throats and flu (20%), and headaches (12%).

Respondents also reported on the immediate health effects on other adults in the household and on effects on children (see Table A4.47). In the flooded sample, at least 664 households contained another adult and 271 contained children aged under 18. Respondents may have hesitated to report on the effects on others and the number of effects reported is a little lower for others and for children possibly as a result. For those reporting effects, the pattern of responses was broadly similar to that for the respondents themselves

Table A4.47 Immediate self-reported physical health effects

Immediate physical health effect	Respondent		Other adults		Children	
	N	%	N	%	N	%
Shock	327	33	194	29	57	21
Cold, coughs, flu, sore throats or throat infections	194	20	128	19	45	17
Headaches	116	12	65	10	16	6
Exposure to chemicals and contaminants in floodwaters	81	8	49	7	12	4
Injuries due to over exertion during the flood e.g. sprains/strains, heart problems	65	7	33	5	1	0.4
Skin irritations e.g. rashes	71	7	40	6	14	5
Injuries e.g. cuts and bruises due to being knocked over by floodwater	44	5	21	3	0	0
Hypothermia	21	2	9	1	2	1
Electric shock	5	0.5	2	0.3	0	0
Other	38	4	20	3	8	3
None of the above	452	46	343	52	134	49
Total	983		664		271	

A simple scale indicating the number of the ten listed immediate physical health effects experienced by each respondent was created for use in the analysis. The scale ranged from 0, none of the effects to 10 (all of the effects listed including the other category). However, most of the respondents had experienced none (46%) or only one (29%), two (13%) or three (7%) effects and the maximum number of immediate health problems reported by one individual was 8. This scale provides a summary measure of the immediate physical health effects of flooding for use in the analysis.

Physical health effects in weeks and months after flooding

Fewer respondents reported health effects in the weeks and months after flooding (see Table A4.48) than had felt immediate effects probably because so many experienced shock at the time of flooding. Two thirds of the respondents did not recall suffering from any physical health effects in the weeks and months after flooding and the pattern was similar for other adults.

For children too, the aftermath of the flooding had less impact in terms of physical health effects than the immediate effect of the flooding. Children did not experience some of the effects that were common among the older people: stiffness in the joints and muscle cramps and other less common but more serious conditions affecting adults: heart problems and raised blood pressure. Thus children were reported to be affected by a narrower range of physical health impacts than the adults.

Table A4.48 Self-reported physical health effects in the aftermath of flooding

Physical health effects in aftermath of flooding	Respondent		Other adults		Children	
	N	%	N	%	N	%
Gastro-intestinal illness/upset stomachs	96	10	58	9	28	10
Stiffness in joints	91	9	43	7	3	1
Respiratory/chest illness e.g. asthma, pleurisy	79	8	52	8	18	7
High blood pressure	76	8	36	5	0	0
Skin irritations e.g. rashes, dermatitis etc	55	6	31	5	11	4
Heart problems	27	3	12	2	0	0
Muscle cramps	22	2	11	2	3	1
Sprains and strains	24	2	12	2	0	0
Cuts and bruises	24	2	18	3	1	.4
Insect or animal bites	19	2	10	2	4	2
Erratic blood sugar levels (diabetics)	21	2	10	2	0	0
Kidney or other infections	8	1	4	.6	0	0
Other	27	2	13	2	3	1
None	658	67	457	69	183	68
Total	983		664		271	

Self-reported psychological effects of the flooding

Most of the respondents (72%) reported experiencing some psychological effects of flooding and the numbers reporting some of the effects were much larger than for the physical effects. The most common psychological effect reported was anxiety when it rains, which 55% of flood victims experienced, followed by increased stress levels and sleeping problems (see Table A4.49). A very small minority, thirteen individuals reported that they had had thoughts of suicide.

Many more flood victims suffered from multiple psychological effects than experienced multiple physical effects. The psychological effects reported by the respondents as experienced by other adults and by children in their household were lower than the effects respondents reported for themselves in most cases. This may be because the respondents did not have any way of fully knowing about the psychological state of others as a result of the flooding and therefore these data must be treated with some caution. It is particularly notable that the respondents thought that 44% of the children in their households suffered no psychological effects from the flooding.

Table A4.49 Self-reported psychological effects of the flooding

Psychological effects	Respondent		Other adults		Children	
	No	%	No	%	No	%
Anxiety when it rains	543	55	299	45	79	29
Increased stress levels	353	36	198	30	29	11
Sleeping problems	245	25	131	20	28	10
Lethargy/lack of energy	93	10	36	5	4	2
Flashbacks to the flood	170	17	75	11	16	6
Mood swings/bad moods	126	13	79	12	17	6
Difficulty in concentrating on tasks	127	13	52	8	10	4
Increased tension in relationships e.g. more arguing	152	16	116	18	16	6
Mild depression	140	14	65	10	8	3
Moderate depression	92	9	46	7	3	1
Severe depression	45	5	23	4	0	0
Panic attacks	82	8	32	5	9	3
Anger/tantrums	91	9	46	7	12	4
Increased use of alcohol/drugs	64	7	31	5	0	0
Nightmares	64	6	23	4	19	7
Thoughts of suicide	13	1	3	.5	1	.4
Other	11	1	3	.5	0	0
None	279	28	239	36	119	44
	982		664		271	

As for the physical effects a similar simple scale indicating the number of the 17 listed psychological health effects experienced since the flooding by each respondent was created for use in the analysis. This scale ranged from 0, none of the effects to 17 (all of the effects listed including the other category). A fifth (20%) of the respondents had suffered from only one psychological problem. Two problems were reported by 14%, three by 10%, four by 7%, 5 to 9 by 17% and ten or more by a very small minority, 2%.

The maximum number of these psychological health problems reported by one individual was 16. Again, the scale is very simple and does not differentiate between degrees of problems experienced, for example, mild and severe depression. The scale has been used in the analyses to summarise the self-reported psychological effects.

Consultations and treatment by a doctor

Research has shown that consultations with doctors rise in the aftermath of flooding (Bennet, 1970). Flooded respondents who reported that they or household members had experienced any one of the physical or psychological health problems as a result of the worst flood were asked whether they or another household member consulted a doctor about these problems and whether they received any treatment from the doctor. The results are summarised in Table A4.50.

Table A4.50 Percentage of flooded respondents consulting and receiving treatment from a doctor for flood health effects

Action	Respondent			Other household member		
	Men	Women	All	Men	Women	All
Doctor consulted	15%	29%	23%*	16%	14%	15%
Treatment received from doctor	12%	25%	20%**	14%	11%	12%
N respondents	381	602	983	381	602	983

Notes: * Chi-square = 24.19; df=1;p<0.001 ** Chi-square=24.13; df=1;p<0.001

The table shows that substantial minorities did consult their doctor about health problems that they attributed to the flood and that, of these, many were treated for these problems.

There were significant differences between men and women among the flooded as a whole in seeking and receiving medical treatment. When only those reporting health problems and providing answers were considered, there were significant differences in the proportions of men and women consulting their doctor about their own problems (Chi-square = 10.45; df = 1; p< 0.01). Women were more likely to have talked to a doctor than men. Reporting of consultations by other members of the household also differed by gender with slightly more men reporting consultations by others than women probably because many of the men were aware of their female partners having sought medical advice. There were no differences in the proportions of those consulting doctors who received treatment. The information on doctor consultation by the flood victims may reflect the general pattern of women having a greater propensity to consult their doctor or it may indicate that women were more seriously affected by the flooding than the men.

A4.5.5 Subjective health effects in the context of other impacts

The flooded respondents were asked to rate a number of effects of the flood upon their household's life using a scale from 1 indicating no effect to 10 indicating an extremely serious effect. Examining these subjective ratings (see Table A4.51) enables us to see the health effects of flooding as perceived by respondents themselves in relation to other impacts. Those who did not experience the impacts are excluded from the calculations of means and percentages. It is important to note that these subjective ratings are in terms of the effect on the household whereas most of the other health measures are for the individual respondent.

Table A4.51 Subjective rating of severity of the effects of flooding

Effect	% with a rating score[1] of					Mean	Mean	Mean	Median	N
	1	2-3	4-7	8-9	10	Men	Women	All	All	
Getting house back to normal	4	7	22	27	40	7.4	8.0 ***	7.8	9	967
Stress of flood	6	11	27	21	35	6.7	7.4 ***	7.1	8	972
Having to leave home	12	10	20	23	35	6.4	7.3 ***	7.0	8	248
Worry about flooding	8	13	32	21	26	6.1	6.8 ***	6.6	7	968
Damage to replaceables	8	14	30	18	29	6.2	6.7 *	6.5	7	943
Damage to house itself	9	16	27	20	18	6.1	6.9 **	6.4	7	951
Irreplaceable items loss	24	14	21	15	25	5.0	6.0 **	5.6	6	656
Builder problems	27	18	24	15	16	4.5	5.1 *	4.9	4	839
Insurance problems	27	21	23	13	16	4.7	4.7	4.7	4	895
Loss of or distress to pets	39	12	17	16	16	3.9	5.0 ***	4.6	3	537
Loss of house value	32	15	26	13	14	4.3	4.7	4.6	4	779
Effects on health	24	19	38	11	8	4.0	4.9 ***	4.5	4	966
Overall effect	2	11	32	26	19	6.7	7.6 ***	7.3	8	973

Notes: [1] Scores were rated as follows: 1 No effect; 2-3 Low effect; 4-7 Medium effect; 8-9 Serious effect; and 10 Extremely serious
[2] T-test two tailed * $p<0.05$; ** $p<0.01$; *** $p<0.001$

In subjective terms, health effects were rated among the lesser effects of flooding on the households. It is not clear whether in rating health, respondents confined their responses to physical health rather than health more broadly defined and also whether they considered the long-term as well as the more immediate impacts of the flooding. It is interesting that the stress of the flood event itself features as one of the most serious effects, along with all the problems and discomfort whilst trying to get the house back to normal and having to leave home. Although this item on the stress of the flood event itself was intended to cover the actual time when the floodwaters arrived and were in the house, it is possible that the respondents interpreted flood event more widely to include the aftermath and recovery as part of the flood event. Thus the stress indicated could include that experienced after the floodwaters had receded. It may be too that stress and other psychological effects associated with the flood event have been categorised as stress effects of the flood event rather than as health effects. In considering the long-term health effects, all the subjective effects listed in the table can be seen as potential contributory factors.

As indicated in the table, there were significant differences between men and women in the mean subjective ratings given to most of the factors. Women consistently rated the individual effects as more serious than the men. They also rated the flood overall as having a more serious effect on their households than did the men. Many researchers have argued that gender has been ignored in the study of the impacts of disasters in general and flooding in particular (Enarson and Morrow, 1998; Fordham, 1998). Flooding research has indicated (Tapsell *et al*. 1999; Tapsell and Tunstall, 2001; Enarson and Fordham, 2001), that flood events can have distinct and different impacts on women compared with men. Women are traditionally responsible for the management of the household and may suffer more inconvenience when it is disrupted. Women too are likely to be more aware of all the impacts of flooding on household members because of their key role in the household. Women may have a greater emotional investment in the home because they may have had more to do with creating and maintaining it. They may, therefore, feel a greater sense of loss when possessions are damaged or lost. Furthermore, women usually carry responsibility for the well-being of their families and may be put under more strain when trying to do so in the aftermath of flooding. Women, finally, may be more able to admit to, and express their feelings. These survey results confirm that women felt that their households were more affected by many aspects of the flooding than did the men.

Table A4.52 shows the Pearson Correlations between the subjective ratings for the different impacts. All the correlations shown are significant at the $p<0.01$ level. Health effects were most strongly associated with the rating of the stress of the flood event itself. The stress of the flood itself was strongly correlated with disruption 'all the problems and discomfort whilst trying to get the house back to normal' which suggests that the flood stress has been interpreted more widely and not restricted to the period when floodwaters entered and remained in the property. Flood stress was also moderately strongly associated with 'Worry about flooding in the future'.

Considering the subjective rating of the overall impact of flooding on the households, it is notable that the stress of the flood itself was the effect most strongly correlated with the overall impact (Pearson Correlation 0.72). The health effects too were moderately strongly related to the overall subjective rating of the impact of the flood on households (Pearson Correlation 0.61). This indicates that the health effects and the stress experienced in the flood event along with the disruption caused by flooding (Pearson Correlation 0.69), having to leave home and associated house damage (Pearson Correlation 0.61 and 0.60 respectively) were the most important factors in the overall impact of flooding on the households.

Table A4.52 Correlations amongst flood effects

Effect	A	B	C	D	E	F	G	H	I	J	K	L
A Health						.						
B Leaving home	.51											
C Damage to replaceables	.40	.50										
D Worry about flooding	.47	.43	.42									
E Irreplaceables	.38	.45	.44	.38								
F Getting house back to normal	.53	.58	.57	.52	.42							
G House Damage	.42	.58	.48	.41	.44	.55						
H Stress of flood	.59	.57	.51	.60	.42	.72	.53					
I Problems: Insurers	.29	.31	.26	.30	.26	.36	.34	.32				
J Problems: Builders	.24	.28	.17	.24	.22	.34	.31	.26	.45			
K Pets distress	.35	.33	.27	.25	.39	.38	.37	.35	.32	.34		
L House value	.27	.30	.27	.38	.26	.29	.33	.30	.30	.25	.30	
M Overall effects	.61	.61	.54	.57	.49	.69	.60	.72	.35	.30	.44	.35

Notes: All the Pearson Correlations in the table significant at the 0.01 level (two-tailed)

A4.5.6 Associations between the health impact measures

It is useful to summarise the relationships amongst the eleven measures of health impacts of flooding using the Pearson Correlation Coefficients as shown in Table A4.53. For the self-reported health effects, the scales for the number of effects reported are used in the analysis. All the correlations shown are positive and significant at the 0.01 level (two tailed). However, some of the associations are stronger than others.

Three of the measures are for the present time: PTSS Intensity and the two GHQ scores, and eight give measures in terms of the health at the time of the flood event: two GHQ worst time scores and the three self-reported health effects scales, reports on doctor consultations and treatment by the respondent and the subjective rating of the health effects of flooding on the household. We would expect the correlations to be strongest for the measures covering a similar time period leaving aside the two different GHQ scores based on different scoring methods which we would expect to correlate very strongly. These were indeed strong at 0.92 for the current GHQ scores and 0.94 for the worst time scores.

The strongest associations for each measure are shown in bold. It is reassuring that the strongest associations for each of the measures of current health were with other measures of current health: current GHQ Method, current GHQ Likert score with PTSS Intensity score. The GHQ and PTSS scales measure somewhat different things. However, the Scott and Dua data report a strong correlation between the PTSS Intensity scale and the GHQ-12 Likert score (Pearson Correlation 0.71, $p<0.01$). These researchers took the findings on relationships between the PTSS scores and a number of other scores for psychological states as an indication of the convergent validity of the scale. A similar moderately strong relationship between the PTSS Intensity scale and the current GHQ Likert score was found in the flooded sample data (Pearson Correlation 0.65, $p<0.01$). For the simpler current GHQ score (0-12 scale) the correlation with the PTSS Intensity score was 0.64, $p<0.01$.

Looking at the health measures that refer to the time of the flood, generally, the strongest associations were again with other measures that refer to the same time. The GHQ scores for the worst time were most strongly associated with other measures that reflect health at the time of the flooding: the self-reported psychological effects of flooding and also the subjective rating of the health effects of the flood on the household. There was, however, also a moderately strong association between the GHQ Likert score for the worst time and the PTSS Intensity score.

The self-reported immediate physical health effects were most strongly associated with other self-reported effects: longer term physical effects and psychological effects. Similarly consulting the doctor about health problems arising from the flooding and receiving treatment was most strongly associated with the self-reporting of health problems at the time of the flood and GHQ Likert worst time scores. However, seeking medical help and receiving treatment were also significantly associated with the measures of longer term health effects.

These findings, therefore, indicate that the measures of health used have differentiated between the current health status of the flooded respondents and how they felt their health was during and after the flood. However, they also show that the current health status of the respondents is linked to the health effects experienced at the time of the flood and its aftermath as there were positive correlations between the measures for the two time periods.

Table A4.53 Correlations between health effects measures: flooded respondents[1]

Scale	Current health effects			Health effects at the time of flooding				
	PTSS Intensity	GHQ Method	GHQ Likert	GHQ Method	GHQ Likert	No. of IPHEs	No. of LPHEs	No. of PHEs
PTSS Intensity		.						
GHQ Method current	**.64****							
GHQ Likert current	**.65****	(.92**)						
GHQ Method worst time	**.51****	.47**	.47**					
GHQ Likert worst time	**.57****	.50**	.54**	(.94**)				
IPHEs[2]	.39**	.32**	.28**	**.44****	**.44****			
LPHEs[3]	.39**	.34**	.31**	.36**	.40**	**.56****		
PHEs[4]	.56**	.46**	.45**	**.58****	**.61****	.57**	.45**	
Subjective scores: health effect	.47**	.41**	.39**	**.56****	**.58****	.43**	.41**	.53**
Consulted doctor	.30**	.33**	.30**	.38**	.42**	.36**	**.43****	**.43****
Treated by doctor	.29**	.30**	.27**	.32**	**.36****	.31	**.42****	**.36****

Notes: [1] Number of respondents: 814-728.
[2] IPHEs = self-reported immediate physical health effects.
[3] LPHEs = self-reported longer term physical health effects.
[4] PHEs = self-reported psychological health effects.
** Pearson Correlation is significant at 0.01 level (two-tailed) and the most significant correlations for each scale are in bold.

A4.6 Tangible losses

Of the 983 flooded respondents, 949 (97%) reported that they suffered damage to property or contents.

A4.6.1 Insured losses

912 respondents reported that they were covered by insurance (the remainder did not know or were covered by the landlord's insurance) and 886 (90% of the total) had made a claim.

Of the 886 claimants, 540 were able to provide estimates of the total insured losses and/or the sums for both buildings/structure damage and contents damage. The estimated amounts paid out by the insurance companies (in response to the various QA18 sub-questions) are summarised in Table A4.54.

Table A4.54 Summary of insured losses

Code	Nature of claim	N responses	Mean value	Max value
A	Buildings/structure damage	369	£18,329	£200,000
B	Contents damage	483	£8,176	£50,000
A+B	Both the above	326	£27,262	£220,000
C	Overall damage	401	£24,296	£202,000
	Maximum of A+B or C	540	£26,977	£220,000

A4.6.2 Uninsured losses

Of the 983 flooded respondents, 375 (38%) reported that they suffered uninsured losses.

Of these 375 respondents, 164 were able to provide estimates of the total uninsured losses and/or the sums for both buildings/structure damage and contents damage. The estimated costs (in response to the various QA20 sub-sections) are summarised in Table A4.55.

Table A4.55 Summary of uninsured losses

Code	Nature of cost	N	Mean value	Max value
A	Buildings/structure damage	131	£1,402	£32,000
B	Contents damage	228	£2,419	£50,000
A+B	Both the above	103	£2,948	£36,000
C	Overall damage	125	£2,282	£36,000
	Maximum of A+B or C	164	£2,756	£36,000

A4.6.3 Irreplaceable items

Qualitative research has shown the importance for flood victims of the loss of possessions which have no market value but which are irreplaceable and priceless to the owner. Items such as letters, photographs, personal collections gathered over a lifetime may be a record of that lifetime and thus an important part of a person's identity (Tapsell *et al.* 1999).

It might be expected that the loss of such items would be associated with certain flood characteristics: the depth of flooding, the speed of onset, the failure to receive a warning. Older people and those resident in their dwelling for a long time might be expected to have accumulated more memorabilia and thus to be more susceptible to such losses. However, these associations have not been found in previous research (Green *et al.* 1994).

In this survey, almost all the respondents, 89%, reported that they lost some irreplaceable items or items of sentimental value.

A4.7 Factors affecting health

A4.7.1 Overview

In this section, consideration is given to those factors which influence the measures of health. As discussed in Section A4.5, a number of measures have been examined and these are briefly summarised in Table A4.56.

Table A4.56 Summary of health measures considered

Parameter being measured	Measure used
Long term psychological effects	GHQ-12 (Current), PTSS, self-reporting checklist
Physical effects in weeks/months after flooding	Self-reporting checklist
Short/mid term psychological effects	GHQ-12 (Worst)
Immediate physical effects	Self-reporting checklist
Overall impact on health and household	Subjective rating

In this analysis, particular attention will be given to the GHQ-12 (Current) and PTSS measures with additional commentary on the other measures as appropriate.

As discussed earlier (Section A4.5.2), two means of scoring the GHQ-12 have been employed. The simpler Method score (on a scale 0-12) was used to provide a basis for comparison with the Health Survey for England results. In this analysis, attention will be restricted to the Likert score (on a scale 0-36) as this provides a greater range of weighted responses.

In relation to the PTSS Intensity scores, the distribution is heavily weighted towards low scores as shown in Figure A4.1. To provide a more even gradation of stress scores, the PTSS Intensity score was transformed using the natural logarithmic expression:

$$\text{Representation of stress score} = \ln(P + 1)$$

where P = PTSS Intensity score
ln(P+1) = natural log of (P+1)

The resultant distribution of ln(P+1) is shown in Figure A4.2.

