

**Research Project to Develop the  
Internal Drainage Board Toolkit and  
Performance Indicators  
FD2673**

**Final Report on Spreadsheet Trial**  
prepared for

**Defra/Environment Agency**

12 August 2014



# Research Project to Develop the Internal Drainage Board Toolkit and Performance Indicators

## FD2673

August 2014

### Report on Spreadsheet Trial

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# 1 Introduction

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## 1.1 Background

Internal Drainage Boards (IDBs) are local public bodies that predominantly work to manage land drainage in areas of special drainage need (Entec, 2010<sup>1</sup>). IDBs are diverse: their catchments may be pumped or gravity drained, they may be predominantly rural or with considerable urban areas, and they may operate individually or as part of a consortium. Although some work has been undertaken by ADA to highlight the benefits provided by IDB activities, the overall benefits are not well known and have rarely been monetised, especially at individual IDB level.

## 1.2 Aims and objectives

The Research Project to develop the IDB toolkit and performance indicators has two distinct parts. This report refers to the part on the spreadsheet toolkit where the specific aim is:

- to ensure the toolkit developed by RPA is fit for purpose; IDBs feel confident using the beneficiaries spreadsheet; and the benefits of using the toolkit are recognised – reflected in positive uptake across the sector.

The associated objective is:

- to road test the toolkit developed by RPA; support IDBs in using the beneficiaries spreadsheet; and facilitate the sharing of best practice across the sector.

## 1.3 Structure of this report

This report provides a summary of the results of the two trials and subsequently sets out revisions that have been made to the toolkit (spreadsheet and associated guidance). Section 2 outlines the approach, whilst Section 3 details the findings. An action plan for the uptake of indicators is presented in Section 4. The conclusions, next steps and acknowledgements are given in Section 5.

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<sup>1</sup> Entec (2010): FL0224: Update of the 2006 Review of the Internal Drainage Board Efficiency Evidence, Report produced for Defra, January 2010.

## **2 Approach**

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### **2.1 Approach to trial**

#### **2.1.1 IDBs involved**

Requests for volunteer IDBs were made at the workshop in September 2013, with workshop discussions suggesting that one of the six IDBs involved during development of the toolkit should again be included to test some of the assumptions included within the spreadsheet. The IDBs who expressed interest in taking part in the trial were:

- North Level District Internal Drainage Board; and
- York Consortium, with a view to testing the spreadsheet with the Local Authority and their consultants on the River Hull Strategy.

#### **2.1.2 Running the trial**

Meetings were held with North Level District IDB and with the Project Board for the River Hull strategy (which comprised of members of the Beverley and North Holderness IDB, East Riding District Council, and the Environment Agency).

The meeting with North Level District IDB enabled the spreadsheet and toolkit to be explained and the trial to be carried out through detailed discussion on the assumptions included, especially default numbers and calculations.

The meeting with the River Hull Project Board provided an opportunity to introduce the toolkit through a presentation covering the main elements. This was followed up by discussions with the consultants appointed by the Board to prepare the strategy, Capita, who provided comments and feedback on the toolkit.

#### **2.1.3 Analysis of the results**

Comments, questions and feedback following the trials was collected and analysed. Where possible, changes have been made to the spreadsheet to improve the reliability of the default calculations and to make the toolkit more accessible.

## 3 Findings

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### 3.1 Overview

This section begins with a summary of the outcomes of the two trials. The full results for each trial can be found in Annexes 1 and 2.

When interpreting and using the results from the toolkit, it is important that consideration is given to the assumptions and methods utilised. The toolkit is designed to provide an indicative estimate of the benefits rather than a precise one. Points to bear in mind include:

- Where specific data are not available for a particular IDB, the toolkit uses default data generated using assumptions. Actual data may result in larger or smaller benefit estimates.
- The area or proportion of assets at risk of being impacted for each probability level (where these vary from 100% to 0.1%) is based on typical distribution of assets across the country as a whole. The assumptions are taken from the Multi-Coloured Handbook. Since IDBs tend to be located in lower-lying areas, the implication of this uncertainty is that a lower percentage of assets is allocated to the higher probabilities than may actually be the case. Therefore, use of these default assumptions may under-estimate the benefits.
- Impacts are divided into two different types: permanent losses, where there is a need to rebuild, relocate or write-off an asset and occasional losses, where damages are based on Weighted Average Annual Damages (WAAD) from the Multi-Coloured Handbook or willingness to pay values. Although WAAD are acknowledged as being uncertain in the Multi-Coloured Handbook (it is suggested that they are used 'where an appraiser has little or no understanding of potential flood depths and return periods'), the greatest uncertainty lies with the permanent losses. Very little evidence was identified on which to base the rebuild/relocation costs for many of the categories, so the costs may be over-estimated in some cases and under-estimated in others. The specific nature of the assets at risk may need to be taken into account when determining the implications of this uncertainty.
- As permanent damages are based on rebuild/relocation costs or write-off values, they need to be converted to annual values so they are consistent with the WAADs used for the occasional losses. This conversion is undertaken using an annualisation factor, which requires an assumption to be made for each benefit category as to an appropriate 'life' for the assets at risk. The default assumptions take into account the likely lifetime of the specific assets within each category, thus they vary across categories. For agricultural land and biodiversity, the life is assumed to be 20 years while for many of the non-residential properties, 25 years is used. If the life of the assets were longer than assumed, then the annual damages would be over-estimated. Conversely, if the lifetimes were shorter, then the benefits would be under-estimated.
- To reflect that assets would not be new when they are affected by flooding or waterlogging, a depreciation factor is applied. A consistent assumption of 50% is applied to all benefit categories. This adjustment has the effect of reducing the permanent damages. A default of