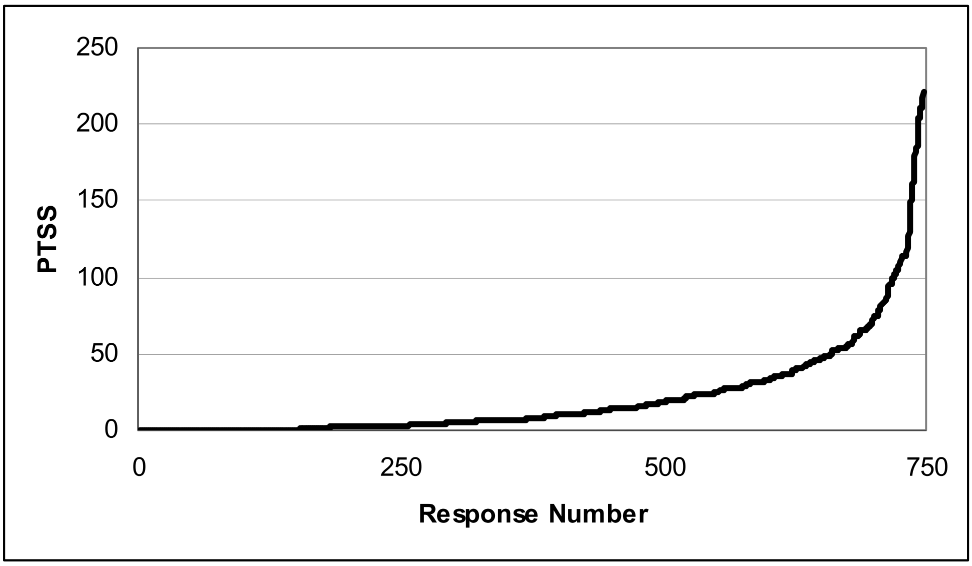


Figure A4.1 Distribution of PTSS scores by response

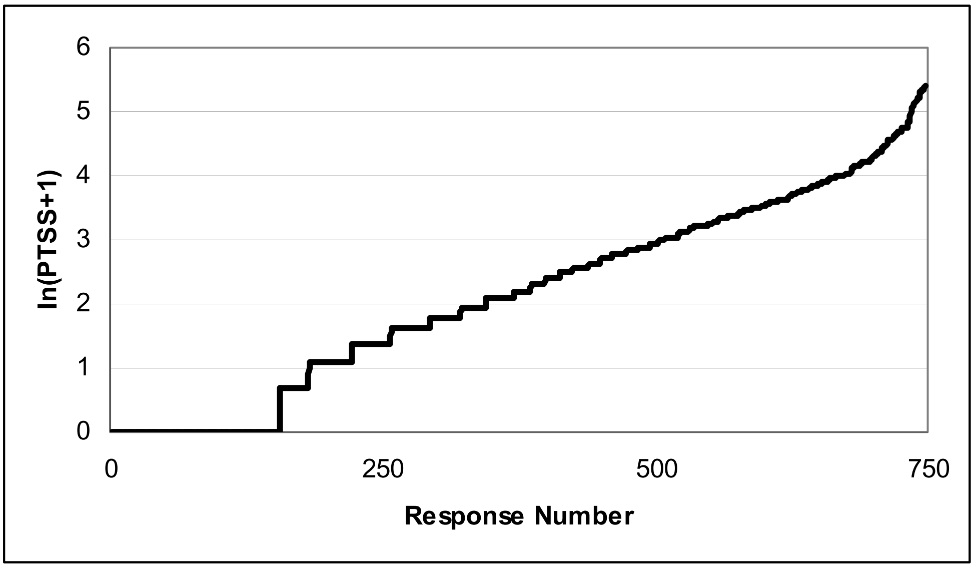


Figure A4.2 Distribution of ln(P+1) values by response

There are three broad groups of factors to be considered:

- socio-demographic factors;
- flood characteristics; and
- post-flood factors.

These are considered in more detail below.

A4.7.2 Socio-demographic factors

Gender

Whichever health measure is used, women were found to be more affected than men by flooding.

In relation to long term effects (as measured by current health), although the PTSS scores are significantly different, those for the GHQ-12 (Likert) are not. There were, however, consistent differences in the health effects reported by men and women for the time of the flood: the GHQ measures for the worst time and the self-reported health effects.

Since there were no significant differences in the health status that respondents reported prior to the worst flooding, these findings suggest that the flooding had a more marked short-term effect on women than on men but that women recovered over time so that there were fewer differences in the long-term effects as indicated by the current health measures.

It may be that women are more health conscious or admit to ill effects more readily than men or may be that they do experience more health effects as defined by the measures included. In studies taken from probability samples of the general population, women are usually found to score higher on various forms of the GHQ than men (Goldberg and Williams, 1988; Erens and Primatesta, 1999). However, Goldberg and Williams express doubts that the difference is biological in origins since studies of men and women in similar social circumstances, for example of teachers or of army personnel, show no significant differences.

Caution must be exercised in attributing any differences in the GHQ scores of men and women to the experience of flooding because women, age for age, usually report poorer health on this measure than men (e.g. Health Survey for England 1998). However, the fact that the women were more likely to report high scores for the time of flooding than men, while current GHQ scores were not as different does tend to suggest that the flooding had more effect on the women's health and well being.

Age

Flooded respondents in their 50s are more susceptible to stress (as measured by PTSS Intensity) than younger or older respondents. This is entirely consistent with the age distribution of the high GHQ scores (see Table A4.40). The relationship between effect and age is therefore non-linear and a quadratic expression of the form: Effect = a x Age + b x Age^2 + c (where a, b and c are constants) was used in the subsequent analysis.

Qualitative research has found some older people to be more resilient and less affected than those in their middle years (Tapsell *et al.* 1999). Of course, the older respondents may be 'survivors' in that those elderly people most severely affected by the flooding may not have survived long thereafter or may not have remained in their homes after the flooding. There was some anecdotal evidence in the qualitative research of this process at work with reports that some elderly people had never returned to their flooded homes (Tapsell *et al*. 1999) - but the numbers of people involved were likely to be small.

Nature of household

At first sight, it might be expected that two (or more) adults sharing a household without children may be best placed to deal with the effects of flooding. On the other hand, single parent families and elderly people on their own might be expected to be more severely effected.

Children

Focus group participants have reported that their children were affected in a number of ways from minor health problems to anxiety and stress-related health effects (Tapsell *et al.* 1999). In the study of the health effects in the autumn 2000 floods in the North East, parents expressed needs for special advice because of the effects of the flooding on their children and child care while coping with the aftermath of the flooding (Tapsell and Tunstall, 2001). There may be an extra strain on adults because of the need to try to maintain cleanliness and restore a routine and certain normality in the face of adverse circumstances in the home for the sake of children.

Table A4.57 provides an example of how care is need in reviewing data. The PTSS and GHQ current means suggest that one parent families are most susceptible (to stress) followed by households with two or more adults with one or more children - in other words, the presence of children leads to greater health effects. However, the median values (for PTSS only) suggest that single adults are most susceptible followed by one parent families. These figures suggest that there are small sub-populations with high stress values which are influencing the mean values.

Table A4.57 PTSS/GHQ-12 scores by nature of household (ranking in brackets)

Nature of Household	N	PTSS Intensity score		N	GHQ-12 Likert (current)	
		Mean	Median		Mean	Median
Single parent family	28	23.25 (1)	8.5 (2)	34	13.5 (1)	12 (1=)
Single adult	189	20.47 (3)	9 (1)	212	12.4 (4)	12 (1=)
Two or more adults with no children	344	20.29 (4)	7 (3)	378	12.6 (3)	12 (1=)
Two or more adults with child(ren)	186	22.74 (2)	7 (3)	190	12.8 (2)	12 (1=)

Although generally, households with children of all ages had higher average scores on the health measures than other households, there were no current health and thence long-term effects, where differences were statistically significant. The only significant differences found were in self-reported psychological effects for the time of the flood. This suggests that the effects of flooding may be worse at the time for those with children but that they recover from those effects so that the long term effect on the health of those with and without children is not very different. Respondents with children in the home are likely to be younger, particularly those with young children and these two factors may interact and make the bivariate analyses difficult to interpret. Self-reported long term physical health effects were unusual and consistent in that respondents without children, perhaps because they were older, reported more of these symptoms on average than respondents with children.

Women still have the main responsibility for child care in most homes and we might expect this burden to fall particularly heavily upon them during and after flooding. When the health effects of flooding were examined for women respondents only, with and without children in the home, again, it appeared that although those with children registered higher scores on most measures, there were no statistically significant differences between the respondents on the current health measures.

Older children may be a help during and after a flood: helping with moving things, clearing up for example. However, when only the small minority of respondents (158) in households containing young children aged nine and under but also in some instances older children as well were considered, it remained the case that few significant effects were found (on self-reported long term physical health and psychological effects for all respondents and long term physical health for women respondents only) and none on current health effects.

Living Alone

As indicated above, although one might expect that flooding would be particularly stressful for those living alone with no one in the home to share the burden of coping with the flood event, this did not emerge in the survey results, when the minority (274 respondents) of all ages who lived alone were considered. Indeed, there was a tendency for those living alone to report fewer health effects but the differences between the mean scores on t-tests for those living alone and with others were not statistically significant. However, the situation does change (as illustrated in Table A4.52) if the median PTSS values are considered as those living alone score highest.

Although the elderly living alone (a small minority of 154 respondents) might seem a group particularly vulnerable to flooding, again this expectation was not borne out by the survey results. The elderly living alone tended to report fewer health effects than other types of household. In particular, the mean GHQ-12 Likert scores for the worst time of flooding were significantly lower for the elderly alone than for the other households and there was a significantly smaller difference between the GHQ scores for the current time and for the worst time for this group as indicated by t-tests. These findings may reflect the fact that the older age groups generally had lower scores on the health effects measures than those in the middle years.

Overall it was concluded that whilst there is some evidence to suggest that adults without children are the least susceptible to health effects, it is difficult to specify the type of household which would be most susceptible. On this basis, a children variable (0 for no children and 1 for one or more children) was used in the subsequent multivariate analysis on the health measures.

Social grade

Although there was a significant relationship between prior health and social grade, there was little to indicate that this was also reflected in the long-term health effects of flooding. There was some indication that the stress (PTSS) varies with class - social grade AB respondents suffer least and social grade DE respondents suffer the most. The DE group, particularly, registered significantly higher mean scores on this measure compared with other class groups. However, when the grouped scores (for all measures) were compared across the class groups, no significant differences were identified. Goldberg and Williams (1988) report that generally social class does not show strong effects on the GHQ scores although some studies show higher rates in lower classes when gender is taken into account.

Education and income

PTSS Intensity scores appear to vary with education and income. Increased levels of education (on a scale 0 for no formal qualifications to 5 for a postgraduate qualification) lead to reduced impacts. Similarly, increased income correlates with reduced PTSS scores but not the GHQ Likert scores nor the other measures.

Overall, having income and resources available might be expected to mitigate the effects of flooding but this did not appear consistently to be the case, although there was some evidence to support this argument.

House price, type and ownership

It appeared that those in more expensive houses were more susceptible to stress (although this is counter to the observed trend for social grade, education and income mentioned above).

Less than 10% of flooded respondents lived in what might be regarded as housing vulnerable to flooding (bungalows, ground floor/basement flats or maisonettes and mobile homes). This group did tend to have higher scores on the health effects than others living in property with a first floor to retreat to in time of flood.

Differences on current health scores were not significant. However, for the worst time, those in vulnerable housing were shown to have experienced significantly more health effects than residents in other property types. Thus, the short-term effects of flooding appear to have been worse for this vulnerable group but they appear to have recovered from the experience so that they did not show significantly more long term effects than others.

There were strong associations between income and the type of property occupied with the lowest income groups much more likely to occupy basement or ground floor only property than others with higher incomes (Chi-square 149.58;df = 24; p,0.001). There was a similar significant association between property type and social grade. However, the trend for occupation of vulnerable property to be higher, the lower the social grade was not so marked as was the association with income.

As there are links between the type of property occupied, income and social class, multivariate analysis is required to elucidate which are the more influential variables for the health effects of flooding.

Amongst flood respondents, 88% of respondents were owner-occupiers (i.e. owning outright or on a mortgage). When these were compared with non-owners with other types of tenure, t-tests showed significant differences in mean scores on a number of the key health measures as indicated in Table A4.58. However, caution must be exercised in drawing conclusions since there may be other variables that explain the difference rather than tenure itself: the council tenants may have been located in an area particularly badly affected by flooding, for example. Tenure, too, is likely to be linked to income and social class.

Table A4.58 Health effects for flooded respondents by tenure

Current health	Owner-occupier		Other tenure[1]
	Mortgage	Outright	
PTSS Intensity (mean)	20.0	19.5	31.6*
GHQ Likert current (mean)	12.5	12.4	13.8*
Health at worst time			
GHQ Likert Worst (mean)	18.9	17.1	20.8**
Self-reported effects			
Immediate physical effects (mean no.)	1.1	0.8	1.1
Longer term physical (mean no.)	0.5	0.5	0.9*
Psychological effects (mean no.)	2.7	2.2	2.7

Notes: [1] * t-test p<0.05, ** t-test p<0.01

Car ownership

The PTSS scores suggested some reduction in stress with increased car ownership but this was not reflected in the GHQ-12 Likert scores.

Employment

As previously indicated, there were very few unemployed respondents. Nevertheless, there was some evidence to suggest the following ranking:

- those in full-time employment were least susceptible to stress;
- those at home were most susceptible to stress (with a small group of 35 disabled respondents having the highest stress levels); and
- those in part-time work appeared to suffer intermediate levels of stress.

For the purposes of the multivariate analysis, the employment states full-time, part-time and not at work were coded 1, 2 and 3 respectively.

Time in residence

Although the PTSS scores suggested that health impacts decrease with length of time in residence, there were only very weak and non significant correlations between the long-term health effects variables and the length of time in years that respondents had lived in their property (Pearson Correlation: PTSS Intensity -.09; current GHQ Likert score -0.002). There were also no significant associations between grouped worst time GHQ scores and the different lengths of residence.

Awareness of the flood risk

Those aware of a flood risk might be expected to be better prepared and more able to cope with a flood event than those without any prior knowledge of the risk. Awareness did make a difference to the health effects (both short and long term) across all measures) - as illustrated in Table A4.59.

Table A4.59 Health effects by prior awareness of flood risk

Current health	Aware of risk	Not aware
PTSS Intensity (mean)	16.8	22.4*
GHQ Likert current (mean)	12.0	12.9*
Health at worst time		
GHQ Likert Worst (mean)	16.6	18.8**
Self-reported effects		
Immediate physical effects (mean no.)	0.8	1.1**
Longer term physical (mean no.)	0.4	0.6*
Psychological effects (mean no.)	2.2	2.5

Notes: * t-test, $p<0.05$; and ** t-test, $p<0.01$

Prior health

Respondents were asked to rate their state of health prior to the worst flood on a scale 1 (poor) to 5 (excellent). As might be expected, those in excellent health (prior to the worst flood) tend to suffer less health effects than those in poor health. Some of the key indicators are shown in Table A4.60. Interestingly, there were no relationships between prior health and the <u>differences</u> between GHQ scores for the time of the flood and the current time, indicating that those with poor or fair prior health recovered from the flooding in much the same way as the others whose health was better prior to the flooding.

A similar picture emerged when considering households where the respondent or another household member had a long-term illness or disability (see Section A4.2.2). In both situations, significantly worse health effects for both the time of flooding and for the current time were found.

Table A4.60 Current and worst time health effects by prior health

Current health (mean scores)	Prior health				
	Poor	Fair	Good	V. good	Excellent
PTSS Intensity	38.8	28.3	23.4	18.5	15.9***
GHQ Likert	14.8	14.5	12.9	12.4	11.4***
Health at worst time (mean scores)					
GHQ Likert Worst	22.7	20.3	17.9	18.5	17.1***
Difference GHQ Likert:	7.4	5.7	5.0	6.0	5.9
Self-reported effects (mean no.)					
Immediate physical effects	1.3	1.0	0.9	1.0	0.9
Longer term physical	1.3	0.9	0.6	0.5	0.4***
Psychological effects	2.8	2.8	2.4	2.4	2.4

Notes: ** * t-test p<0.001; ** t-test p<0.01; and * t-test p<0.05

Such households and respondents, however, were no different from other households in terms of the difference between the GHQ scores at the worst time and the current time indicating that these respondents recovered in a similar way to others from the short term impacts of flooding.

A4.7.3 Flood characteristics

As discussed earlier (see Section A4.3.2, Table A4.21) respondents were most concerned about speed of onset, dirtiness (contamination), depth and warning time. To these have been added: years since worst flood; frequency of flooding; duration of flood event; and rooms flooded.

Speed of onset

A rapid onset of flooding might be hypothesised to be more stressful in itself because of the element of surprise and to lead to more long-term health effects than a slower flood. There were some significant if very weak correlations between the speed of onset of flooding and the long-term health effects of flooding (Pearson Correlation: PTSS Intensity -0.09 and current GHQ Likert -0.06) indicating that there was some tendency for a speedy onset to be associated with higher scores. However, there were no significant patterns found when the speed of onset was related to the grouped PTSS and GHQ scores for the respondents' current health.

A similar picture emerged when the short-term health effects were considered. There were no significant differences in the grouped GHQ scores for the worst time of flooding according to the speed of onset of flooding. So even at the time of flooding, how quickly the floodwaters rose hardly appeared to be a significant factor in the health impact of the flood event.

Contamination

There were very weak correlations between long-term health measures and the belief that the floodwaters were polluted (Pearson Correlation: PTSS Intensity 0.12; Current GHQ Likert 0.13) suggesting that there was some link between a perception of the floodwaters as polluted and long-term health effects. This was confirmed when the grouped PTSS scores were examined for those who did and did not consider the floodwaters to have been polluted. Those who thought the floodwaters were unpolluted were more likely to report no current symptoms and less likely to report low, mild and moderate or more severe symptoms (see Table A4.61).

Table A4.61 PTSS Intensity scores according to beliefs about pollution of floodwaters

PTSS Intensity score	Floodwater polluted %	Water not polluted/don't know %	All %
0 score: no symptoms	17	31	21
1-20: very low	49	49	49
21-41: low	16	10	15
42-82: mild	11	7	10
83 and over: moderate/high/extreme	6	3	5
N respondents	570	177	747

Notes: Chi-square=20.50; df=4: p<0.001

The findings were similar for the current grouped GHQ Likert scores: those believing the floodwaters to have been contaminated reported significantly higher current GHQ Likert scores (Chi-square = 20.84; df = 5; p<0.01).

Not surprisingly, there were similar short-term effects. There were significant associations between beliefs about pollution of the floodwaters and the health effects reported for the worst time of flooding as measured by the GHQ Likert scores (Chi-square = 39.86; df = 5; p<0.001).

Respondents who believed that the floodwaters were polluted were also significantly more likely to report physical and especially psychological health effects at the time of, and in the aftermath of flooding (see Table A4.62).

Table A4.62 Self-reported health effects and beliefs about pollution of floodwaters

Self-reported effects	Floodwater polluted %	Water not polluted/don't know %	All %
Immediate physical effects: Mean No.	1.1	0.7	1.0 ***
Longer term physical: Mean No.	0.7	0.3	0.6 ***
Psychological effects: Mean No.	2.7	1.7	2.5 ***
N respondents	755	228	983

Notes: t-test: p<0.001

Depth

A key question for the research was to establish whether there was any relationship between the depth of flooding experienced and the long or short-term health effects.

Looking first at the maximum depth in any of the four main rooms (living room, bedroom, bathroom or kitchen including those not flooded there as zeros) and the measures of long-term health effects, a simple correlation analysis indicated that there were very weak but significant associations (Pearson Correlation: PTSS Intensity 0.15; current GHQ Likert 0.13). When the data on maximum flood depth in the main rooms was grouped and cross tabulated with the grouped PTSS Intensity scores, there was a significant pattern of increasing mild and moderate or more extreme scores with increasing depths of flooding. However, Table A4.63 also shows that there was a wide range of responses within each flood depth category with substantial proportions reporting little or no stress at the time of the interview even among those flooded to a depth of 80cm or more.

Table A4.63 PTSS Intensity scores according to the maximum depth of flooding in the main rooms

PTSS Intensity score	None %	<9cm %	10-39 cm %	40-79 cm %	>79 cm %	All %
0 score: no symptoms	47	27	23	15	11	21
1-20: very low	41	47	47	52	52	49
21-41 low	6	16	17	13	17	15
42 -82 mild	3	8	9	13	12	10
>79 moderate, high or extreme	3	3	4	7	8	5
Number of respondents	66	77	216	201	185	745

Notes: Chi-square=53.38; df=16; p<0.001

A similar finding emerged when the association between grouped GHQ scores (Method and Likert) and the depth of flooding was examined. Those flooded to a greater depth were more likely to report high GHQ scores.

When the short-term impacts of the maximum depth of main room flooding on health were considered, the associations between depth of flooding and GHQ scores for the worst time of the flooding and self-reported health effects at the time of the flood were weak but also statistically significant (Pearson Correlation Coefficient: GHQ Likert for worst time 0.15, immediate physical health effects 0.10, longer term physical health effects 0.11, psychological effects 0.18, subjective rating of the health effects 0.20).

Table A4.64 showing GHQ scores for the worst time of the flooding again shows a significant association between the scores and the depth of flooding. However, it also shows that even for the worst time of the flooding, the scores of the individual respondents faced with a given level of flooding were very varied. The most marked distinction in this table appears to be between those who experienced no main room flooding and the others flooded in their main rooms.

Table A4.64 Worst time GHQ Method scores and the maximum depth of flooding in the main rooms

	Maximum depth of main room flooding					
Worst time GHQ Method score (0-12)	None %	<9cm %	10-39 cm %	40-79 cm %	>79 cm %	All %
0 score	49	28	19	15	16	21
Low score 1-3	21	15	16	15	16	16
High score 4-8	21	29	33	32	31	31
Very high score 9-12	10	28	33	37	38	33
Number of respondents	72	87	233	218	197	807

Notes: Chi-square = 53.91; df = 12; p<0.001

For the worst time of flooding, there was a similar significant association between the grouped GHQ Likert scores and depth of flooding (Chi-square = 51.00; df = 20; p<0.001).

Table A4.65 showing mean health effect scores at different depths of flooding summarises the relationship between depth of flooding and the long and short-term health measures. It offers consistent evidence across all the health measures of increasing effects upon physical and mental health with increasing depth of flooding. However, the mean scores mask the great variability in the scores at given depths of flooding.

Table A4.65 Health effects according to the maximum depth of flooding in main rooms

Current health (means)	None %	<9cm %	10-39 cm %	40-79 cm %	>79 cm %	All %
PTSS Intensity	8.8	15.9	18.3	24.4	27.1	21.0
GHQ Likert current	11.3	12.1	12.4	12.8	13.4	12.6
Health at worst time of flood (mean)						
GHQ Likert Worst	13.5	16.7	18.3	19.2	19.8	18.3
Self-reported effects (mean no.)						
Immediate physical	0.5	0.7	0.9	1.2	1.1	1.0
Longer term physical	0.3	0.5	0.6	0.7	0.7	0.6
Psychological effects	0.9	1.7	2.4	2.8	3.1	2.5

A significant proportion (15%) of respondents suffered cellar flooding although this was restricted to a handful of locations. Analysis of these results did not indicate positive correlations as the various scores for those with flooded cellars tended to be lower than for other respondents. Furthermore, for some measures, health effects appeared to decrease with increased depth of cellar flooding.

Warning time

The intention in providing a flood warning service is that, not only should the warning enable residents and businesses to protect people and property in the event of flooding, but that it should also reduce the intangible impacts including the health and stress effects of flooding. However, it appears from the bivariate analysis that the receipt of a warning and warning lead time had little or no effect upon the long or short-term health effects of flooding.

When the grouped PTSS Intensity and current GHQ scores of the warned and unwarned were compared, no significant differences were found. Comparison of the means of the current health effects measures confirmed that the receipt of a flood warning did not have a significant influence on the long-term health effects of the flooding as indicated by t-tests.

Warning lead times grouped as in the table above did not appear to influence significantly current health as measured by the grouped GHQ and PTSS Intensity scores. However, for those who received a warning, there were significant but weak negative correlations between the length of warning time and the scores. The long-term health effects were lower, the longer the warning lead time (Pearson Correlation for warning time and GHQ Likert scores and PTSS Intensity score -0.18 and -0.16 respectively).

In terms of the short-term effects, the only statistically significant differences found were in the grouped GHQ Likert scores for the worst time of the flooding. More of those who did not receive a warning registered higher GHQ Likert scores for the worst time than of those warned. A comparison of the mean worst time GHQ scores of those who did and did not receive a warning confirmed that there were no significant differences in worst time scores.

For those who received a warning, the grouped GHQ scores for the worst time of flooding did not vary significantly according to the number of hours of warning received. However, there were again very weak but statistically significant correlations between warning time in hours and the short-term health effects of flooding as measured by the GHQ scores for the worst time and the self-reported health effects (Pearson Correlation: GHQ Likert for worst time -0.14, immediate physical health effects -0.22, longer term physical health effects -0.21, psychological effects -0.20).

Years since worst flood

We would expect people to recover to some degree from some of the health effects of a flood, particularly the physical health effects, over time and qualitative research (Tapsell *et al.* 1999) suggests this to be the case. Therefore, we would expect those flooded more recently to report more health effects than those flooded a longer time ago.

There were very weak albeit significant negative correlations between the number of months since the worst flood and the health effects measures at the time of the interview suggesting some slight tendency for the health effects to decline with the passage of time (Pearson Correlations: PTSS Intensity: -0.12, GHQ Likert, -0.12). When the months since the worst flood were grouped into four time elapsed periods (see Table A4.66), there were significant differences in the PTSS Intensity scores (grouped) and the grouped current GHQ scores in the different time periods (Current GHQ Likert: Chi-square = 26.36; df = 15; $p<0.05$). The more recently flooded thus tended to report more current symptoms.

Table A4.66 PTSS Intensity scores according to the time elapsed since the worst flood

PTSS Intensity score	< 2.5 yrs (Autumn 2000) %	2.5 - 3 yrs (June 2000) %	3 - 4 yrs (Nov/Dec 1999) %	4 - 5 yrs (Easter 1998) %	All%
0 score: no symptoms	17	19	31	29	21
1-20: very low	50	47	40	49	49
21-41: low	17	14	16	12	15
>41 mild or higher	17	19	13	10	16
Number of respondents	443	72	45	179	739

Notes: *Chi-square = 19.20; df = 9; $p<0.05$.

However, the same significant pattern of diminishing GHQ and Likert scores with the number of years since the worst flood was found for the reports on health effects at the worst time of flooding (worst time GHQ score: Chi-square = 28.87; df=9, $p<0.01$; worst time GHQ Likert: Chi-square = 43.89; df=15; $p<0.01$). Thus, both the measures of health impacts referring to current health and those focused on the time of the flooding declined with the passage of time.

We might expect, too, that the differences between the current GHQ scores and those for the worst time of the flood would be greatest for those flooded the longest time ago because they would have had time to recover as more time passed. However, the reverse was the case suggesting that not only the effects of flooding but also the memory of the experience and its effects at the time of the flood diminishes as time passes as shown in Table A4.67.

Table A4.67 Differences between current and worst time GHQ scores according to time elapsed since the worst flood

PTSS Intensity score	< 2.5 yrs (Autumn 2000) %	2.5 - 3 yrs (June 2000) %	3 - 4 yrs (Nov/Dec 1999) %	4 - 5 yrs (Easter 1998) %	All%
Mean difference: GHQ Method score	3.8	3.5	2.8	3.0	3.5
Mean difference: GHQ Likert score	6.3	5.8	4.7	4.3	5.7
Number of respondents	465	84	46	188	783

Frequency of flooding

Those who experience frequent flooding may be better able to cope with the event because of their prior experience and the event may be less shocking and stressful as a result. Alternatively, the health and stress effects of flooding may be cumulative increasing with the number of events experienced. Simple correlations between the current health effects measures: PTSS Intensity and GHQ scores indicated that there was no significant association between the frequency of flooding both since January 1998 and since living at the address and long term health effects. The number of respondents affected by multiple events was very small and restricted to particular areas and may have limited this analysis.

Flood duration

Associations as shown by the Pearson Correlation Coefficient between the duration of flooding and both the PTSS Intensity and current GHQ Likert scores were found to be very weak and not statistically significant. This was confirmed when the grouped PTSS Intensity scores and GHQ scores were analysed. The duration of flooding, therefore, appeared to have no effect on the long-term health of those flooded.

The duration of the flood event also did not appear to make any difference directly to health effects reported for the worst time of the flood as measured by the GHQ scores. There were however significant if very weak correlations between duration and the subjective rating of the health effects of flooding.

Rooms flooded

There were very weak but significant positive correlations between the number of main parts (i.e. kitchen, living room, bedroom, bathroom) of the dwelling affected and the measures of the current health of the respondents (Pearson Correlation: PTSS Intensity 0.14; GHQ Likert 0.09). However when the scores for these health measures were grouped a significant pattern of association emerged, with the severity of health effects increasing as the number of parts of the home affected increased, as shown in Table A4.68.

Table A4.68 PTSS Intensity scores according to the number of parts of the home affected

PTSS Intensity score	None of the main parts %	One %	Two %	Three %	Four %	All %
0 score: no symptoms	47	22	16	22	20	21
1-20: very low	40	62	52	43	42	49
21-41 low	7	8	16	19	16	15
42-82: mild	3	3	10	15	12	10
>83 moderate or higher	3	5	6	2	11	5
Number of respondents	62	63	404	136	82	747

Notes: Chi-square = 56.10; df = 16; p<0.001

The cross tabulation for the current GHQ Method score with the parts of the home showed the same pattern of increasing scores as the number of parts of the home affected increased (GHQ score: Chi-square = 29.79; df = 12; p<0.01). Only 13% of the minority with no main parts affected scored 4 or more on the GHQ and could thus be considered as potential 'cases' compared with 29% of those with three parts flooded and 27% of those with four parts flooded. However, there was no significant association between the GHQ Likert scores and the number of main parts of the home flooded. It does appear nevertheless that the severity of the long-term health effects of flooding depends to some degree upon the extent of flooding in the home.

When the short-term effects were considered, there were more marked differences in the GHQ Likert scores, for the worst time of the flood according to the number of parts of the dwelling flooded (GHQ Likert worst time: Chi-square = 60.42; df = 20; p<0.001). The mean number of self-reported health effects, particularly psychological effects increased as the number of parts of the home affected increased. The relationships between the various health effects measures and the extent of flooding in the home are summarised in Table A4.69.

It might be expected that the more rooms (including hallways and basements/cellars but not garages) that were flooded, the greater would be the disruption to the household and the burden of getting the home back to normal and thence the health effects of the flooding. However, those with large properties flooded might be expected to have more resources available to aid them in dealing with the flood event. There were very weak but significant correlations between the long-term health effects as measured by the PTSS Intensity score and the GHQ Likert Scores (Pearson Correlation 0.13 and 0.08).

Table A4.69 Health effects by number of main parts of the property flooded

	Number of main parts (rooms) flooded				
Current health	None	One	Two	Three	Four
PTSS Intensity: Mean score	9.2	13.5	22.2	20.4	31.3
GHQ Likert current : Mean score	11.4	12.3	12.5	13.0	13.7
Health at worst time of flood					
GHQ Likert Worst: Mean score	13.8	16.7	18.8	18.8	20.0
Self-reported effects					
Immediate physical effects: Mean No.	0.5	0.6	1.0	1.1	1.0
Longer term physical: Mean No.	0.3	0.2	0.6	0.7	0.9
Psychological effects: Mean No.	0.9	1.2	2.6	2.9	3.3

There were significant differences in the grouped PTSS Intensity scores according to the number of rooms flooded. Many more of those with no rooms or only one room flooded experienced no symptoms (Table A4.70). The same was true of the current grouped GHQ Method score and the number of rooms flooded (Chi-square = 36.75; df = 15; $p<0.01$) but not the current GHQ Likert score.

Table A4.70 PTSS Intensity scores according to the number of rooms flooded

PTSS Intensity score	None or one %	2 %	3 %	4 %	5 %	>5 %
0 score: no symptoms	43	18	16	18	22	19
1-20: very low	45	56	57	48	40	44
21-41: low	8	16	14	17	19	16
42-82: mild	3	11	9	13	13	11
>82 moderate or higher	3	9	4	4	6	11
Number of respondents	80	114	201	189	72	75

Notes: Chi-square = 47.51; df = 20; $p<0.001$

In the short term, the number of rooms flooded also appeared to be a significant factor. When the grouped GHQ and Likert worst time scores were tabulated according to the number of rooms flooded, the distinctions again appeared to be between those with no rooms or just one room flooded and those who had two or more rooms under floodwater (GHQ score: Chi-square = 46.58; df = 15; $p<0.001$; GHQ Likert score: Chi-square = 65.10; df = 25; $p<0.001$).

Table A4.71 summarises the relationships between the extent of flooding as measured by the number of rooms flooded and the long and short-term effects of flooding. Across all the measures of health, both long and short term, an increase in the number of rooms flooded is associated consistently with an increase in the severity of the health effects.

Table A4.71 Health effects according to the number of rooms flooded

Current health (mean score)	None or one	2	3	4	5	>5
PTSS Intensity	8.8	25.0	17.9	21.3	23.4	32.8
GHQ Likert current	11.1	13.2	12.0	12.8	13.4	13.6
Health at worst time of flood (mean score)						
GHQ Likert worst	14.1	18.9	18.4	18.9	19.1	19.7
Self-reported effects (mean number)						
Immediate physical effects	0.5	0.9	1.0	1.1	1.3	1.3
Longer term physical	0.3	0.5	0.5	0.7	0.8	0.9
Psychological effects	0.9	2.3	2.5	2.7	3.2	3.3

A4.7.4 Post-flood characteristics

Parameters considered

As indicated by the subjective rating of the effects of flooding (see Table A4.51), the greatest impact amongst those that have been flooded is associated with 'all the problems and discomfort whilst trying to get the house back to normal' with 40% of respondents stating that the overall effects were 'extremely serious'.

It was considered that the effect of getting the house back to normal would be associated with the scale of the damage (the greater the damage, the greater the impact), problems with insurers/builders (although these factors were not rated that highly in Table A4.51), the need for evacuation, the time taken to get back to normal and support from the community.

Scale of damage

In relation to the scale of damage, the values for insured and uninsured losses were considered (as summarised in Section A4.6). However the analysis was hampered by the fact that many responses to the questions on tangible losses were 'don't knows'. When combined with the PTSS scores (which were derived for 75% of the flooded respondents), this led to a dramatically reduced data set.

It is worth noting that the loss of irreplaceable items was not associated directly with either the long or short-term health effects of flooding as indicated by the Pearson Correlations. Nor did whether or not respondents had lost such items appear to be related to the subjective rating of health effects of flooding and the effects of flooding overall in the correlation analysis.

Problems with insurers/builders

As already indicated, problems with insurers/builders were rated on a scale 0 (no effect/not applicable) to 10 (extremely serious) by the vast majority of respondents (over 85%).

Having insurance can reduce the stress and worry of being flooded and therefore it might be expected that those without insurance would experience more health effects in the short and long term than those who could claim compensation from their insurance company. Of course, whether or not this is the case will depend in part on how efficiently and sympathetically, any insurance claims are handled by the companies. Certainly, there was no simple relationship between having any of the forms of insurance cover and long-term health effects as measured by the grouped PTSS Intensity score or GHQ scores either for the present or the short-term effects indicated by the GHQ scores for the worst time. The small minority without any contents insurance were not found to be subject to more long-term or short-term health effects as measured by the grouped PTSS and GHQ scores.

Qualitative research has showed that flood victims' experiences with insurance companies were very varied, some reporting excellent service and others great difficulties with insurance companies and loss adjusters. Dealing with insurance companies and loss adjusters has been found in qualitative research to be one of the most stressful aspects of flooding for some flooded households (Tapsell *et al.* 1999).

The responses for those who had dealings with insurance companies and loss adjusters were polarised with 39% reporting little or no problems (rating 1 or 2) and 28% reporting serious effects (rating 8, 9 or 10). These subjective ratings were moderately weakly but significantly correlated with measures of current health effects (Pearson Correlation Coefficient: PTSS Intensity and GHQ Likert scores: 0.21, 0.24 respectively) and with GHQ Likert scores for the worst time (0.34). This indicates that dealings with insurers and loss adjusters were a contributory factor in the long-term and more particularly the short-term health effects of flooding.

Respondents were also asked to rate the effects of problems with builders on the same scale. Qualitative research had shown that for some respondents 'cowboy builders' had made the whole experience of being flooded more drawn out and generally more stressful (Tapsell *et al.* 1999). Responses on problems with builders were again somewhat polarised with 29% reporting little or no problems (rating 1 or 2) and 26% reporting serious effects (rating 8, 9, and 10). Many households were in between and thus were affected to some degree by problems with builders.

The subjective ratings of 'problems dealing with builders' were similarly significantly if fairly weakly correlated with long-term health effects as measured by the PTSS Intensity and the GHQ Likert scores for the current time (Pearson Correlation 0.20 and 0.17). These ratings were somewhat more strongly associated with the short-term health effects of the flooding as indicted by the GHQ Likert scores for the worst time (Pearson Correlation 0.31) and the self-reported psychological effects (Pearson Correlation 0.32).

Thus, the experience with builders and insurance companies and loss adjusters during the recovery period appears to have some influence on both the long and short-term health effects of flooding.

Evacuation

Evacuation can be frightening and stressful in itself, particularly when it takes place during the flood event rather than before or after it. Living in temporary accommodation or with relatives or friends brings its own stresses. There are no data available on the timing of the evacuation or the kind of temporary accommodation occupied in the flooded survey. Green *et al.* (1994) found that the subjective severity rating of evacuation was higher for those who stayed with relatives or friends compared with those who stayed elsewhere.

Respondents from households where evacuation had occurred had significantly higher scores for their current health status than households where no one had to leave home. The same was true of health effects reported for the time of the flood (see Table A4.72).

Table A4.72 Health effects by having to leave home

Current health (mean scores)	Someone had to leave home	No one had to leave home
PTSS Intensity	24.2	16.3**
GHQ Likert	13.0	11.9**
Health at worst time (mean scores)		
GHQ Likert Worst	19.6	16.0**
Self-reported effects (mean no.)		
Immediate physical effects	1.1	0.7**
Longer term physical	0.7	0.4**
Longer term physical	3.0	1.5**

Notes: * t-test, p<0.05; ** t-test, p<0.01

There was a moderately strong association between the number of weeks before the household could all live together at home and the subjective rating of the effects of having to leave home (Pearson Correlation 0.45). The duration of the evacuation, thus, was a significant factor in how people felt about leaving home. However, for those who had to evacuate, the length of the time before the whole family could live together at home did not appear to have an influence of the long term health effects of flooding as measures by the PTSS Intensity score and the GHQ Likert scores for the current time (Pearson Correlations 0.08 and 0.08).

Similarly for the health effects at the worst time or at the time of flooding, there appeared to be only weak but significant correlations between the duration of time away from the home and these health effects (Pearson Correlation: worst time GHQ Likert score: 0.11) apart from the self-reported psychological effects which were significantly but very weakly associated with length of evacuation (Pearson Correlation 0.10). Thus, in the bivariate analysis, at least, it was the fact of having to leave home rather that the duration of the evacuation that appeared have an influence on the long and short-term health effects of flooding.

Back to normal

The time taken to get back to normal was reported on by almost all the respondents (99%) as discussed in Section A4.4.10. Correlation analysis did not indicate that the time taken to get back to normal after flooding was of much importance in explaining long-term health effects. There were significant but very weak correlations between the weeks taken to recover and long-term health effects as measured by the PTSS Intensity score and GHQ Likert current scores (Pearson Correlation 0.12, 0.11 respectively).

There was, similarly, a weak but significant association between the time taken to recover and the short-term health effects as indicated by in the GHQ scores for the worst time and the self-reported health effects.

Support from the community

It is unlikely that the amount of help received considered on its own will have a direct effect upon the long-term health effects of flooding. Therefore, it is not surprising that the correlations between the social support rating and the measures of current health were not significant. There were some significant, albeit very weak, positive correlations between the self-reported health effects experienced after flooding and the amount of help received but not with the GHQ scores for the worst time. It remains possible that the amount of social support forthcoming may have some mitigating effect upon the health effects of flooding.

A4.7.5 Results of multivariate analysis

Introduction

The multivariate analysis involved the stepwise rejection of variables from an initial list of 34 variables covering socio-demographic factors (17), flood characteristics (10) and post-flood factors (7) until the remaining variables were considered to be significant. The cut-off for 'significance' was taken as the probability that the observed relationship occurring by chance was less than 0.05 (5%). The analysis was run with and without insured losses. It was found that the inclusion of insured losses led to a substantially reduced data-set (due to numerous unknown values) and to a lower overall degree of explanation. As such the results are presented without insured losses.

PTSS results

The results of the multivariate analysis for the PTSS results (as ln(P+1)) are shown in Table A4.73.

Table A4.73 Stepwise multivariate analysis for ln(P+1)

Number of variables	Number of observations	R^2	R^2 (adj.)	Variable removed from next round of analysis	Prob. that relationship due to chance
34	276	33.7%	24.4%	No. of main parts flooded	1.000
33	276	33.7%	24.7%	Car ownership	0.944
32	277	33.8%	25.1%	Children in household	0.823
31	277	33.7%	25.4%	Flood awareness	0.831
30	277	33.7%	25.6%	Frequency of flooding	0.756
29	277	33.7%	25.9%	Income	0.714
28	344	32.6%	26.6%	Flood duration	0.938
27	355	32.6%	27.0%	Help received	0.756
26	355	32.6%	27.2%	Rented accommodation	0.662
25	357	32.5%	27.4%	Years since flood	0.611
24	357	32.5%	27.6%	Long term illness	0.425
23	357	32.3%	27.7%	Uninsured losses	0.402
22	480	29.9%	26.5%	Sentimental loss	0.967
21	480	29.9%	26.7%	Residence time	0.836
20	480	29.9%	26.8%	Education	0.494
19	554	29.3%	26.8%	Employment	0.497
18	560	29.1%	26.8%	Social grade	0.419
17	567	28.3%	26.0%	House type	0.553
16	567	28.2%	26.1%	Speed of onset	0.542
15	620	28.0%	26.3%	House price	0.159
14	620	27.8%	26.1%	Cellar flooding	0.112
13	620	27.5%	25.9%	Builder problems	0.078
12	620	27.1%	25.7%	No. of rooms flooded	0.054
11	630	26.2%	24.9%	All variables p<0.05	

Table A4.74 Factors influencing ln(PTSS +1) (N=630, R^2 = 0.26, R^2_{adj} = 0.25)

Parameter	Coeff.	St Error	t value[1]	p	Comment
Problems with insurers/loss adjusters (0-10)	0.11	0.02	7.18	<0.0001	Highly significant - stress increases with problems
Prior health (1(poor) - 5)	-0.26	0.05	5.15	<0.0001	Highly significant - those with poor health suffer more stress
Gender (M = 1, F = 2)	0.46	0.11	4.32	<0.0001	Highly significant - women suffer more stress than men
Evacuation (No = 0, Yes = 1)	0.41	0.12	3.39	0.0007	Highly significant - evacuation of household members increases stress
Depth in cm (max of depth in main rooms)	0.0027	0.0009	2.87	0.0042	Significant - stress increases with flood depth
Age Age^2	0.061 -0.0006	0.021 0.0002	2.85 2.89	0.0045 0.0039	Significant - those c54 suffer highest stress
Warning time ln(WT+1)	-0.055	0.020	2.74	0.0064	Significant - increased warning time reduces stress
Time to get back to normal (weeks)	0.0045	0.0018	2.53	0.0115	Significant - stress increases with time taken to get back to normal
Contamination (Yes = 1, No = 2)	-0.35	0.14	2.40	0.0167	Significant - stress increases with contamination
Vulnerable housing (No = 0, Yes = 1)	0.43	0.19	2.26	0.0239	Significant - those in vulnerable housing suffer more stress
Intercept	0.28	0.65	0.43	0.6682	Not significant

Notes: [1] For negative coefficients, the t value would be negative but in this and subsequent tables, t values are presented as absolute values for ease of presentation (in other words t = -1.5 and t = 1.5 are both presented as t = 1.5).

Current GHQ-12 results

The multivariate exercise was repeated for the current GHQ-12 Likert score for comparison (since both are measures of the respondent's current well-being) and the results are shown in Table A4.75.

Table A4.75 Stepwise multivariate analysis for current GHQ-12 Likert score

Number of variables	Number of observations	R^2	R^2 (adj.)	Variable removed from next round of analysis	Prob. that relationship due to chance
34	306	25.0%	15.6%	Age (squared)	0.836
33	306	25.0%	15.9%	Vulnerable housing	0.815
32	306	25.0%	16.2%	House type	0.840
31	311	24.7%	16.3%	Cellar flooding	0.823
30	311	24.7%	16.6%	Flood depth	0.810
29	313	24.8%	17.1%	Car ownership	0.826
28	314	25.0%	17.6%	Frequency of flooding	0.716
27	314	24.9%	17.8%	Education	0.716
26	355	23.5%	17.4%	Builder problems	0.983
25	355	23.5%	17.7%	Speed of onset	0.942
24	379	22.6%	17.3%	Flood awareness	0.621
23	379	22.5%	17.5%	Sentimental loss	0.583
22	379	22.5%	17.7%	No. of rooms flooded	0.504
21	386	21.9%	17.4%	Years since flood	0.456
20	386	21.7%	17.5%	No. of main parts flooded	0.417
19	386	21.6%	17.5%	Employment	0.358
18	388	21.3%	17.5%	Flood duration	0.375
17	406	19.2%	15.7%	Long term illness	0.423
16	406	19.1%	15.8%	Age	0.356
15	406	18.9%	15.8%	Children in household	0.261
14	406	18.7%	15.7%	Gender	0.251
13	406	18.4%	15.7%	Warning time	0.226
12	441	16.0%	13.7%	Residence time	0.285
11	441	15.8%	13.7%	Income	0.388
10	553	15.5%	13.9%	Rented accommodation	0.351
9	557	15.6%	14.3%	Social grade	0.236
8	566	14.9%	13.7%	Uninsured losses	0.254
7	753	12.5%	11.7%	All variables $p<0.05$	

The analysis resulted in seven significant variables as shown in Table A4.76. Given the relatively poor correlation ($R^2_{adj} = 0.12$) and the potential impact of the relatively late rejection of the variable 'uninsured losses', it was decided to rerun the analysis without uninsured losses (and without insured losses). Although this led to slightly fewer data observations, the correlation was marginally higher ($N=746$, $R^2 = 0.14$, $R^2_{adj} = 0.13$). Apart from uninsured losses, the parameters listed in Table A4.76 re-emerged as significant ($p<0.05$) variables, with the exception of evacuation, together with two further variables - years since flood and rented accommodation.