50% was used to reflect that, on average, it can be assumed that assets are halfway through their projected life.

- Willingness to pay values are used for some benefit categories, such as recreation and tourism, and heritage. The values used within the spreadsheet have been selected as they are viewed as the most transferable to the type of impacts expected from flooding and/or waterlogging, however, there is always uncertainty associated with transferring a value elicited for a specific change in a specific location to another type of impact in a different location. Some of the values are used to give an indication of the typical level of damages that might occur. This is especially the case for heritage, where a paucity of available willingness to pay values means that there is considerable uncertainty. Similarly, the value used for recreation and tourism is taken from a US study. As such, it may be considered more uncertain than if an appropriate value had been available from a study in the UK.
- The approach to assessing carbon, designated biodiversity and non-designated biodiversity benefits is based on a projected change in land use. This requires some speculation as to what the land use would be under the baseline of no IDB activities. Since the baseline would often result in much wetter conditions, there may be benefits under the baseline compared with the current scenario. As a result, these impacts are often recorded as damages (negative benefits) in the 'with IDB' scenario. For non-designated biodiversity, current management of land and watercourses could include activities to enhance biodiversity. To reduce the risk that biodiversity benefits under current land management are not taken into account, the assessment of impacts is based on a simple scoring system. Scores have been assigned from +2 to -2 to reflect where biodiversity is likely to increase or decrease from the baseline (no IDB) scenario. The scores relate to changes in land use and have been assigned based on expert judgement during development of the spreadsheet. This approach was used as there were no readily available data to provide a more scientific approach. This means that there is considerable uncertainty associated with the non-designated biodiversity benefits (or damages).
- The toolkit has been set up to enable the calculation of benefits for one IDB only. It is not appropriate to add benefits from multiple IDBs as this is likely to significantly underestimate the cumulative benefits.
- All monetary benefit values ignore the timing of benefits and provide a snapshot as opposed to considering the potential benefits over a particular time period. If benefits were to occur sometime into the future, they could be significantly smaller than those presented in this document (this is due to the need to discount values that occur in the future to convert them into present values (PV)).

## 3.2 Results for North level District IDB

The main aim of the North Level IDB trial was to test the assumptions included within the spreadsheet, especially the default assumptions to see how much the estimate of benefits might change if these assumptions were changed. Table 3-1 presents the estimated benefits before the trial, summarises changes made to the assumptions and then the estimated benefits following these changes.

Table 3-1: Impacts of changes to default assumptions for North Level IDB trial

Benefit category	Estimated benefits per year before trial	Changes made	Estimated benefits per year following changes
Residential properties	£3.7 million	No. of properties at risk unchanged Percentage of properties within 100% and 50% impact ratings were increased to 25% of the total in each (increased no. of properties at high risk from 218 to 5,448). This was identified as being of <b>high uncertainty</b> with further investigation needed (e.g. using LiDAR) to support these assumptions Regional market value reduced to £160,000 (from £250,000)	£27.7 million
Business properties	£2.3 million	No. of business properties at risk unchanged Percentage of properties within 100% and 50% impact ratings was changed to be consistent with residential properties Average life of business property of 25 years unchanged Specific data on business properties by type and floor area: time needed to collect specific data would be very large given the number of businesses present so no changes made	£9.2 million
Social infrastructure	£2.299 million	Number of assets changed based on local knowledge Probability of impact was based on local knowledge (based on location) No change to other assumptions due to time needed to collect specific data or because assumptions were assumed to be okay (e.g. average life of assets)	£2.312 million
Emergency services	£900	Number of emergency service assets reduced to zero (police station closed down)	£0
Utilities	£1.6 million	Number of assets revised based on local knowledge (many assets removed as not being affected as they were IDB assets) Probability of impacts for sewage treatment works increased from 50% to 100%	£1.4 million
Transport (road)	£6.8 million (direct) £2.2 million (indirect)	Other roads (those providing access to properties) were removed from calculations as being no longer needed if those properties were written-off A and critical B roads: probability of impacts was linked to that of properties Traffic data from Cambridgeshire County Council website were used to reflect high proportion of lorries on roads Default delay reduced from 12 hours to 4 hours (considered that 12 hours was too long and default should be 4 hours)	£7.0 million (direct) £15,000 (indirect)
Transport (rail)	£0.7 million	Although 1km length passes through the IDB area it was thought that there would be no change in probability of impacts	£0