Table A4.76 Factors influencing current GHQ-12 Likert score (N=753, R^2 = 0.13, R^2_{adj} = 0.12)

Parameter	Coeff.	St Error	t value	p	Comment
Intercept	16.99	1.11	15.36	<0.0001	Highly significant
Prior health (1(poor) - 5)	-0.98	0.18	5.54	<0.0001	Highly significant - those with poor health suffer more effects
Problems with insurers/loss adjusters (0-10)	0.28	0.05	5.14	<0.0001	Highly significant - adverse effects increase with problems
Time to get back to normal (weeks)	0.020	0.006	3.31	0.0010	Highly significant - adverse effects increase with time taken to recover
Contamination (Yes = 1, No = 2)	-1.44	0.50	2.85	0.0044	Significant - adverse effects increase with contamination
Help received (0-50)	-0.068	0.028	2.43	0.0152	Significant - adverse effects decrease if help received
Evacuation (No = 0, Yes = 1)	0.98	0.41	2.40	0.0165	Significant - evacuation of household members increases stress
Area house prices (1 = high, 5 = low)	-0.27	0.12	2.19	0.0290	Significant - adverse effects increase with area house price

However, as a measure of the long term psychological effects of past flooding, it would appear that the PTSS scores (as ln(P+1)) provide a more reliable indication than the current GHQ scores (however analysed) as they are more readily explained by the variables under consideration. Finally, it is worth noting that for all the significant factors listed in Table A4.74 and Table A4.76, the coefficients are of the direction (i.e. positive or negative) which might be expected.

GHQ-12 results for the 'worst time'

The extent of short-term psychological impacts due to flooding was indicated by the GHQ-12 score at the 'worst time'. As before, for the multivariate analysis, the GHQ-12 Likert score was used and the results are shown in Table A4.77 and Table A4.78.

Table A4.77 Stepwise multivariate analysis for the GHQ-12 Likert score at the worst time

Number of variables	Number of observations	R^2	R^2 (adj.)	Variable removed from next round of analysis	Prob. that relationship due to chance
34	308	34.2%	26.1%	Flood duration	0.944
33	317	34.6%	27.0%	Cellar flooding	0.997
32	317	34.6%	27.2%	Car ownership	0.902
31	318	35.0%	27.9%	Flood depth	0.827
30	320	35.0%	28.2%	Sentimental loss	0.750
29	320	34.9%	28.4%	Years since flood	0.670
28	320	34.9%	28.6%	House type	0.623
27	320	34.8%	28.8%	Employment	0.616
26	322	34.8%	29.0%	Frequency of flooding	0.648
25	322	34.7%	29.2%	House price	0.574
24	322	34.7%	29.4%	Residence time	0.521
23	322	34.6%	29.5%	Help received	0.493
22	322	34.5%	29.6%	Speed of onset	0.471
21	348	28.8%	24.2%	Children in household	0.625
20	348	28.8%	24.4%	Social grade	0.571
19	352	28.6%	24.5%	Builder problems	0.390
18	352	28.4%	24.5%	No. of main parts flooded	0.358
17	352	28.2%	24.6%	No. of rooms flooded	0.640
16	357	28.2%	24.8%	Education	0.427
15	407	28.9%	26.2%	Flood awareness	0.510
14	407	28.9%	26.3%	Long term illness	0.299
13	407	28.7%	26.3%	Income	0.251
12	513	27.7%	26.0%	Vulnerable housing	0.134
11	521	26.7%	25.1%	All variables p<0.05	

Table A4.78 Factors influencing GHQ-12 Likert score at the worst time (N=521, R^2 = 0.27, R^2_{adj} = 0.25)

Parameter	Coeff.	St Error	t value	p	Comment
Problems with insurers/loss adjusters (0-10)	0.63	0.09	6.68	<0.0001	Highly significant - effects increase with problems
Gender (M = 1, F = 2)	2.20	0.63	3.50	0.0005	Highly significant - men suffer less than women
Evacuation (No = 0, Yes = 1)	2.33	0.70	3.34	0.0009	Highly significant - evacuation of household members increases effects
Uninsured losses (as ln(U+1))	0.34	0.10	3.25	0.0012	Significant - effects increase with scale of uninsured losses
Prior health (1(poor) - 5)	-0.97	0.31	3.14	0.0018	Significant - those in poor health suffer more
Age Age^2	0.38 -0.0035	0.12 0.0011	3.08 3.15	0.0022 0.0017	Significant - those c54 suffered most

Table A4.78 Factors influencing GHQ-12 Likert score at the worst time ($N=521$, $R^2 = 0.27$, $R^2_{adj} = 0.25$)

Parameter	Coeff.	St Error	t value	p	Comment
Time to get back to normal (weeks)	0.036	0.013	2.84	0.0047	Significant - adverse effects increase with time taken to recover
Contamination (Yes = 1, No = 2)	-2.14	0.83	2.59	0.0100	Significant - effects increase with contamination
Rented accommodation (No = 0, Yes = 1)	2.60	1.07	2.43	0.0153	Significant - effects increase if property rented
Warning time ln(WT+1)	-0.27	0.12	2.33	0.0200	Significant - increased warning time reduces effects
Intercept	5.80	3.83	1.51	0.1306	Not significant

For completeness, the analysis was rerun without uninsured losses as a variable. Although this led to more data observations, the correlation was slightly lower ($N=727$, $R^2 = 0.26$, $R^2_{adj} = 0.24$). Apart from uninsured losses, the parameters listed in Table A4.78 re-emerged as significant ($p<0.05$) variables with the exception of warning time and rented accommodation together with five further variables - problems with builders, flood awareness, help received, long-term illness and vulnerable housing.

A4.7.6 Review of multivariate results

Overview

As outlined in the previous sub-section, it is apparent that various types of factors all influence the resultant health effects. This finding is entirely consistent with that found in the earlier pilots (during Phase 1 and Phase 1A).

Degree of worry

As discussed earlier (see Section A4.3.2), flooded respondents were asked to rate their degree of worry over flooding in the next 12 months on a scale 1 (not worried) to 5 (very worried). If 'worry' is added to the list of parameters presented in Table A4.74 and the multivariate analysis for the PTSS Intensity scores repeated, the degree of worry becomes the dominant factor (with a t value of 14) and the overall degree of explanation increases as shown below:

- results from Table A4.74: N=630, $R^2 = 0.26$, $R^2_{adj} = 0.25$; and
- results if worry is included: N=627, $R^2 = 0.43$, $R^2_{adj} = 0.42$.

This finding is unsurprising in that the degree of worry over future flooding is likely to be largely influenced by the stress (i.e. as measured by the PTSS Intensity score) caused by a past flood event (within the last few years).

Review of residuals

In multivariate analysis, it is important to review the residuals (i.e. the difference between the predicted and observed values) against each variable. The first step was to review the plots of the residuals (and the squares of the residuals) against each variable to ensure that their distribution was even across the range of the variable. Where there is a significant variation, this represents heteroscedasticity - in other words, the variation in the dependent variable is not correctly modelled using a linear function of the independent variable. This can be formally checked using the Goldfield-Quandt test in which the data are ordered by the suspect variable, multivariate regression analyses are undertaken on two portions of the sorted data and the sum of the squares of residuals compared. For the PTSS analysis (see Table A4.74), very little variation in the residuals and their squares was observed. This also applied to most of the significant variables considered in the GHQ analysis (for the 'worst time' - see Table A4.78).

However, there was one exception - the time taken to get back to normal. Figures A4.3 and A4.4 illustrate the variation in residuals and their squares respectively.

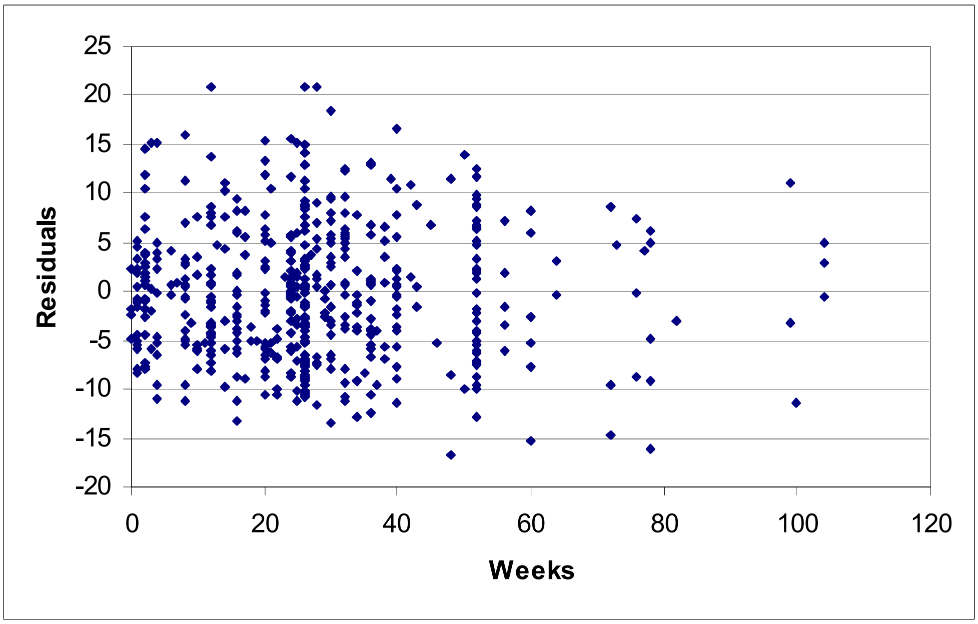


Figure A4.3: Plot of residuals for GHQ at the worst time against time taken to get back to normal (weeks)

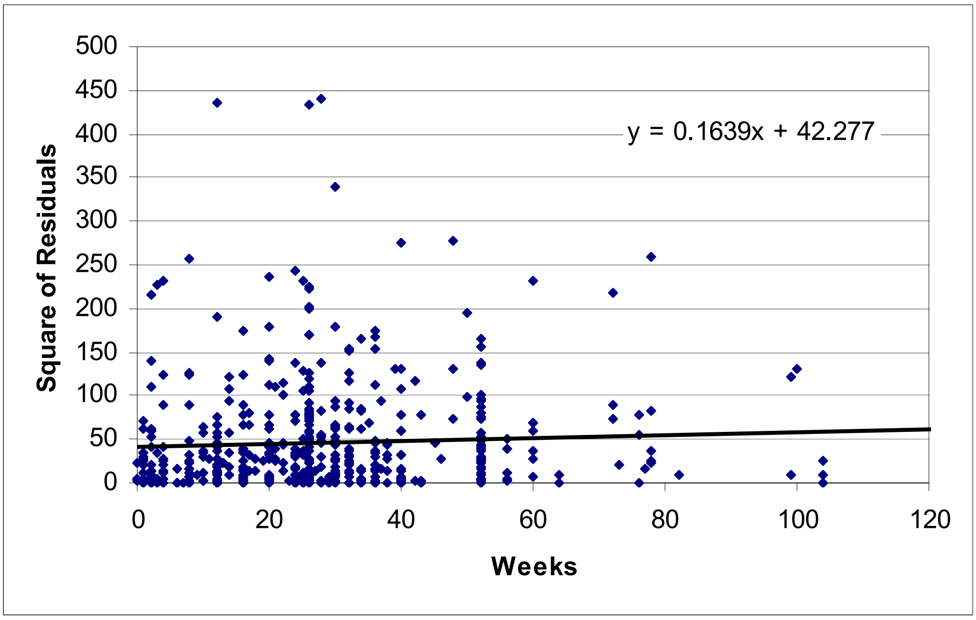


Figure A4.4: Plot of square of residuals for GHQ at the worst time against time taken to get back to normal (weeks)

Although Figure A4.3 does not reveal an obvious trend in the pattern of residuals, Figure A4.4 suggests that there is a slight increase in variability with longer recovery times. Whether such variation is 'significant' can be determined from the Goldfield-Quandt (GQ) test. In this example, the raw data (521 observations) were sorted by the time taken to get back to normal and two regression runs undertaken - one for the first 230 observations (i.e. for those respondents who were back to normal within six months) and one for the last 230 observations (i.e. for those respondents who were took longer than six months to get back to normal). The resultant sums of the squares of the residuals were 8,375 and 11,743 respectively to give a (GQ) ratio of 1.40. The associated degrees of freedom for the residuals in each regression were 218 (230 observations - (11 variables + 1 intercept)).

If there is no significant difference between the two populations (the null hypothesis), the critical F value should be greater than the GQ ratio - and the presence of heteroscedasticity can be discounted. The critical value of $F_{218,218}$ at the 95% confidence level is 1.25. Since this value is less than the GQ ratio of 1.40, it was concluded that there is some evidence of heteroscedasticity (to the 95% confidence level) - but this finding did not extend to the other variables considered (in the PTSS and the GHQ at the worst time analyses).

Relative importance of factors

The relative importance of each factor depends not only on its statistical significance (as indicated by the t and p values) but also by its contribution to the overall total. This was determined from the product of the potential range in value of each factor and the associated coefficient and comparing that with the total of all such products.

For the PTSS scores and excluding 'worry', the top four factors (which accounted for 67% of the overall total) were problems with insurers (17%), prior health (16%), flood depth (12%), age (11%) and time taken to get back to normal (10%).

For the GHQ Likert scores at the worst time, the top five factors (which accounted for 66% of the overall total) were problems with insurers (18%), age (13%), time taken to get back to normal (13%), prior health (11%) and uninsured losses (10%).

A4.8 Analysis of WTP Responses

A4.8.1 Introduction

The analysis of the WTP responses is presented as follows:

- an overview of the responses (Section A4.8.2);
- a review of reasons for WTP (Section A4.8.3);
- a review of high (more than £1,000 per year) values (Section A4.8.4);
- a review of reasons for non-WTP and assignment of 'zero' bids (Section A4.8.5);
- derivation of WTP values, taking account of the above factors (Section A4.8.6);
- a review of the influence of the payment scale used (Section A4.8.7);
- analysis of WTP against stress results (Section A4.8.8);
- multivariate analysis of WTP values for at risk respondents (Section A4.8.9); and
- multivariate analysis of WTP values for flooded respondents (Section A4.8.10).

A4.8.2 Overview

More than 60% of respondents had, in principle, a willingness to pay (WTP) to avoid the stress effects of flooding as shown in Table A4.79. Further detail on the valuation results is presented below.

Table A4.79 Those in favour of paying something towards improvements

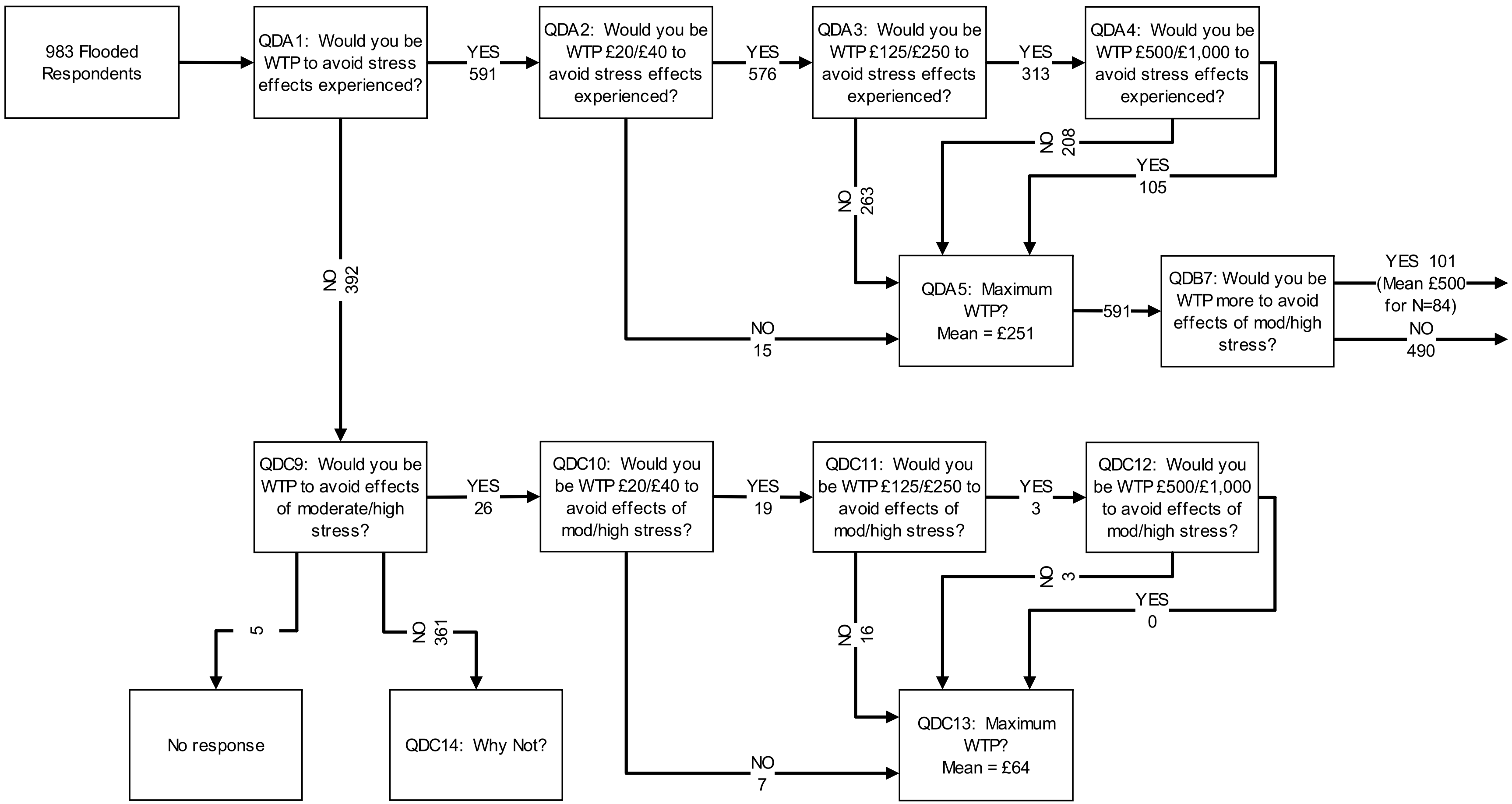
Respondents	N	N respondents WTP to avoid		N not WTP	%WTP to avoid stress effects
		Actual or low/ mild stress effects	Moderate/high stress effects[1]		
Flooded	983	591	617 = 591 + 26	366	63%
At risk	527	320	342 = 320 + 22	185	65%
All	1510	911	959 = 911 + 48	551	64%

Note: [1] The number of respondents WTP to avoid moderate/high stress effects is based on the number WTP to avoid actual or low/mild stress effects <u>plus</u> those who were not WTP to avoid actual or low/mild stress effects but were WTP to avoid moderate/high stress effects.

A more detailed breakdown of the responses is shown in Figures A4.5 and A4.6.

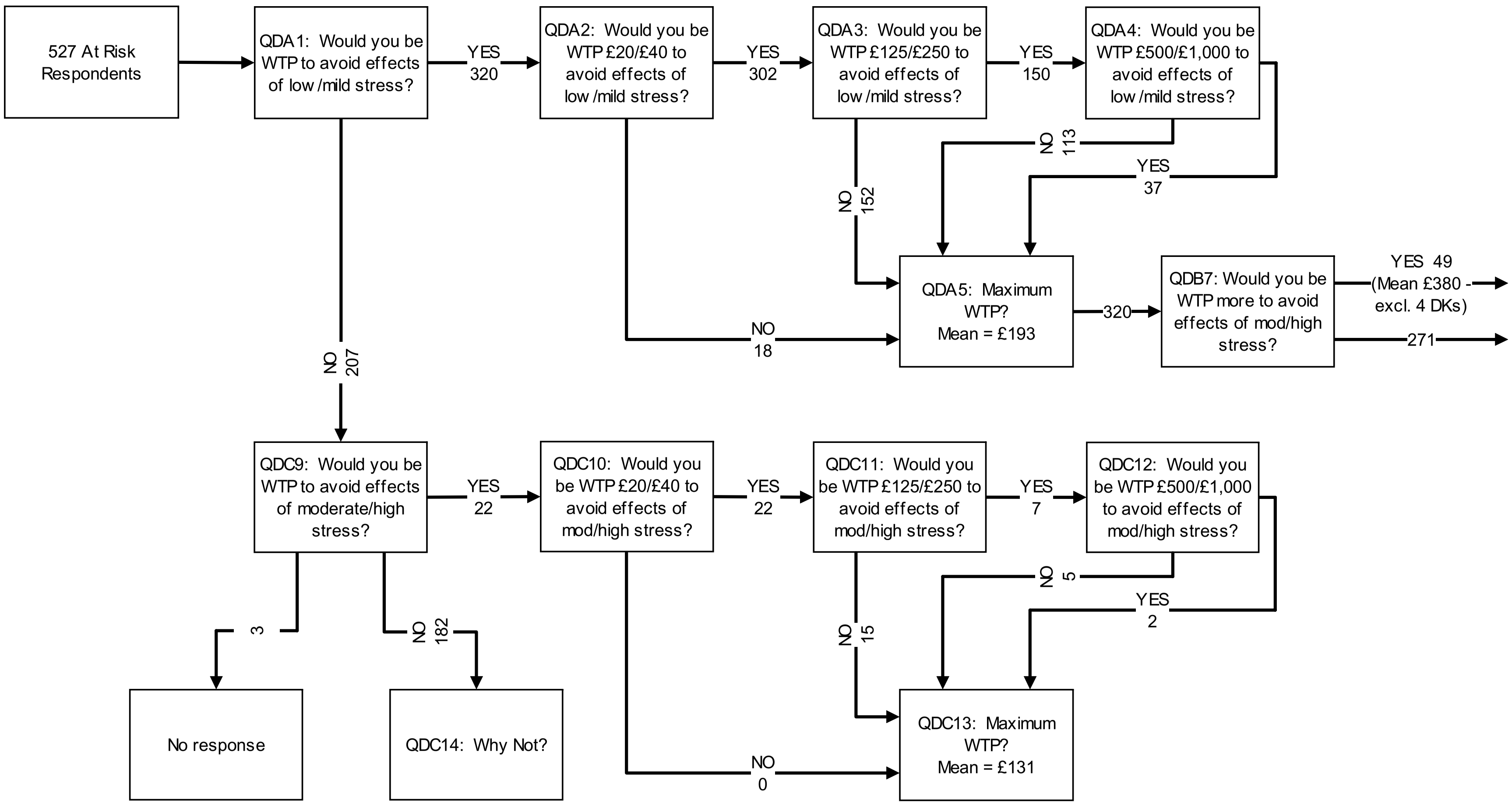
The valuation questions for both questionnaires are attached (see Section D of the 'flooded' and 'at risk' questionnaires in Annex 3). Both questionnaires introduce the concept of payment with the question:

> *Would you in principle be in favour of paying something towards improvements in flood defence to ensure that you and other members of your household do not experience such stress effects?* (Qn QDA1).



Variant	Colour	Stress Scale	WTP Scale
1	Yellow	Actual & High	£20, £125, £500
2	Pink	Actual & Moderate	£20, £125, £500
3	Blue	Actual & High	£40, £250, £1,000
4	Green	Actual & Moderate	£40, £250, £1,000

Figure A4.5 Overveiw of WTP response for flooded respondents



Variant	Colour	Stress Scale	WTP Scale
1	Yellow	Mild & High	£20, £125, £500
2	Pink	Low & Moderate	£20, £125, £500
3	Blue	Mild & High	£40, £250, £1,000
4	Green	Low & Moderate	£40, £250, £1,000

Figure A4.6 Overveiw of WTP response for at risk respondents

Note that 'such effects' relate to actual effects for flooded respondents and low or mild stress effects for those at risk (depending on the questionnaire variant).

The results are shown below in Table A4.80, from which it can be seen that 591 (60%) and 320 (61%) of flooded and at risk respondents respectively were in favour.

Table A4.80 In favour of paying something towards improvements to avoid actual or low/mild stress effects

Respondents	Question	N	N yes	% yes
Flooded	QDA1	983	591	60%
At risk	QDA1	527	320	61%
All		1510	911	60%

Of those who were prepared to pay (see Table A4.81), the mean annual WTP was £251 (flooded) and £193 (at risk).

Table A4.81 Initial annual WTP to avoid actual or low/mild stress effects

Respondents	Question	N	Mean	Median	Max
Flooded	QDA5	591	£251	£125	£5,000
At risk	QDA5	320	£193	£115	£1,000

For those flooded respondents who provided an initial WTP, the question (Valuation Question QDB7) was asked as to whether they would be prepared to pay more to avoid 'moderate' or 'high' stress effects which may or may not have been experienced. 84 respondents increased their WTP with mean and median values of £500 and £250 respectively (and a maximum bid of £10,000 per year). 17 respondents stated that they would increase their WTP but did not provide a value.

For those at risk respondents who provided an initial WTP, the question (Valuation Question QDB7) was asked as to whether they would be prepared to pay more to avoid 'moderate' or 'high' stress effects. 45 respondents increased their WTP with mean and median values of £380 and £250 respectively (and a maximum bid of £2,000 per year). Four respondents stated that they would increase their WTP but did not provide a value.

For those who did not provide an initial WTP, the question (Valuation Question QDC9) was asked as to whether they would, in principle, be in favour of paying to avoid 'moderate' or 'high' stress effects (depending on the questionnaire variant) which, for the 'flooded' respondents, may or may not have been experienced. 26 and 22 of the flooded and at risk respondents respectively who did not provide an initial WTP were WTP to avoid moderate/high levels of stress. The results are summarised in Table A4.82.

Table A4.82 WTP to avoid moderate or high stress effects for those not WTP to avoid actual or low/mild stress effects

Respondents	Initial WTP	Question	N	Mean	Median	Max
Flooded	No	QDC9	26	£64	£33	£250
At risk	No	QDC9	22	£131	£90	£1,000

A4.8.3 Reasons for WTP

Respondents were asked (QDA6) to provide the main reason for WTP for improved flood defence. The results are summarised in Table A4.83 and demonstrate that the responses are very similar from both flooded and at risk respondents.

Table A4.83 Main reasons for WTP

Reason	Flooded respondents	At risk respondents	All respondents
I would like to avoid the stress effects described	246 (44%)	95 (31%)	341 (39%)
I would like to avoid damage to my property and contents	122 (22%)	98 (32%)	220 (25%)
I am concerned about others in this area	37 (7%)	26 (8%)	63 (7%)
I would like to avoid my property losing its value	21 (4%)	11 (4%)	32 (4%)
I would like to avoid the impacts on my physical health	20 (4%)	9 (3%)	29 (3%)
It is a good cause	16 (3%)	8 (3%)	24 (3%)
I would like to avoid loss of my irreplaceable items	6 (1%)	10 (3%)	16 (2%)
I would like to avoid stress to my pets	1 (0.2%)	0 (0%)	1 (0.1%)
Other (see below)	93 (17%)	54 (17%)	147 (17%)
N respondents	562	311	873

Table A4.83 indicates that over 60% of respondents (both flooded and at risk) stated that the main reason for WTP was either avoidance of stress or damage to property to contents. The next most significant reason was ‘other’ and a sample of responses is presented in Table A4.84. Such responses are generally representative of the ‘other’ category and, say, 80% or more of the responses relate to avoiding the general experience of flooding.

Table A4.84 'Other' reasons for WTP

Flooded respondents (every 10th response)	At risk respondents (every 6th response)
avoid overall grief for all people affected	as important as each other
disruption to normal life and after effects	avoidance of disruption
I do not have stress, but don't want the upheaval again	decreasing the worry
less worry	for a number of reasons too many to count
peace of mind	keeps insurance down and peace of mind
peoples well-being/security	peace of mind
to avoid flooding	to avoid being flooded
to improve the strand area	to prevent flooding
want to know where the money is being spent	wouldn't be willing *(sic)*

Although there was a minority (10%) of responses which did not relate to avoiding direct impacts on the household (with particular reference to 'concerned about others in the area' and 'it is a good cause' - see Table A4.83), about a quarter of respondents were thinking about damage to their property and contents (i.e. tangible losses) in providing a WTP value. It could be argued that such responses should not be considered further as the emphasis of the valuation questions was on the 'intangible' losses. It should be noted that in the introductory text (to Section D of the questionnaires - see Annex 3), respondents were asked to disregard tangible losses and to focus on the stress and hassle aspects of flooding.

This illustrates the practical difficulty in asking people to focus on just one aspect of an event which could impact upon them in a variety of ways. Clearly, this of particular concern if the associated WTP values are significantly affected by the impact being considered. Table A4.85 presents a comparison of the WTP values (in response to QDA5) for those who did and did not identify tangible losses as the main reason for WTP.

Table A4.85 Variation of (initial) WTP with main reason for WTP

Respondents	Main reason for WTP	N	Mean	Median	Max
Flooded	Damage to property/contents	122	£259	£125	£3,000
	Other reasons	469	£249	£125	£5,000
At risk	Damage to property/contents	98	£219	£125	£1,000
	Other reasons	222	£182	£100	£1,000

For flooded respondents, the WTP values are very close whether or not damage to property/contents was identified as the main reason for WTP. However, for the at risk respondents, the WTP values are slightly higher where damage to property/contents was identified as the main reason for WTP.

For the purposes of the analysis which follows, all WTP values were retained on the grounds that excluding those for which damage to property/contents had been identified would not result in major changes to the overall WTP values.

A4.8.4 High WTP values

Mean values are strongly influenced by high values in datasets. To minimise such effects, all WTP values of greater than £1,000 per year were reviewed in order to assess whether the values could be regarded as valid. By way of example, a WTP value representing a significant portion of household income is unlikely to be valid. In each case, the coded responses to the whole questionnaire were reviewed together with verbatim comments (where provided). The results are summarised in Table A4.86.

Table A4.86 Review of highest WTP values

Respondent	WTP value	Age M/F	House hold[1]	House type[2]	Social grade	Annual Income	Verdict
1. Flooded	£5/10,000	41F	4A/3C	Terr	C2	£20-30k	Invalid
2. Flooded	£3,000	54F	3A	Bung	DE	£30-40k	Valid?
3. Flooded	£2,000	65F	1A	Terr	DE	£5-10k	Valid?
4. Flooded	£2,000	36M	2A/1C	Det	AB	>£50k	Valid
5. Flooded	£2,000	43M	2A/1C	Terr	AB	£30-40k	Valid
6. At risk	£2,000	43M	2A/2C	Det	AB	>£50k	Valid
7. Flooded	£1,600	56M	2A	Det	AB	not given	Valid
8. Flooded	£1,500	36M	2A	Terr	AB	£40-50k	Valid
9. Flooded	£1,500	48M	3A/1C	Det	C1	>£50k	Valid
10. Flooded	£1,500	55F	2A	Det	AB	£40-50k	Valid

Notes: [1] A and C refer to the numbers of adults and children in the household.
[2] Terr, Bung and Det refer to terrace house, bungalow and detached house respectively.

The results of the review suggested that there were three potentially invalid WTP responses on the basis that the WTP values represented 10% or more of household income. These three responses corresponded to those of respondents 1 to 3 in Table A4.86 and are outlined further below:

- Respondent 1 was flooded in autumn 2000 to moderate depth (76cm) six weeks after moving in. Respondent 1 had considerable difficulties with insurers and builders and scored relatively highly on the PTSS scale (border of mild/moderate effects). Although clearly affected by the flooding, the WTP values offered of £5,000 (to avoid actual effects) and £10,000 (to avoid high stress effects) appear unrealistic when considering their income and social circumstances. On this basis, the WTP values were deemed to be invalid and were not included in further analysis;
- Respondent 2 was flooded in autumn 2000 to a slight depth (5cm) for the first time after living in the house for over 20 years. Respondent 2 had considerable difficulties with builders and scored relatively highly on the PTSS scale (mild effects). Although the WTP value appears high when judged against income, the

verbatim comments provided indicate that the respondent had calculated the WTP value with reference to other charges paid by the household (council tax, utility bills, etc.). On this basis, it was concluded that this person had made an informed (and affordable) choice on their WTP and the value was carried forward in the analysis; and

- Respondent 3 was flooded in autumn 2000 to a moderate depth (36cm) for the first time after living in the house for eight years. Respondent 3 had considerable difficulties with builders and it took over a year for her to get back to normal. Respondent 3 scored highly on the PTSS scale (moderate effects). Although the WTP value is high when judged against income, the verbatim comments provided indicate that the respondent was aware that she would have to make sacrifices to meet such payments (and, indeed, recognised that there might be some difficulties in maintaining the payments in the longer term). However, for the purposes of this analysis, it was considered that the WTP value offered was genuine and affordable (at least in the short term).

A4.8.5 Analysis of non-WTP responses

366 flooded and 185 at risk respondents (36% of total) were not in favour, in principle, of paying to avoid the stress effects of flooding. Of these, 355 flooded and 175 at risk respondents provided a reason. The reasons given (to QDC14) are grouped by category as indicated in Table A4.87.

Table A4.87 Main reasons for non-WTP

Reason[1]	Flooded respondents	At risk respondents	All respondents
The government or council should pay for this	91 (26%)	40 (23%)	131 (25%)
I object to paying higher taxes	78 (22%)	34 (19%)	112 (21%)
I cannot afford to pay	71 (20%)	37 (21%)	108 (20%)
I do not believe flood defence will be improved	18 (5%)	4 (2%)	22 (4%)
I do not believe I am at risk of being flooded	16 (4.5%)	26 (15%)	42 (8%)
I do not believe I will suffer from stress in the event of a flood	12 (2.5%)	10 (6%)	22 (4%)
Water companies or industry should pay for this	11 (3%)	8 (5%)	19 (4%)
Other people causing flooding should pay	10 (3%)	2 (1%)	12 (2%)
I have already taken flood protection measures and hence do not need improvements to flood defence	6 (2%)	1 (0.6%)	7 (1%)
I do not believe flood defence improvements can help me avoid stress effects	3 (1%)	3 (2%)	6 (1%)
Other	39 (11%)	10 (6%)	49 (9%)
N respondents	355	175	530

Notes: [1] Reasons provided in italics are (potential) 'protest' votes - see below.

The distribution of reasons for non-WTP for both sets of respondents are very similar - although a significantly greater number (15%) of at risk respondents did not believe that they were at risk of flooding. Over 40% of responses relate to government expenditure with a further 20% of respondents stating that they could not afford to pay.

The treatment of non-responses in WTP surveys is an important issue with particular regard to determining which (non) responses represent a 'genuine' zero value bid (for example due to being unable to afford a payment). In other cases, respondents do not provide a valuation of the benefits being offered on the grounds that others (usually the government) should provide the benefits in any event. These are sometimes referred to as 'protest' bids (DTLR, 2002).

The reasons listed in Table A4.87 in italics represent responses which cannot be considered to represent a 'genuine' zero value bid. In relation to *Other* reasons, the verbatim comments provided by the flooded respondents were reviewed and categorised into 18 'zero' and 21 'non-responses'. This information was not available for the at risk respondents and, to err on the side of caution, all ten were assumed to be 'non-responses'.

A4.8.6 Revised WTP values

The WTP data sets were modified to incorporate the 'genuine' zero bids and 'non-responses' together with the very high WTP bids (of £5,000 and £10,000) were removed. As explored in earlier sections, less than 5% of flooded respondents suffered moderate or high stress effects (see Table A4.45). The prime WTP value of concern is therefore that associated with the 'initial' value offered to avoid actual or low/mild stress effects. The revised WTP values are shown in Table A4.88.

Table A4.88 Initial annual WTP to avoid actual or low/mild stress effects (incorporating zero bids)

Respondents	Question	N	Mean	Median	Max
Flooded	QDA5	734	£196	£80	£3,000
At risk	QDA5	401	£154	£52	£1,000

A4.8.7 Influence of the payment scale used

Two payment scales were used in the WTP questions:

- Low in variants 1 (yellow) and 2 (pink) - £20, £125, £500 and
- High in variants 3 (blue) and 4 (green) - £40, £250, £1,000.

An issue to be considered is whether the results were dependent on the scale used (also referred to as starting point effects). The percentages of respondents with non-responses and with an initial WTP together with the associated mean values (for the initial WTP questions - QDA5) are shown in Table A4.89 and Table A4.90 for flooded and at risk respondents respectively.

Table A4.89 Responses by payment scale - flooded respondents

Scale - Variant	N	%Non-response[1]	%Initial WTP[2]	Mean WTP[3]
Low - 1	264	23%	61%	£220
Low - 2	245	24%	62%	£228
High - 3	244	27%	59%	£307
High - 4	230	28%	57%	£219
All	983	25%	60%	£243

Notes: [1] % of respondents who were not WTP in principle due to a view that others should pay (i.e. 'protest' bids).
[2] % of respondents who were WTP in principle to avoid actual stress effects (QDA1).
[3] Mean initial WTP of those willing to pay to avoid actual stress effects.

Table A4.90 Responses by payment scale - at risk respondents

Scale - Variant	N	%Non-response[1]	%Initial WTP[2]	Mean WTP[3]
Low - 1	135	23%	61%	£148
Low - 2	107	23%	64%	£221
High - 3	130	27%	55%	£207
High - 4	155	23%	63%	£203
All	527	24%	61%	£193

Notes: [1] % of respondents who were not WTP in principle due to a view that others should pay (i.e. 'protest' bids).
[2] % of respondents who were WTP in principle to avoid low/mild stress effects (QDA1).
[3] Mean initial WTP of those willing to pay to avoid low/mild stress effects.

As already indicated, the percentages of flooded and at risk respondents who were prepared to offer an initial WTP were very similar (around 60%). Similarly, the overall percentages of non-responses (i.e. those not WTP after allowing for 'genuine' zero bids) are very similar for both sets of respondents (at around 25%). There is also little variation amongst these two values by variant.

For the flooded respondents (see Table A4.89), although marginally fewer respondents offered an initial WTP and marginally more offered non-responses to the 'high' payment scale, this cannot be associated with the payment scale, since the 'in principle' questions (QDA1 and QDC9) make no reference to payment values (as these come in subsequent questions). For the at risk respondents (see Table A4.90), there are no obvious biases in the percentage figures between the low and high payment scales - although, curiously, variant 3 appeared to attract fewer WTP respondents - which, as for the flooded respondents, would not be expected in any event (since the in principle questions make no reference to payment scales).

In relation to the mean values, it would appear that the payment scale used has very little influence on the WTP value - although mean values (in all cases) are influenced by a small number of high values. Interestingly, the mean values of the logarithmic expression ln(WTP+1) are near-identical for the 'low' and 'high' variants for both sets of respondents[5].

A4.8.8 WTP values as a function of stress

All respondents were given the opportunity of offering two WTP values:

- an initial WTP value to avoid actual (flooded respondents) or low/mild stress effects (at risk respondents); and
- a further WTP value to avoid moderate/high stress effects (all respondents).

As explored above, some respondents made two 'zero' bids (as they were not, in principle, WTP to avoid any stress effects). Relatively few respondents made an initial zero bid followed by a WTP value to avoid moderate/high stress effects[6]. Most respondents provided an initial WTP value and some of these provided an increased WTP value to avoid more severe effects.

In order to explore the variation of WTP with stress, use was made of a simple scale from 1 (low stress effects) to 4 (high stress effects) as shown in Table A4.91. Responses were coded by the level of stress actually recorded by the respondent and by the set of stress characteristics which respondents were asked to consider (which was determined by the variant being used).

Table A4.91 Coding of stress effects

Stress Scale	Actual PTSS score (flooded)	Initial effects considered (at risk)	Further effects considered (all)
1 - Low	0 - 41	Variants 2 and 4	
2 - Mild	42 - 82	Variants 1 and 3	
3 - Moderate	83 - 147		Variants 2 and 4
4 - High	148 - 272		Variants 1 and 3

At risk respondents

For the at risk respondents, there was a slight increase in WTP values as respondents moved from the lower (low/mild) stress effects to the higher (moderate/high) stress effects. However, the expected increase in WTP values from valuing low to mild and from moderate to high stress effects was not generally detected as shown in Table A4.92.

5 For the flooded respondents, the mean values for the low (variants 1 and 2) and high (variants 3 and 4) payment scales were 4.81 (£122) and 4.85 (£126) respectively. For the at risk respondents, the corresponding figures were 4.65 (£104) and 4.63 (£102).

6 Note that in all cases where respondents offered a WTP value for moderate/high stress effects but not an initial WTP value (for actual effects), an initial WTP value of £0 was assumed.

Table A4.92 WTP for at risk respondents by level of stress effects (incorporating zero bids)

Variant	Stress Effects	N	WTP (mean)	WTP (median)
2 and 4	Low	213	£165	£50
1 and 3	Mild	210	£128	£50
2 and 4	Moderate	213	£184	£65
1 and 3	High	210	£157	£78
All	All	846	£158	£52

These results suggest that respondents tend to value 'stress' effects in general as opposed to being able to adjust their WTP to the precise set of stress characteristics presented (as listed in Table A4.46).

Flooded respondents

For a significant proportion of flooded respondents (24%), it was not possible to derive a PTSS stress score which reduced the number of WTP relevant values for 'actual' effects (since these could not be associated with a particular level of stress). However, in some cases, these respondents had provided a WTP value to avoid moderate/high stress effects.

Table A4.93 presents the results of WTP values (including zero bids) to avoid 'actual' levels of stress and these show an increase in WTP values with level of stress experienced. However, the numbers of respondents decrease rapidly with increased levels of effects.

Table A4.93 WTP for flooded respondents by level of stress effects experienced (incorporating zero bids)

Stress Effects	N	WTP (mean)	WTP (median)
Low	479	£194	£100
Mild	65	£253	£100
Moderate	23	£310	£125
High	10	£290	£93
All	577	£207	£100

The data in Table A4.93 were combined with WTP values to avoid moderate/high stress effects where these were based on:

- the WTP values provided by those respondents who provided a value above that for actual effects (i.e. in response to question QDB7);
- the WTP values provided by those respondents who did not provide an initial WTP value (for actual effects) but did provide a value for moderate/high stress effects (i.e. in response to question QDC13); and
- for those who did not provide a revised WTP value in respect of moderate/high stress effects, the same initial value was assumed to apply to moderate/high stress effects.

The combined results are shown in Table A4.94.

Table A4.94 WTP for flooded respondents by level of stress effects (incorporating zero bids)

Stress Effects	N	WTP (mean)	WTP (median)
Low (actual)	479	£194	£100
Mild (actual)	65	£253	£100
Moderate[1]	386	£198	£100
High[2]	397	£232	£100
All	1327	£209	£100

Notes: [1] WTP values to avoid actual and hypothetical moderate effects (variants 2 and 4).
[2] WTP values to avoid actual and hypothetical high effects (variants 1 and 3).

Summary

Overall, it would appear that increased stress effects lead to slightly higher WTP values. Using simple linear regression (on the mean values), the two equations are:

- WTP (at risk) = 150 + 3.4 x level of stress effects ($R^2 = 0.035$)
- WTP (flooded) = 205 + 5.6 x level of stress effects ($R^2 = 0.065$)

Given the low statistical significance, it would appear that, as indicated above, respondents tend to value 'stress' effects in general[7] as opposed to being able to adjust their WTP to a precise set of stress characteristics. However, in relation to the flooded respondents, there is additional uncertainty due to a lack of PTSS results to which 'actual' WTP values could be associated.

A4.8.9 Multivariate analysis of WTP values for at risk respondents

The purpose of the multivariate analysis was to explore the degree to which the variation in the WTP values (including zero bids) could be explained by other variables. For this analysis, attention was focused on the initial WTP values offered to avoid low/mild stress effects. Although the WTP values did not appear to vary between these two levels of effects nor between the two payment scales, these variables were included in the analysis.

Family as a variable

One factor which was not found to be significant for impacts on health was nature of the household (see Table A4.57 and associated text). In contrast, there were variations with WTP values by nature of household as shown in Table A4.95.

[7] It will be noted that the constants of £150 and £205 are close to the actual initial WTP mean values of £154 and £196 for at risk and flooded respondents respectively (see Table A4.88).

Table A4.95 WTP for at risk respondents by nature of household (incorporating zero bids)

Code	Nature of household	N responses	WTP (mean)	mean of ln(WTP+1)	WTP (median)
1	Single parent family	32	£50	2.63 (£13)	£40
2	Single adult	96	£92	3.00 (£19)	£40
3	Two or more adults with no children	178	£180	3.67 (£38)	£56
4	Two or more adults with child(ren)	117	£166	3.92 (£50)	£50
All		423	£146	3.51 (£32)	£100

For the multivariate analysis, the nature of household was scored on a simple 1 to 4 scale (with the increasing score being associated with an increasing WTP).

Flood related factors

Specific attention was given to those flood prevention measures taken by respondents (see QA5 on the at risk questionnaire). Each of the following measures was scored 0 (measure not taken) or 1 (measure taken):

- keep alert for flood warnings;
- household insurance against flooding;
- avoid expensive furnishings downstairs;
- buy water pumps;
- build walls;
- avoid irreplaceable items downstairs;
- keep ditches/drains clear; and
- keep sand/sandbags.

Multivariate analysis

The multivariate analysis of the WTP values for at risk respondents against 27 variables (socio-demographic factors[8] (15), current GHQ score, degree of worry, payment/stress scales used and the flood related factors (8) listed above) resulted in a relatively poor correlation (N = 391, R^2 = 0.09, R^2_{adj} = 0.08) with four significant ($p<0.05$) variables remaining at the end of the analysis (keeping alert for flood warnings, age squared, gender and house type).

As for the PTSS results (see Figure A4.1), the distribution of the WTP values is non-linear. It was therefore decided to repeat the analysis using the logarithmic transform ln(WTP+1) which provided a more linear distribution of responses (see Figure A4.7).

[8] These were similar to the 17 socio-demographic factors used in the analysis of health impacts (see Section A4.7.5). Questions relating to prior health and long-term illness were not asked of at risk respondents resulting in the 15 socio-demographic factors used in the WTP analysis.

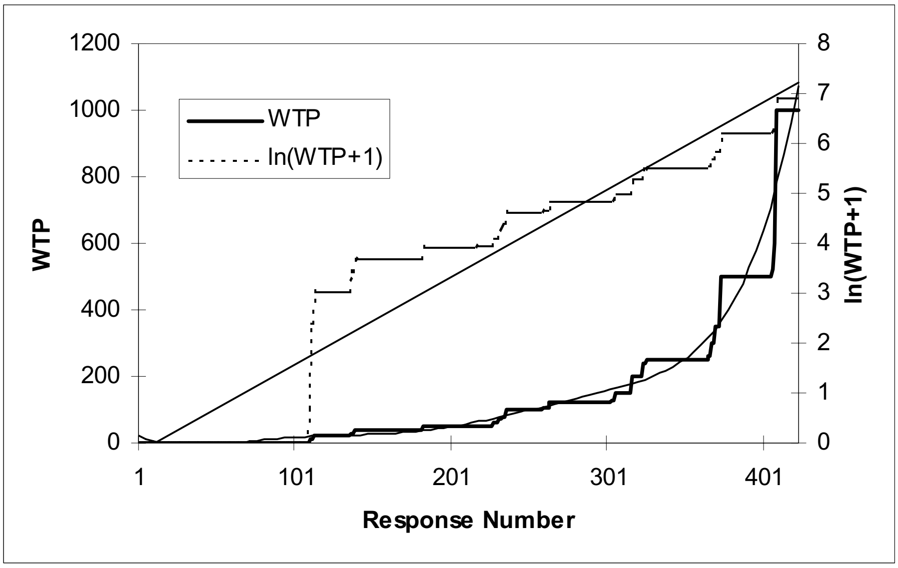


Figure A4.7 Distribution of 'at risk' WTP values by response

The results of the stepwise multivariate analysis are presented in Table A4.96.

Table A4.96 Stepwise multivariate analysis of ln(WTP + 1) for at risk respondents (incorporating zero bids)

Number of variables	Number of observations	R^2	R^2 (adj.)	Variable removed from next round of analysis	Prob. that relationship due to chance
27	273	21.7%	13.0%	House type	0.979
26	273	21.7%	13.4%	Employment	0.959
25	273	21.7%	13.7%	Income	0.960
24	319	18.4%	11.7%	Keep ditches/drains clear	0.997
23	319	18.4%	12.0%	Keep sand/sandbags	0.994
22	319	18.4%	12.3%	Area house prices	0.904
21	319	18.4%	12.6%	Buy water pumps	0.807
20	319	18.4%	12.9%	Build walls	0.728
19	319	18.3%	13.1%	Residence time	0.610
18	319	18.3%	13.4%	Rented accommodation	0.481
17	323	17.3%	12.7%	Flood risk awareness	0.440
16	323	17.2%	12.8%	Household insurance against flooding	0.510
15	323	17.1%	13.0%	Current health (GHQ now)	0.455
14	349	18.4%	15.0%	Car ownership	0.430
13	349	18.3%	15.1%	**Stress scale used**	0.443
12	349	18.1%	15.2%	Social grade	0.338
11	349	17.9%	15.2%	**Payment scale used**	0.285
10	349	17.6%	15.2%	Gender	0.213
9	349	17.2%	15.1%	Avoid irreplaceable items downstairs	0.236
8	349	16.9%	15.0%	Vulnerable housing	0.079
7	368	17.6%	16.0%	Avoid expensive furnishings downstairs	0.119
6	368	17.0%	15.6%	All variables $p<0.05$	

There are three immediate observations that can be made on the revised analysis:

- the use of the logarithmic function results in an improved degree of explanation (as indicated by the increased values of R^2 and R^2_{adj});
- although the WTP values may be influenced by the payment and stress scales used (as discussed in Sections A4.8.7 and A4.8.8), the influence is not statistically significant; and
- perhaps surprisingly, income was one of least significant explanatory variables.

A summary of the remaining significant variables is presented in Table A4.97.

Table A4.97 Factors influencing ln(WTP+1) amongst at risk respondents (N=368, R^2 = 0.17, R^2_{adj} = 0.16)

Parameter	Coeff.	St Error	t value[1]	p	Comment
Degree of worry (1 (not worried) to 5 (very worried))	0.27	0.08	3.25	0.0013	Significant - WTP increases with degree of worry
Family type (1 = single parent to 4 = adults with children)	0.36	0.12	2.97	0.0031	Significant - WTP varies by family type (as shown in Table A4.95)
Education (0 = no quals. to 5)	0.18	0.07	2.63	0.0088	Significant - those with more qualifications are WTP more
Keep alert for flood warnings (No = 0, Yes = 1)	0.55	0.22	2.51	0.0124	Highly significant - those who keep alert are WTP more
Age^2	-0.0008	0.0003	2.40	0.0170	Significant - those c36 are WTP the most
Age	0.06	0.03	1.73	0.0843	
Intercept	0.44	0.85	0.51	0.6077	Not significant

Notes: [1] As before, t values are all presented as positive values.

Review of residuals

As for the health results, the plots of the residuals (and the squares of the residuals) against each variable (as listed in Table A4.97) were reviewed to ensure that their distribution was even across the range of the variable. Some variation in residuals and their squares was observed - with particular reference to degree of worry. Figure A4.8 illustrates the variation in the squares of the residuals.

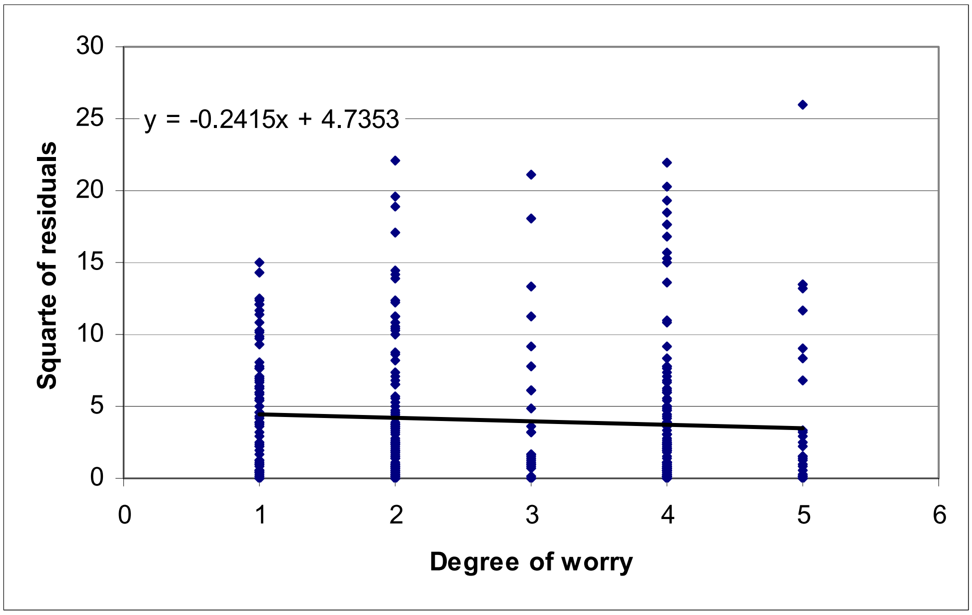


Figure A4.8: Plot of square of residuals for ln(WTP+1) against degree of worry (1-5)

Figure A4.7 suggests that there is a decrease in variability with the degree of worry variable. Whether such variation is 'significant' can be determined from the Goldfield-Quandt (GQ) test. In this example, the raw data (368 observations) were sorted by degree of worry and two regression runs undertaken - one for the first 160 observations (i.e. for the least worried respondents) and one for the last 160 observations (i.e. for the most worried respondents). The resultant sums of the squares of the residuals were 709 and 574 respectively to give a (GQ) ratio of 1.24. The associated degrees of freedom for each regression were 153 (160 observations - (6 variables + 1 intercept)).

If there is no significant difference between the two populations (the null hypothesis), the critical F value should be greater than the GQ ratio - and the presence of heteroscedasticity can be discounted (as discussed earlier in Section A4.7.6). The critical value of $F_{153,153}$ at the 95% confidence level is 1.31. Since this value exceeds the GQ ratio of 1.24, it is concluded that there is no evidence of heteroscedasticity (to the 95% confidence level).

Relative significance of factors

As before, the relative significance of each factor was determined from the product of the potential range in value and the associated coefficient and comparing that with the total of all such products.

For the WTP (as ln(WTP+1)) amongst at risk respondents, the relative contributions were age (24%), family type (23%), degree of worry (22%), education (19%) and keeping alert for flood warnings (12%).

A4.8.10 Multivariate analysis of WTP values for flooded respondents

For this analysis, attention was focused on the initial WTP values[9] offered to avoid actual stress effects experienced.

As before, consideration was given to the nature of the household and the variation of WTP values by nature of household is shown in Table A4.98.

Table A4.98 WTP for flooded respondents by nature of household (incorporating zero bids)

Code	Nature of household	N	WTP (mean)	mean of ln(WTP+1)	WTP (median)
1	Single parent family	32	£235	4.09 (£59)	£113
2	Single adult	221	£127	3.20 (£24)	£40
3	Two or more adults with no children	324	£211	4.00 (£54)	£100
4	Two or more adults with child(ren)	159	£252	4.53 (£92)	£125
All		734	£196	3.51 (£47)	£80

Although the WTP of single parent families does not follow the same pattern as for the at risk respondents, there is an increase in WTP values as one moves up the scale from 2 (single adult) through 3 (adults only) to 4 (adults with child(ren)). As before, for the multivariate analysis, the nature of household was scored on a simple 1 to 4 scale (increasing score generally reflecting an increasing WTP).

To be consistent with the approach adopted for the at risk respondents and for the multivariate analysis of the health effects (see Section A4.7.5), 45 variables were used:

- 17 socio-demographic factors as used in the health analysis (with the factor for children in household being replaced by family type);
- 8 of the 10 flood characteristics used in the health analysis. The number of main parts flooded was excluded on the grounds that it effectively duplicated another variable - number of rooms flooded - and was found to offer less explanation. Cellar flooding was excluded on the grounds that it was found to be consistently acting as a counter factor (i.e. people were WTP more for deeper cellar flooding);
- 7 post-flood factors as used in the health analysis (i.e. including uninsured losses but excluding insured losses);
- 8 flood prevention measures as used in the WTP analysis of the at risk respondents;
- 3 health measures (GHQ now, GHQ at worst time and PTSS score);
- degree of worry over future flooding; and
- a variable to account for the payment scale used.

[9] Where these included zero bids but excluded the very high value (as discussed earlier).

The initial analysis was undertaken with WTP as the dependent variable. Applying the criterion of $p<0.05$ resulted in seven significant variables (buy water pumps, keep ditches/drains clear, age, residence time, prior health, income and stress) with a relatively poor degree of explanation (N=457, $R^2 = 0.15$, $R^2_{adj} = 0.13$). However, if the variable selection criterion is set at the higher standard of $p<0.01$, only two significant variables remained after the stepwise analysis of 45 variables to give the elegant result:

$$WTP = 60 \times Income + 34 \times \ln(P+1) - 72$$

where, WTP = WTP per household per year (£)
Income = 1 to 7 (1 = <£100 per week, 7 = >£1,000 per week)
P = PTSS score

For the typical respondent on a salary rating of 3 (£200-£399 per week) and a PTSS intensity score of 20, this would result in a WTP of £243 which is comparable with the actual initial WTP mean value of £196 for flooded respondents (see aboveaboveTable A4.88). Unfortunately, the overall correlation was poor (N=457, $R^2 = 0.10$, $R^2_{adj} = 0.10$), and it was decided to repeat the multivariate analysis using ln(WTP+1). As for the at risk respondents, the distribution of the WTP values is non-linear while that for ln(WTP+1) values is more linear as shown in Figure A4.9.

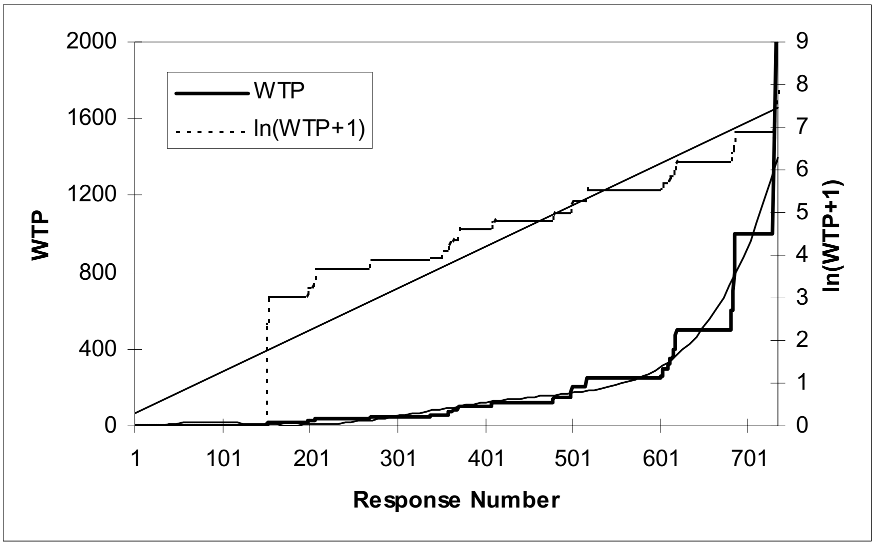


Figure A4.9 Distribution of 'flooded' WTP values by response

The results of the stepwise analysis are presented in Table A4.99 and the remaining significant variables are listed in Table A4.100.

Table A4.99 Stepwise multivariate analysis of ln(WTP + 1) for flooded respondents (incorporating zero bids)

Number of variables	Number of observations	R^2	R^2 (adj.)	Variable removed from next round of analysis	Prob. that relationship due to chance
45	187	36.7%	16.5%	Car ownership	0.987
44	188	36.8%	17.3%	Long term illness	0.932
43	188	36.8%	17.9%	Vulnerable housing	0.933
42	188	36.7%	18.4%	Keep sand/sandbags	0.908
41	188	36.7%	19.0%	Worry over future flooding	0.917
40	190	36.7%	19.7%	No. of rooms flooded	0.973
39	192	38.1%	22.2%	Employment	0.945
38	193	38.5%	23.3%	Education	0.960
37	225	37.8%	25.5%	Current health (GHQ)	0.934
36	230	37.8%	26.3%	Warning time	0.838
35	248	36.0%	25.4%	Sentimental loss	0.997
34	248	36.0%	25.8%	Time to get back to normal	0.773
33	248	36.0%	26.1%	Speed of onset	0.750
32	266	35.5%	26.6%	Flood awareness	0.996
31	266	35.5%	26.9%	Gender	0.675
30	266	35.4%	27.2%	Build walls	0.652
29	266	35.4%	27.4%	Family type	0.596
28	266	35.3%	27.7%	Evacuation	0.534
27	266	35.2%	27.8%	**Payment scale used**	0.401
26	266	35.0%	27.9%	Uninsured losses	0.383
25	372	27.3%	22.0%	House type	0.502
24	379	27.7%	22.8%	Flood depth	0.548
23	381	27.8%	23.1%	Buy water pumps	0.428
22	381	27.6%	23.2%	Avoid expensive furnishings downstairs	0.412
21	381	27.5%	23.3%	Area house prices	0.359
20	381	27.3%	23.3%	Avoid irreplaceable items downstairs	0.272
19	381	27.1%	23.3%	Problems with insurers	0.280
18	381	26.9%	23.2%	Contamination	0.268
17	415	28.8%	25.8%	Frequency of flooding	0.316
16	415	28.7%	25.8%	Flood duration	0.281
15	436	26.5%	23.9%	Years since flood	0.235
14	436	26.2%	23.8%	Builder problems	0.220
13	436	26.0%	23.7%	GHQ at worst time	0.072
12	448	24.0%	21.9%	Keep alert for flood warnings	0.208
11	448	23.8%	21.8%	All variables $p<0.05$	

Table A4.100 Factors influencing ln(WTP+1) amongst flooded respondents (N=448, R^2 = 0.24, R^2_{adj} = 0.22)

Parameter	Coeff.	St Error	t value[1]	p	Comment
Age Age^2	0.14 -0.0013	0.04 0.0003	3.95 3.89	<0.0001	Highly significant - those c57 are WTP the most
ln(P+1)	0.21	0.06	3.34	0.0009	Highly significant - WTP increases with PTSS Intensity score
Income (1(low) to 7(high))	0.23	0.07	3.07	0.0023	Significant - those who earn more are WTP more
Residence time	-0.023	0.008	2.83	0.0049	Significant - WTP decreases with residence time
Rented accommodation (No = 0, Yes = 1)	-0.71	0.29	2.43	0.0155	Significant - owner occupiers are WTP more
Household insurance (No = 0, Yes = 1)	0.44	0.19	2.31	0.0215	Those who take out insurance against flooding are WTP more
Prior health (1(poor) - 5)	0.22	0.10	2.29	0.0225	Significant - those in good health are WTP more
Social grade (1 to 4)	-0.23	0.10	2.23	0.0263	Significant - ABs are WTP more than DEs
Help received (0-50)	0.028	0.013	2.16	0.0310	Significant - those who received help are WTP more
Keep ditches/drains clear (No = 0,Yes = 1)	-0.46	0.22	2.09	0.0369	Those who take this flood prevention measure are WTP less
Intercept	-1.13	1.18	-0.96	0.3399	Not significant

Notes: [1] As before, t values are all presented as positive values.

Some concerns were expressed as to the independence of the significant variables. In particular, it would be expected that there would be some correlation between income and social grade and, indeed, this was observed (N=741, Pearson correlation = -0.58). The analysis was therefore repeated with income excluded. It was hoped that this would result in more observations being considered (due to many respondents refusing to supply income data).

In the event, the remaining significant variables ($p<0.05$) resulted in marginally fewer observations and a marginally greater degree of correlation. However, both house type and vulnerable housing were among the remaining significant variables. Since vulnerable housing is essentially a reclassification of house type, the two cannot be considered as independent variables. The analysis was re-run without vulnerable housing to produce a very similar set of results - as illustrated in Table A4.101.

Table A4.101 Factors - excluding income - influencing ln(WTP+1) amongst flooded respondents listed in order of decreasing statistical significance

Parameter	Incl. vulnerable housing	Excl. vulnerable housing
Highly significant ($p<0.001$)	Age (and Age^2)	Age (and Age^2)
Significant ($p<0.05$)	House type Years since flood Prior health Education Stress (as ln(P+1)) Avoid irreplaceable items downstairs Social grade GHQ at worst time Vulnerable housing	House type Years since flood Prior health Education Stress (as ln(P+1)) Social grade Avoid irreplaceable items downstairs GHQ at worst time
Not significant	Intercept	Intercept
Initial no. of variables	44	43
No. of observations	442	442
R^2 and R^2_{adj}	0.25 and 0.23	0.24 and 0.22

In the absence of income, house type and education appeared as the most significant surrogates. Whilst income and education were found to be strongly correlated (N=663, Pearson correlation = 0.53), income and house type were less so (N=743, Pearson correlation = -0.36).

Given that the results presented in Table A4.101 do not result is the presence of more observations, nor a significantly improved correlation, the original results (i.e. those with income as presented in Table A4.100) were taken forward for further analysis. Finally, it is worth noting that the payment scale used was not a significant factor in the analysis.

Review of residuals

As for the at risk results, the plots of the residuals (and the squares of the residuals) against each significant variable (as presented in Table A4.100) were reviewed to ensure that their distribution was even across the range of the variable. Several variables appeared to have a degree of heteroscedasticity and the case of social grade is illustrated in Figure A4.10.

As before, the raw data (488 observations) were sorted by social grade and two regression runs undertaken - one for the first 200 observations (i.e. for the AB and C1 respondents) and one for the last 200 observations (i.e. for the C2 and DE respondents). The resultant sums of the squares of the residuals were 574 and 814 respectively to give a (GQ) ratio of 1.42. The associated degrees of freedom for the residuals in each regression were 188 (200 observations - (11 variables + 1 intercept)).

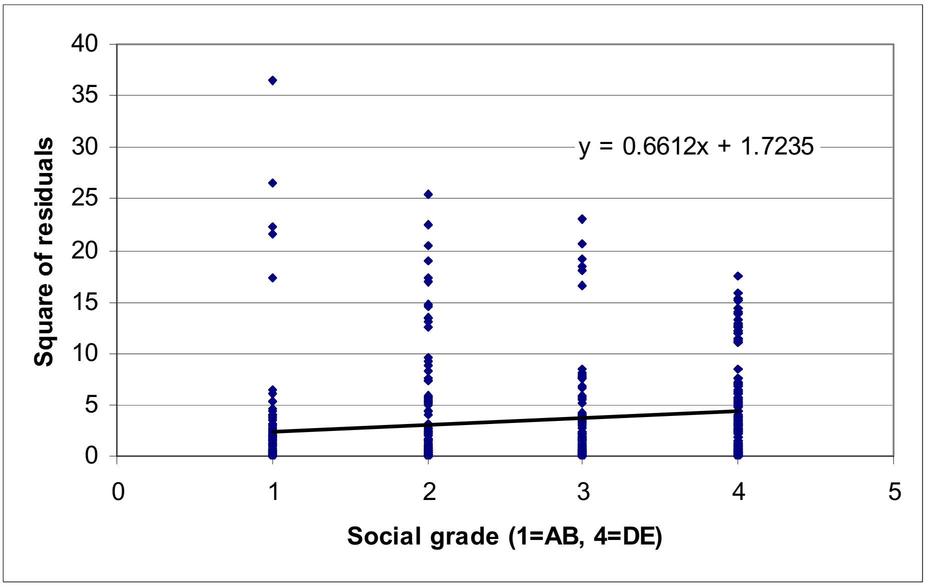


Figure A4.10 Plot of square of residuals for ln(WTP+1) against social grade (1-4)

If there is no significant difference between the two populations (the null hypothesis), the critical F value should be greater than the GQ ratio - and the presence of heteroscedasticity can be discounted. The critical value of $F_{188,188}$ at the 95% confidence level is 1.27. Since this value does not exceed the GQ ratio of 1.42, it is concluded that there is some evidence of heteroscedasticity (to the 95% confidence level) - in other words, the variation in ln(WTP+1) is not correctly modelled using a linear scale for social grade. Similar results were obtained for income and prior health. Given that there is a degree of interdependence amongst these variables (for example, income vs social grade as above and social grade vs prior health as reported in Table A4.6), this finding is not entirely unexpected.

Relative significance of factors

As before, the relative significance of each factor was determined from the product of the potential range in value and the associated coefficient and comparing that with the total of all such products.

For the WTP (expressed as ln(WTP+1)) amongst flooded respondents (accounting for the factors listed in Table A4.100), the relative contributions of the most important factors were age (17%), residence time (16%), income (14%), stress (11%) and help received (10%).

ANNEX 5

APPLICATION OF ECONOMIC APPRAISAL METHODOLOGY TO FOUR CASE STUDIES

A5.1 Ottery St Mary

A5.1.1 Overview

An area of the village of Ottery St Mary in Devon has been subjected to repeated flooding in recent years. The area at risk of flooding comprises 63 properties (31 residential, 28 small commercial, a fire station, a medical centre and two public houses). A full cost-benefit analysis has been prepared and summarised in a Project Appraisal Report (PAR). The PAR forms the source document for the information presented in this sub-section (Environment Agency, 2002). Given the recent changes in discount rates, the analysis is presented firstly for the 'old' discount rate of 6% and then for the 'new' discount rate of 3.5%/3%.

A5.1.2 The options (@6%)

Under the do-nothing option (Option A), properties within the area at risk will become flooded so frequently that they become uninhabitable.

The do-something options represent a range of risk reduction schemes and those taken forward within the cost-benefit analysis may be summarised as follows:

- Option B - do minimum. The option to maintain the current situation through essential maintenance involves minimal cost (PV of £368k) but the level of protection is of the order of 1 in 5 years;
- Option Q - on-line conveyance. This option involves engineering improvements to the existing system. Three sub-options were proposed with levels of protection of 1 in 50, 1 in 100 and 1 in 150 years with associated PV costs of £2,911k, £2,970k and £3,051k respectively; and
- Option R - off-line conveyance. This option involves some engineering works to improve the existing system and to provide a new culvert to relieve the pressures on the existing system. The option was costed at £3,493k for a 1 in 100 year protection.

A5.1.3 Using the FCDFCDPAG3 spreadsheets (@6%)

The summary FCDFCDPAG3 spreadsheet is reproduced in Table A5.1.

Table A5.1 Results from FCDFCDPAG3 spreadsheet for Ottery St Mary (using a 6% discount rate[1]) as presented in the PAR

	Costs and benefits (£k) by Option					
	A	B	Qi	Qii	Qiii	R
PV costs PVc	0	368	2911	2970	3051	3493
PV damage PVd (tangible losses)	5348	3017	417	233	161	233
PV damage avoided (the benefits)		2330	4931	5115	5187	5115
Net Present Value NPV		1962	2020	2145	2136	1622
Average benefit/cost ratio		**6.33**	1.69	1.72	1.70	1.46
Incremental benefit/cost ratio			1.02	3.12	0.89	-0.16

Notes: [1] For this example, benefits and costs have been discounted over 50 years.

A5.1.4 The preferred option (@6%)

Based on the tangible benefits only, the preferred option was determined to be Qii using the FCDFCDPAG3 decision rules as follows:

1) *Select option with highest B/C ratio* - Option B (6.33)
2) *What is the level of protection?* - Below indicative standard.
3) *Does the next highest option* (i.e. Qi) *have an incremental B/C ratio greater than 1?* - Yes (1.02).
4) *What is the level of protection?* - Within indicative standard range.
5) *Does the next highest option* (i.e. Qii) *have an incremental B/C ratio greater than 3?* - Yes (3.12).
6) *What is the level of protection?* - Within indicative standard range.
7) *Does the next highest option* (i.e. Qiii) *have an incremental B/C ratio greater than 3?* - No (0.89).

The application of the FCDFCDPAG3 decision rules results in the emergence of Option Qii (on-line conveyance with a 100 year standard) as the preferred option.

A5.1.5 The options (@3.5%)

Costs and tangible damages

The Ottery St Mary PAR provides updated costs and benefits (Appendix D) based on interim guidance from Defra (issued before the revised Treasury Green Book) which advised using a discount rate of 3.5% (over 50 years) and increased damage figures. Given the marginal difference between PV values based on discount rates of 3.5% and of a combination of 3.5% and 3%, the figures presented in the PAR are used in this illustrative example.

As before, under the do-nothing option (Option A), properties within the area at risk will become flooded so frequently that they become uninhabitable. The revised PV costs of Options B, Qi, Qii, Qiii and R are £534k, £2,957k, £3,016k, £3,097k and £3,688k respectively (based on a 3.5% discount rate).

Intangible damages

The situation at Ottery St Mary comprises properties at differing levels of risk (decreasing risk as one moves way from the river). On this basis, the human-related damages were derived using the method based on level of flood risk (see S5.5 of the main text).

The assumed distribution of the 31 households 'at risk' is presented in Table A5.2.

Table A5.2 Distribution of households[1] by flood risk 'band' (no defences)

Return period (years)	1	5	10	15	25	50	100	150	250	1000
Annual flood prob (AFP)	1.000	0.200	0.100	0.067	0.040	0.020	0.010	0.007	0.004	0.001
N h'holds (cumulative)	0	5	10	15	20	25	30	31	31	31
Ni h'holds (per band)	0	5	5	5	5	5	5	1	0	0

Notes: [1] This distribution is presented for illustrative purposes only and may not accurately reflect the situation in Ottery St Mary

The average flood probability (AFPij) by location ('band') and option are summarised in Table A5.3.

Table A5.3 Average flood probability[1] per 'band' taking account of options

Annual flood probability with no defences	0.600	0.150	0.083	0.053	0.030	0.015	0.008	0.005	0.003
Option A (do-nothing)	0.492	0.150	0.083	0.053	0.030	0.015	0.008	0.005	0.003
Option B (1 in 5)	0.200	0.150	0.083	0.053	0.030	0.015	0.008	0.005	0.003
Option Qi (1 in 50)	0.020	0.020	0.020	0.020	0.020	0.015	0.008	0.005	0.003
Option Qii (1 in 100)	0.010	0.010	0.010	0.010	0.010	0.010	0.008	0.005	0.003
Option Qiii (1 in 150)	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.005	0.003
Option R (1 in 100)	0.010	0.010	0.010	0.010	0.010	0.010	0.008	0.005	0.003

Notes: [1] Since there are no houses in the 'first' band, the first column represents the average flood probability for houses (under each option) within the second band - i.e. the area that would be flooded (in the absence of defences) by events with probabilities in the range 0.2 - 1 per year.

The intangible damages are then simply the product of the number of households per band (last line of Table A5.2) and the annual damages per household (where these are a function of the flood probabilities presented in Table A5.3). These values were then summed and discounted (as described in the main text).

Since the benefits of the engineering options (Q and R) will take two years to come on-stream, the associated health impacts for Years 0 and 1 will be higher than in subsequent years and this was accounted for in the analysis**.** Specifically, the undiscounted 'intangible' damages for the current situation (AFP = 0.2) were determined to be £5,919 per year. This value was entered (manually) on the 'intangible' discounting spreadsheet for Years 0 and 1 respectively for each of Q and R options.

A5.1.6 Using the FCDFCDPAG3 spreadsheets (@3.5%)

The revised summary FCDFCDPAG3 spreadsheet is reproduced in Table A5.4. It should be noted that the revised tangible costs incorporate not only the new discount rate but also revised damage/depth relationships.

Table A5.4 Results from FCDFCDPAG3 spreadsheet incorporating health damages based on flood risk for Ottery St Mary (using a 3.5% discount rate)

	Costs and benefits (£k) by Option					
	A	B	Qi	Qii	Qiii	R
PV costs PVc	0	534	2957	3016	3097	3688
PV damage PVd (tangible losses)	10418	8502	1167	649	434	649
PV health impacts	*144*	*144*	*109*	*30*	*17*	*30*
PV damage (total)	*10562*	*8646*	*1276*	*679*	*451*	*679*
PV damage avoided (the benefits)		1916	9285	9882	10110	9882
Net Present Value NPV		1382	6328	6866	7013	6194
Average benefit/cost ratio		**3.59**	3.14	3.28	3.26	2.68
Incremental benefit/cost ratio			3.04	10.12	2.82	-0.39
Without health impacts, the final two rows would read (as in the PAR):						
Average benefit/cost ratio		**3.59**	3.13	3.24	3.22	2.65
Incremental benefit/cost ratio			3.03	8.78	2.65	-0.36

A5.1.7 The preferred option (@3.5%)

Applying the FCDFCDPAG3 decision rules (as illustrated in Section A5.1.4) to the revised figures would still result in Option Qii emerging as the preferred option with or without the benefits associated with the avoidance of health impacts.

A5.2 Pett Frontage Sea Defences

A5.2.1 Overview

The Pett Level is a low-lying area of land behind the coastal defences between the Sussex villages of Cliff End and Winchelsea. The area at risk of flooding includes 390 properties and 600ha of farmland. A full cost-benefit analysis has been prepared and summarised in a Project Appraisal Report (PAR). The PAR forms the source document for the information presented in this sub-section (Environment Agency, 2002a).

Given the recent changes in discount rates, the analysis is presented firstly for the 'old' discount rate of 6% and then for the 'new' discount rate of 3.5%/3%. To provide a basis for comparison, both analyses are based on discounting over 50 years.

A5.2.2 The options (@6%)

Under the do-nothing option (Option A), properties within the area at risk will become flooded so frequently that they become uninhabitable.

The do-something options represent a range of risk reduction schemes and those taken forward within the cost-benefit analysis may be summarised as follows:

- Option M - maintain. The option to maintain current management practice through essential maintenance and recycling of beach materials involves costs with a PV of £5,824k and the level of protection decays from around 1 in 5-10 years to near certain failure by Year 49;

- Option S - sustain. This option involves recycling of beach materials, improved maintenance and some engineering works to sustain the current situation. The associated PV costs are £8,975k; and

- Option I - improve. This option involves some additional beach recharge, improved maintenance and some engineering works. Three sub-options were analysed I-20, I-50 and I-200 with standards of 1 in 20, 50 and 200 years respectively. The associated PV costs were £14,278k, £14,575k and £14,873 respectively.

A5.2.3 Using the FCDPAG3 spreadsheets (@6%)

Although detailed spreadsheets for the three 'improve' options are presented in Appendix F of the PAR, the results for Option I-50 are not presented in the main text. This results in the preferred option being I-200 (as the only option within the indicative standard of 1 in 50-200 years). However, for the purposes of this analysis, the detailed figures from Appendix F have been used to provide an additional option for comparison purposes.

The summary FCDPAG3 spreadsheet is presented in Table A5.5.

Table A5.5 Results from FCDPAG3 spreadsheet for Pett Level Sea Defences (using a 6% discount rate) as presented in PAR

	Costs and benefits (£k) by Option[1]					
	A	M	S	I-20	I-50[2]	I-200
PV costs PVc	0	5824	8975	14278	14570	14873
PV damage PVd (tangible losses)	32146	22806	13032	3166	2151	1401
PV damage avoided (the benefits)		9340	19114	28980	29995	30745
Net Present Value NPV		3516	10139	14702	15425	15872
Average benefit/cost ratio		1.60	**2.13**	2.03	2.06	2.07
Incremental benefit/cost ratio			3.10	1.86	3.47	2.47

Notes: [1] Source data from Appendix F, PAR (and increased by 8.6% inflation as discussed in Appendix G, PAR).
[2] Note that the cost figure for I-50 is based on the mid-value between I-20 and I-200 as no further detail is provided in Appendix F.

A5.2.4 The preferred option (@6%)

As already indicated, based on the tangible benefits only, the preferred option presented in the PAR was Option I-200. However, using the (tangible) figures presented in Table A5.4, the application of the FCDPAG3 decision rules would appear as follows:

1) *Select option with highest B/C ratio* - Option S (2.13)
2) *What is the level of protection?* - Below indicative standard (of 1 in 50-200 years)
3) *Does the next highest option* (i.e. I-20) *have an incremental B/C ratio greater than 1?* - Yes (1.86).
4) *What is the level of protection?* - Below indicative standard
5) *Does the next highest option* (i.e. I-50) *have an incremental B/C ratio greater than 1?* - Yes (3.47).
6) *What is the level of protection?* - Within indicative standard range.
7) *Does the next highest option* (i.e. I-200) *have an incremental B/C ratio greater than 3?* - No (2.47).

As such, the application of the FCDPAG3 decision rules results in the emergence of Option I-50 (improve to a one in 50 year standard).

A5.2.5 The options (@3.5%/3%)

Costs and tangible damages

The Pett Level Sea Defences PAR was prepared using the 'old' discount rate of 6%. However, based on the detailed information provided in Appendix F, it was possible to revise the figures (for all options) using the combined 3.5% and 3% discount rates (over a 50 year period).

The revised PV costs of Options M, S, I-20, I-50 and I-200 were estimated to be £8,066k, £11,043k, £16,729k, £17,112k and £17,495k respectively. The costs were based on the detailed costs presented in Appendix B of the PAR for Option I-200 suitably adjusted for the proposed programme of works for each option.

Intangible damages

As indicated above, up to 390 properties on low-lying level ground (the Pett Level) behind sea defences could be flooded in the event of a breach. For this reason, the human-related damages were derived using the method based on standards of defence (see S5.4 of the main text).

For each option, the human-related damages were calculated year by year where these were a function of the number of properties (390) and the annual flood probability. It should be noted that the benefits of the Option I schemes will take eight years to come on-stream and the higher health impacts over Years 0 to 7 were accounted for in the analysis (by using the higher flood probabilities).

A5.2.6 Using the FCDPAG3 spreadsheets (@3.5%/3%)

The revised summary FCDPAG3 spreadsheet is reproduced in Table A5.6.

Table A5.6 Results from FCDPAG3 spreadsheet incorporating health damages based on standards of defence for Pett Level Sea Defences (using a 3.5%/3% discount rate)

	Costs and benefits (£k) by Option					
	A	M	S	I-20	I-50	I-200
PV costs PVc	0	8066	11043	16729	17112	17495
PV damage PVd (tangible losses)	40721	36252	19499	4724	2954	1653
PV health impacts	*2144*	*2139*	*2121*	*2051*	*1636*	*628*
PV damage (total)	*42865*	*38391*	*21620*	*6775*	*4590*	*2281*
PV damage avoided (the benefits)		4474	21245	36090	38275	40584
Net Present Value NPV		-3592	10202	19361	21163	23089
Average benefit/cost ratio		0.55	1.92	2.16	2.24	**2.32**
Incremental benefit/cost ratio			5.63	2.61	5.71	6.03
Without health impacts, the final two rows would read:						
Average benefit/cost ratio		0.55	1.92	2.15	2.21	**2.23**
Incremental benefit/cost ratio			5.63	2.60	4.62	4.01

A5.2.7 The preferred option (@3.5%/3%)

Applying the FCDPAG3 decision rules to the revised figures would lead to Option I-200 with or without the benefits associated with the avoidance of health impacts (due to having the highest B/C ratio).

A5.3 Gowdall Urgent Works

A5.3.1 Overview

The village of Gowdall in the East Riding of Yorkshire was severely flooded in autumn 2000 and was one of the locations used in the main survey (see Section A2.8). The area at risk of flooding includes over 140 residential properties (95% of which flooded in 2000) and nearly 700ha of farmland. A full cost-benefit analysis has been prepared and summarised in a Project Appraisal Report (PAR). The PAR forms the source document for the information presented in this sub-section (Environment Agency, 2002b).

Given the recent changes in discount rates, the analysis is presented firstly for the 'old' discount rate of 6% and then for the 'new' discount rate of 3.5%/3%. As before, both analyses are based on discounting over 50 years.

A5.3.2 The options (@6%)

Under the do-nothing option (Option 1), some properties within the area at risk will become flooded so frequently that they become uninhabitable.

The do-something options represent a range of risk reduction schemes and those taken forward within the cost-benefit analysis may be summarised as follows:

- Option 2 - do minimum. This option is based on maintaining the defences to that achieved by the emergency works undertaken after the 2000 floods. The associated PV costs were estimated to be £2,033k with levels of protection of 1 in 25 years and 1 in 8 years against overtopping and breach events respectively. However, the breach risk in some areas would increase over time;

- Option 3 - improve. This option involves engineering works to heighten and strengthen the defences. The associated PV costs are £3,699k with levels of protection of 1 in 50 years and 1 in 75 years against overtopping and breach events respectively; and

- Option 3A - improve-100. This is an additional hypothetical option which is not presented in the PAR but has been introduced for illustrative purposes in this analysis. The associated PV costs are an assumed £4,077k (based on the same costs for Option 3 together with an additional £400k expended in Year 1 to provide extra height and strength to the defences) with levels of protection of 1 in 100 years and 1 in 150 years against overtopping and breach events respectively.

For the purposes of this analysis, it was assumed that Options 2 and 3/3A would take one and two years respectively to come on-stream.

A5.3.3 Using the FCDPAG3 spreadsheets (@6%)

The summary FCDPAG3 spreadsheet is presented in Table A5.7.

Table A5.7 Results from FCDPAG3 spreadsheet for Gowdall Urgent Works (using a 6% discount rate)

	Costs and benefits (£k) by Option			
	1	2	3	3A[1]
PV costs PVc	0	2033	3699	4077
PV damage PVd (tangible losses)	13506	5663	1889	1183
PV damage avoided (the benefits)		7843	11617	12323
Net Present Value NPV		5810	7918	8246
Average benefit/cost ratio		**3.86**	3.14	3.02
Incremental benefit/cost ratio			2.27	1.87

Notes: [1] Unlike the other options, Option 3A is not from the PAR but has been introduced as a hypothetical additional option for illustrative purposes.

A5.3.4 The preferred option (@6%)

Using the (tangible) figures presented in Table A5.8, the application of the FCDPAG3 decision rules would appear as follows:

1) *Select option with highest B/C ratio* - Option 2 (3.86)
2) *What is the level of protection?* - Below indicative standard (of 1 in 25-100 years)
3) *Does the next highest option* (i.e. Option 3) *have an incremental B/C ratio greater than 1?* - Yes (2.27).
4) *What is the level of protection?* - Within indicative standard range
5) *Does the next highest option* (i.e. Option 3A) *have an incremental B/C ratio greater than 3?* - No (1.87).

As such, the application of the FCDPAG3 decision rules results in the emergence of Option 3 (improve to a one in 50/75 year standard) as the preferred option.

A5.3.5 The options (@3.5%/3%)

Costs and tangible damages

The revised PV costs for Options 2, 3 and 3A were derived from the PAR spreadsheets (Appendix C) adjusted for the new discount factors. The FCDPAG3 spreadsheets were recreated to generate the results presented above and were than re-worked with the 'new' discount rates (3.5%/3%).

Intangible damages

Gowdall is situated on level ground and many of the properties were flooded in 2000 to a few feet. For the purposes of this analysis, 143 properties will be assumed to be at risk and the human-related damages were derived using the method based on standards of defence (see S5.4 of the main text).

For each option, the human-related damages were calculated year by year where these were a function of the number of properties (143) and the annual flood probability. As noted above, it was assumed that Options 2 and 3/3A would take one and two years respectively to come on-stream and the higher health impacts initially were accounted for in the analysis (by using the higher flood probabilities in Years 0/1).

A5.3.6 Using the FCDPAG3 spreadsheets (@3.5%/3%)

The revised summary FCDPAG3 spreadsheet is reproduced in Table A5.8.

Table A5.8 Results from FCDPAG3 spreadsheet incorporating health damages based on standards of defence for Gowdall Urgent Works (using 3.5%/3% discount rates)

	Costs and benefits (£k) by Option			
	1	2	3	3A
PV costs PVc	0	2295	3778	4164
PV damage PVd (tangible losses)	14125	6393	2631	1689
PV health impacts	*786*	*776*	*553*	*143*
PV damage (total)	*14911*	*7169*	*3185*	*1832*
PV damage avoided (the benefits)		7742	11726	13079
Net Present Value NPV		5447	7948	8915
Average benefit/cost ratio		**3.37**	3.10	3.14
Incremental benefit/cost ratio			2.69	3.50
Without health impacts, the final two rows would read:				
Average benefit/cost ratio		**3.37**	3.04	2.99
Incremental benefit/cost ratio			2.54	2.44

A5.3.7 The preferred option (@3.5%/3%)

Applying the FCDPAG3 decision rules to the revised figures for the tangible damages/ benefits would lead, as before, to Option 3 emerging as the preferred option. However, with the inclusion of the benefits associated with the avoidance of health impacts, the results would be as follows:

1) *Select option with highest B/C ratio* - Option 2 (3.37)
2) *What is the level of protection?* - Below indicative standard (of 1 in 25-100 years)
3) *Does the next highest option* (i.e. Option 3) *have an incremental B/C ratio greater than 1?* - Yes (2.69).
4) *What is the level of protection?* - Within indicative standard range
5) *Does the next highest option* (i.e. Option 3A) *have an incremental B/C ratio greater than 3?* - Yes (3.50).

As such, Option 3A would emerge as the preferred option.

A5.4 Robertsbridge Flood Alleviation

A5.4.1 Overview

The town of Robertsbridge in East Sussex has suffered increasing flooding during the post-war years and was severely flooded in autumn 2000. The area at risk of flooding includes about 80 residential and 20 commercial properties (80% of which flooded in 2000). A full cost-benefit analysis has been prepared and summarised in a Project Appraisal Report (PAR). The PAR forms the source document for the information presented in this sub-section (Environment Agency, 2002c).

Given the recent changes in discount rates, the analysis is presented firstly for the 'old' discount rate of 6% and then for the 'new' discount rate of 3.5%/3%. As before, both analyses are based on discounting over 50 years.

A5.4.2 The options (@6%)

Under the do-nothing option (Option 1), there will be increasing flooding leading to severe disruption with possible loss of properties and livelihoods.

The do-something options represent a range of risk reduction schemes and those taken forward within the cost-benefit analysis may be summarised as follows:

- Options 2 to 6 - improve. These options all involve engineering works to varying degrees proving levels of protection of 1 in 5, 25, 50, 100 and 200 years respectively. The associated PV costs are £2,320k, £2,916k, £3,057k, £3,183k and £3,391k respectively.

A5.4.3 Using the FCDPAG3 spreadsheets (@6%)

The summary FCDPAG3 spreadsheet is presented in Table A5.9.

Table A5.9 Results from FCDPAG3 spreadsheet for Robertsbridge Flood Alleviation (using a 6% discount rate) as presented in PAR

	Costs and benefits (£k) by Option					
	1	2	3	4	5	6
PV costs PVc	0	2320	2916	3057	3183	3391
PV damage PVd (tangible losses)	5961	3576	1323	796	571	0
PV damage avoided (the benefits)		2386	4638	5165	5391	5961
Net Present Value NPV		66	1722	2108	2208	2570
Average benefit/cost ratio		1.03	1.59	1.69	1.69	**1.76**
Incremental benefit/cost ratio			3.78	3.72	1.80	2.74

A5.4.4 The preferred option (@6%)

Using the (tangible) figures presented in Table A5.10, the application of the FCDPAG3 decision rules would appear as follows:

1) *Select option with highest B/C ratio* - Option 6 (1.76).
2) *What is the level of protection?* - Above indicative standard (of 1 in 25-100 years).
3) *Does the next highest option* (and an option with a 1 in 500 year level of protection is considered in the PAR Appendices) *have an exceptional incremental B/C ratio?* - No (<1).

As such, the application of the FCDPAG3 decision rules results in the emergence of Option 6 (improve to a one in 200 year standard) as the preferred option.

Interestingly, within the PAR, the decision was made to proceed with Option 5 (improve to a 1 in 100 year standard) on the grounds that this was a more robust conclusion. It is worth noting that in the absence of Option 6, the application of the FCDPAG3 decision rules to the 'tangible' figures would lead to Option 4 (since the incremental benefit/cost ratio for Option 5 is less than three).

A5.4.5 The options (@3.5%/3%)

Costs and tangible damages

The FCDPAG3 spreadsheets were recreated to generate the results presented above and were then re-worked with the 'new' discount rates (3.5%/3%).

The revised PV costs for Options 2 to 6 were derived from the PAR spreadsheets (Appendix 5.4) adjusted for the new discount factors. As with initial analysis, the benefits of these options would take a year to come on-stream and this was accounted for.

Intangible damages

As for Ottery St Mary, Robertsbridge comprises properties at differing levels of risk (decreasing risk as one moves way from the river). On this basis, the human-related damages were derived using the method based on level of flood risk (see S5.5 of the main text).

The assumed distribution of the 85 households 'at risk' is presented in Table A5.10 (where this is based on the detailed 'asset annual average damage' worksheets used for the production of the PAR).

Table A5.10 Distribution of households by flood risk 'band' (no defences)

Return period (years)	1	5	10	15	25	50	100	150	250	1000
Annual flood prob (AFP)	1.000	0.200	0.100	0.067	0.040	0.020	0.010	0.007	0.004	0.001
N h'holds (cumulative)	0	42	55	60	66	69	73	78	85	85
Ni h'holds (per band)	0	42	13	5	6	3	4	9	7	0

The average flood probability (Pij) by location ('band') and option are summarised in Table A5.11.

Table A5.11 Average flood probability per 'band' taking account of options

Annual flood probability with no defences	0.600	0.150	0.083	0.053	0.030	0.015	0.008	0.005	0.003
Option 1 (do nothing)	0.600	0.150	0.083	0.053	0.030	0.015	0.008	0.005	0.003
Option 2 (1 in 5 year)	0.200	0.150	0.083	0.053	0.030	0.015	0.008	0.005	0.003
Option 3 (1 in 25 year)	0.040	0.040	0.040	0.040	0.030	0.015	0.008	0.005	0.003
Option 4 (1 in 50 year)	0.020	0.020	0.020	0.020	0.020	0.015	0.008	0.005	0.003
Option 5 (1 in 100 year)	0.010	0.010	0.010	0.010	0.010	0.010	0.008	0.005	0.003
Option 6 (1 in 200 year)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.003

Notes: [1] Since there are no houses in the 'first' band, the first column represents the average flood probability for houses (under each option) within the second band - i.e. the area that would be flooded (in the absence of defences) by events with probabilities in the range 0.2 - 1 per year.

The intangible damages are then simply the product of the number of households per band (last line of Table A5.11) and the annual damages per household (where these are a function of the flood probabilities presented in Table A5.12). These values were then summed and discounted (as described in the main text). Since the benefits of the improvement options (2 to 6) would take a year to come on-stream, the associated health impacts for Year 0 will be higher than in subsequent years and this was accounted for in the analysis. Specifically, the undiscounted 'intangible' damages for the current situation (equivalent to a standard of 1 in 5) were determined to be £15,756 per year and this value was entered (manually) on the 'intangible' discounting spreadsheet for Year 0 for each of the improvement options.

A5.4.6 Using the FCDPAG3 spreadsheets (@3.5%/3%)

The revised summary FCDPAG3 spreadsheet is reproduced in Table A5.12.

Table A5.12 Results from FCDPAG3 spreadsheet incorporating health damages based on flood risk for Robertsbridge Flood Alleviation (using 3.5%/3% discount rates)

	Costs and benefits (£k) by Option					
	1	2	3	4	5	6
PV costs PVc	0	2446	3104	3246	3371	3580
PV damage PVd (tangible losses)	8772	5262	1947	1171	840	0
PV health impacts	387	386	363	275	62	28
PV damage (total)	9159	5648	2310	1447	902	28
PV damage avoided (the benefits)		3511	6849	7712	8257	9131
Net Present Value NPV		1065	3745	4466	4886	5551
Average benefit/cost ratio		1.44	2.21	2.38	2.45	**2.55**
Incremental benefit/cost ratio			5.07	6.08	4.36	4.18
Without health impacts, the final two rows would read:						
Average benefit/cost ratio		1.43	2.20	2.34	2.35	**2.45**
Incremental benefit/cost ratio			5.04	5.46	2.65	4.02

A5.4.7 The preferred option (@3.5%/3%)

Applying the FCDPAG3 decision rules to the revised figures (with or without the inclusion of the benefits associated with the avoidance of health impacts) would lead, as before, to Option 6 emerging as the preferred option.

In the absence of Option 6, the application of the FCDPAG3 decision rules to the 'tangible' figures could lead to Option 5 (highest b/c ratio) or to Option 4 (since the b/c ratio is only marginally less than that for Option 5 and since the incremental benefit/cost ratio for Option 5 is still less than three). However, the inclusion of the benefits associated with the avoidance of health impacts would, as before, lead to Option 5 (as it has the highest b/c ratio and an incremental b/c ratio of more than three).

ANNEX 6

MANUAL FOR THE APPRAISAL OF HUMAN-RELATED INTANGIBLE IMPACTS

A6.1 Introduction

This manual has been prepared to assist in the incorporation of the valuation of health impacts into the cost-benefit analysis undertaken in relation to flood and coastal defence works. The methodology is based on the results of a Defra/Environment Agency R&S Project (FD2005) as described in RPA *et al*. (2003): **The Appraisal of Human-Related Intangible Impacts of Flooding**.

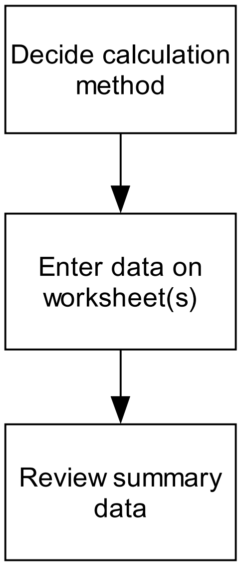
It is intended that this guidance will accompany a revised FCDPAG3 spreadsheet which incorporates the following three worksheets:

- *Intan-SoS*;
- *Intan-FR1*; and
- *Intan-FR2*.

These three worksheets have been semi-automated to minimise the need for data entry. The format for the worksheets is the same as that for the other FCDPAG3 worksheets and those cells requiring data entry are coloured white.

A6.2 Overview of methodology

The methodology comprises three basic steps as shown in the figure.



The first step is to determine whether the health 'damages' should be based on standards of defence or on level of flood risk.

The second step is to provide the requisite data entries on the three relevant worksheets. Since these worksheets automatically incorporate data from the other FCDPAG3 worksheets, the analysis should be done at the same time as that for the tangible costs and benefits of options rather than in isolation.

The third step is to review the results which are automatically generated on the *Summary* FCDPAG3 worksheet.

A6.3 Decide calculation method

The following question needs to be considered:

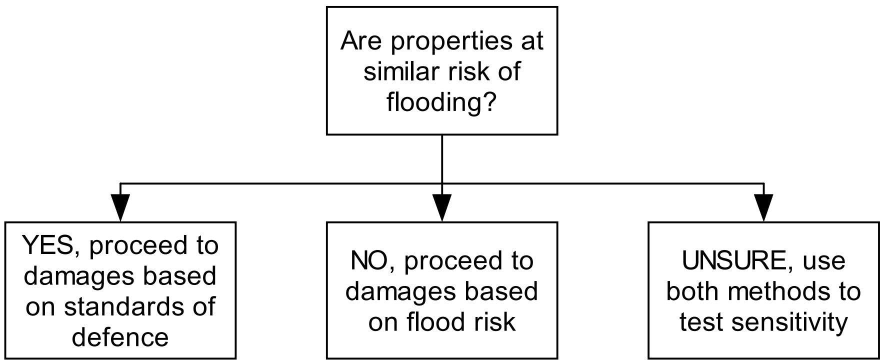
Is the level of flood risk (effectively) the same for all the residential properties at risk?

If YES, as would be the case for housing on level ground behind a flood defence for example, **then proceed to A6.4** for damages based on standards of defence.

If NO, as would be the case for houses on a slope leading away from an undefended river for example, **then proceed to A6.5** for damages based on level of flood risk.

If unsure, proceed to A6.4 (and 6.6) to evaluate damages based on standards of defence (which will provide an upper bound) and **then proceed to A6.5** and recalculate the damages based on level of flood risk (which will provide a lower bound). In such cases, both sets of calculations should be saved in separate workbooks (perhaps of the form *Scheme-upper.xls* and *Scheme-lower.xls*) to provide an audit trail.

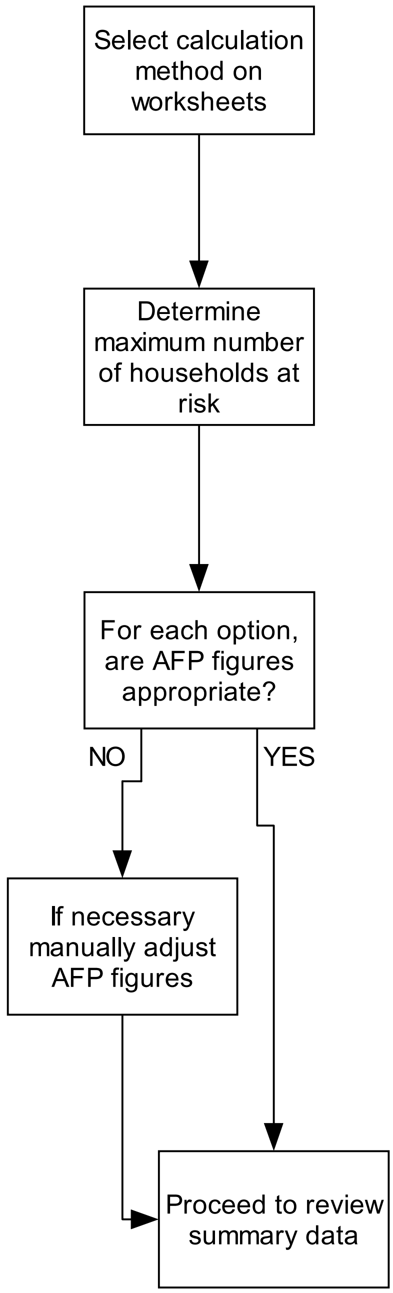
This decision stage is summarised in the figure below:



A6.4 Damages based on standards of defence

Select calculation method

To select damages based on standards of defence, first enter 1 in Cell H11 (as noted earlier, data entry cells are white), worksheet *Intan-SoS* and enter 0 (zero) in Cell I11, worksheet *Intan-FR2*. This ensures that the results presented in the *Summary* worksheet are based on the standards of defence method.



Enter data

The **first** data entry required is the number of households at risk of flooding[1]. This value should be entered in Cell D11, worksheet *Intan-SoS*. This should be the greater of the maximum number of households being considered **or** the number within the indicative floodplain (i.e. within the 100/200 year boundary for fluvial/coastal flooding).

The **second** data entry which **may** be required is an adjustment to the annual flood probability (AFP) figures. Within worksheet *Intan-SoS*, AFP is simply the 'Probability of failure/breach' as used the other worksheets for the options being considered. In cases where the probabilities of overtopping are higher (and the overtopping leads to significant flooding), this higher probability value should be used as the AFP value. These values will need to be manually entered into the columns headed 'Flood Prob = AFP' (worksheet *Intan-SoS*) for each of the options.

Note that in some cases, the households affected under the do-nothing option are written-off. Clearly, if people are not present to be flooded then there should be no intangible damages. However, it could be argued that the stress of knowing that one's household was to be written off would be much greater than that associated with having the household flooded. On this basis, the intangible damages are calculated based on all 'at risk' households being occupied during the lifetime of the project.

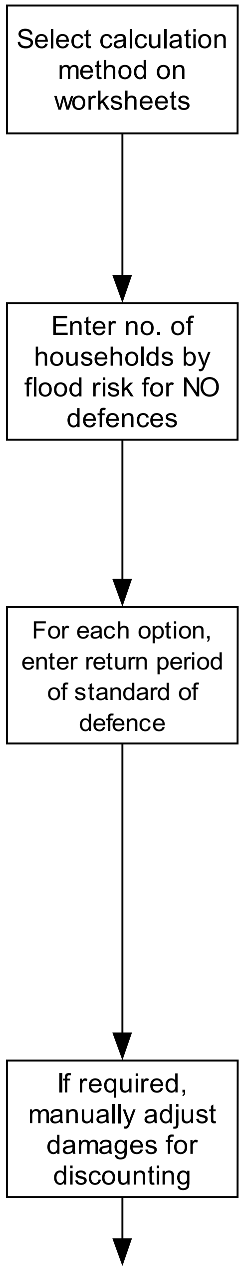
Once complete, proceed to A6.6 to review results.

---

[1] Note that households with no main room at ground or basement level (such as a first floor flat) are not considered to be at risk.

A6.5 Damages based on level of flood risk

Select calculation method



To select damages based on level of flood risk, first enter 1 in Cell I11, worksheet *Intan-FR2* and enter 0 (zero) in Cell H11, worksheet *Intan-SoS*. This ensures that the results presented in the *Summary* worksheet are based on the level of flood risk method.

Enter data

The **first** data entry required is the numbers of households at risk of flooding[2] by flood risk **in the absence of flood defences**. Normally, this would be the same as under the do-nothing option. These numbers should be entered in Cells D17 to M17, worksheet *Intan-FR2* as illustrated in the table below:

Flood Return Period	1	5	10	15	etc.
Annual Flood Prob (AFP)	1.000	0.200	0.100	0.067	etc.
No. of h'holds (cumulative)	0	0	5	10	etc.
No. of h'holds per 'band'	0	0	5	5	etc.

The **second** data entry required is the entry of the 'return periods' of the standards of defence for each of the do-something options being considered in Cells H23 to H27, worksheet *Intan-SoS* as illustrated in the table below:

Options	Standard of Defence:		RP (yrs)	AFP
Option 1	Do nothing	Current (Yr 0)	10	0.1
		Average (Yrs 0-100)	7	0.15
Option 2	Improve to 1 in 20		20	0.05
Option 3	Improve to 1 in 50		50	0.02
etc.	etc.		etc.	etc.

The **third** data entry that **may** be required is an adjustment for the delay in benefits of engineering options to come on-stream[3]. In such cases, the associated health impacts for the initial years will be higher than in subsequent years. These higher values can be estimated and entered (manually) on worksheet *Intan-FR1* spreadsheet (as described on the next FCDPAGe).

---

2 Note that households with no main room at ground or basement level (such as a first floor flat) are not considered to be at risk.

3 Manual adjustments may also be made for other time-varying probabilities. However, for the do-nothing option, although the flood probability increases with time, the impact upon the intangible damage values is marginal. For this reason, the same value is used in the 'damages' column.

By way of example, consider Option 3 (AFP = 0.02, RP = 50 yrs). If the benefits were realised in Year 0, the discounted damage figures on worksheet *Intan-FR1* might appear as follows:

Year	.....	Pflood	Damages = fn(P)	Discounted damages
0	.....	0.02	£14,266	£14,266
1	.....	0.02	£14,266	£13,784
2	.....	0.02	£14,266	£13,318
3	.....	0.02	£14,266	£12,867
etc.	.....	etc.	etc.	etc.

However, if Option 3 was to take three years to be completed, the level of damages would be higher in Years 0, 1 and 2. Based on the data already entered, a range of ‘annualised’ damages against different standards of defence are automatically generated on worksheet *Intan-FR2* (in Cells N49 to N62) including the entries shown below:

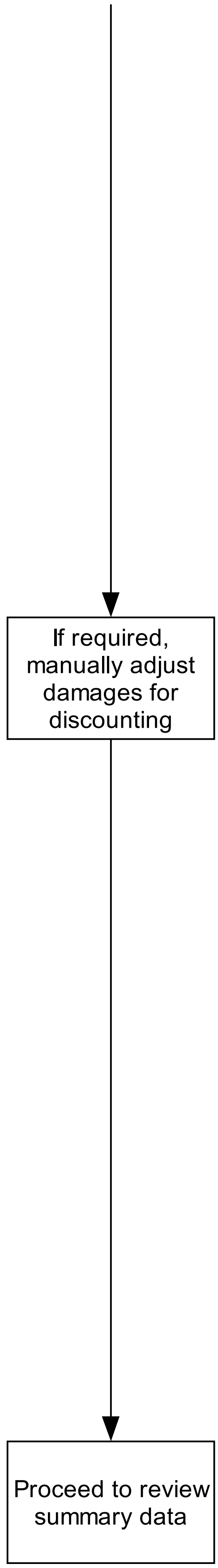
Option	Standard	.....	Totals
Option 1	0.15	.....	£17,636
Current	0.10	.....	£17,627
Option 2	0.05	.....	£17,542

This includes an estimate of £17,627 for the ‘Current’ situation (with an associated standard of 0.1 per year). As such, this value is inserted manually (for Option 3) into Cells J16 to J18, worksheet *Intan-FR1* as shown below:

Year	.....	Pflood	Damages = fn(P)	Discounted damages
0	.....	0.02	£17,627	£17,627
1	.....	0.02	£17,627	£16,949
2	.....	0.02	£17,627	£15,106
3	.....	0.02	£14,266	£12,867
4	.....	0.02	£14,266	£12,432
etc.	.....	etc.	etc.	etc.

For this example, this ‘correction’ results in an increase of total intangible damages (expressed in present value terms) for Option 3 from £426k to £436k.

Once complete, proceed to A6.6 to review results.



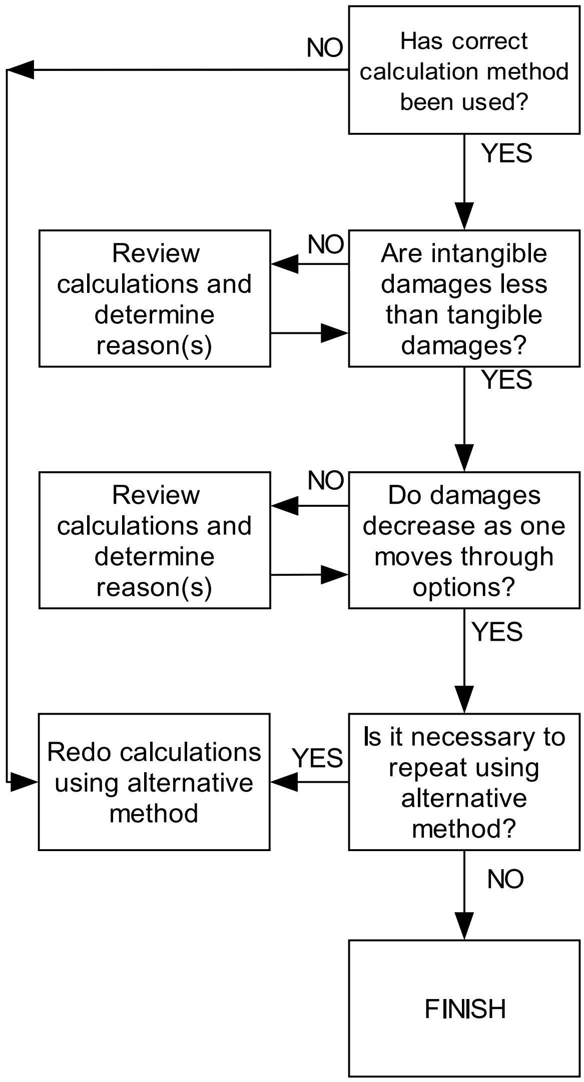
A6.6 Review summary data

Within the revised FCDPAG3 spreadsheet, the first worksheet (*Summary*) presents a summary of the results of the cost-benefit analysis including benefit-cost ratios and incremental benefit-cost ratios.

For completeness, the *Summary* worksheet includes the results with and without the incorporation of 'intangible' (health-related) damages. For clarity, the results with intangibles are highlighted in bright yellow and those without intangibles are highlighted in pale green.

On inspecting the results the following items should be checked:

- has the appropriate method been used? (check Row 10, *Summary* worksheet which indicates the basis for calculation - either 'standards of defence' or 'flood risk');
- are the intangible damages significantly lower than the tangible damages? (normally, this will be the case - check Rows 19 and 20, *Summary* worksheet - but if not, ensure that the relative significance can be explained);
- do the intangible and tangible damages both decrease as one moves through the options? (normally, this will be the case - check Rows 19 and 20, *Summary* worksheet - but if not, ensure that the relative significance can be explained); and
- is it necessary to rework the analysis using the alternative method? (in some cases, it may be necessary to determine the damages using both methods - for example, where one is unsure which method is appropriate).



Finally, ensure that the finalised workbooks are saved to provide an audit trail.

PB10121

Nobel House
17 Smith Square
London SW1P 3JR

www.defra.gov.uk

Printed in the UK, September 2004, on material containing 80% post-consumer waste and 20% Totally Chlorine Free virgin pulp

Department for Environment
Food and Rural Affairs