Table 3-1: Impacts of changes to default assumptions for North Level IDB trial

Benefit category	Estimated benefits per year before trial	Changes made	Estimated benefits per year following changes
Food production	£18.6 million	Area of arable land obtained from drainage rate and modified accordingly Livestock land not expected to show any change in probability of impacts Land values reduced to reflect local values Considered that arable needed to be separated into 'combinable', 'non-combinable' and 'other' crops Decrease in annual damages when actual land values were used was considered to <b>significantly underestimate</b> benefits to food production. Not possible to relocate to produce food elsewhere, hence, the assumption of write-off values for agricultural land was questioned. Estimates were made using <b>annual impacts</b> for 50% and 100% probability of impacts and these were considered to be a <b>better reflection of the impacts</b> (seemed a better balance when compared with impacts on properties)	£4.6 million, or if annual losses are used, £21.3 million
Energy (direct)	£7.4million	Considered that there would be no impact on the power lines	£0
Energy (indirect)	£17.9 million	The change in number of properties that were written-off meant the number of properties affected by loss of energy was reduced	£6.1 million
Designated biodiversity sites	£5.1 million	Area revised in line with drainage rate data Discussion over difference between willingness to pay values used for biodiversity and actual land values for agriculture (using actual land values for biodiversity would significantly reduce benefits) No changes made to other assumptions	£4.8 million
Biodiversity non-designated	-£3.9 million	Areas of land revised to align with those for food production All watercourses moved to 'managed to enhance biodiversity where possible' under current situation and 'other watercourses' under baseline Change in score for move from extensive grassland managed to enhance biodiversity' to 'intensive arable managed to enhance biodiversity' from -2 to -1 No other changes made	-£3.4 million
Carbon	-£5.5 million	Areas revised to align with other worksheets No other changes made	-£5.4 million
Water supply	£36,000 (direct) £1.2 million (indirect)	No abstraction licences known in the area that were used to provide water for use outside the area	£0



**Table 3-1: Impacts of changes to default assumptions for North Level IDB trial**

Benefit category	Estimated benefits per year before trial	Changes made	Estimated benefits per year following changes
Heritage	£4.9 million	No change to number or type of assets, value per trip, relocation costs, etc. Considered that there would be no impact on prehistoric sites as these would have been present before the IDB existed and were assumed to survive under a baseline of no IDB	£4.4 million
Recreation and tourism	£0.4 million	Increase in number of horse riding centres and sports grounds (increased total number of assets to 56 from 46) Sports grounds assigned a weight of 2 No change to number of visitors, value per trip, relocation costs, etc.	£0.5 million
Jobs	£0.8 million	Leakage value (for money spent by IDB that is outside the IDB) was reduced from 70% (default) to 20% No other changes made	£2.2 million
<b>TOTAL</b>	£76 million (benefits) -£10 million (damages) <b>Overall: £66 million</b>	Main changes were increase in number of properties written-off (increasing property damages but reducing indirect damages under other categories). Main uncertainty is approach to estimating agricultural damages (benefits increase to £85 million if annual damages are used, overall benefits of £77 million per year)	£68 million (benefits) -£8 million (damages) <b>Overall: £60 million</b>

### 3.3 Results for River Hull Strategy

Due to the timing of the River Hull strategy, the results below reflect comments received on the toolkit from the consultants employed to undertake the economic assessment, but where there were no data available to test the spreadsheet in detail. The main comments were:

- Initial impression that the spreadsheet looked complicated, and difficult to identify what each worksheet was doing and how it all linked together. A flowchart in the instructions tab would help.
- Questionnaire type data entry field might speed up the start.
- Useful to have something to highlight where you are in the process at each level of assessment (like the Multi-Coloured Handbook).
- User will have to have done some leg work before any round table discussions with stakeholders, a more specific list of data than is included in Table 4-1 of the guidance would be helpful.
- Weblinks for the data sources in Table 4-1 would be useful.
- There is no mention of the National Receptors Dataset in Table 4-1; this could be a source that may require less analysis than the datasets mentioned.
- Should there be a mention of threshold levels in relation to properties.
- Length of roads would be easier to quantify than area.

- Blue to blue colour range in the map of magnitude-significance makes it difficult to see what it is showing.

### 3.4 Implications of the results

The North Level IDB trial showed that:

- Default assumptions for number of properties at risk in low-lying IDBs with flat topography could significantly underestimate the proportion of properties with high probability of impact. This holds for both residential and non-residential properties.
- **Response:** Needs to be addressed for each IDB specifically. No change to default assumptions, but additional information included in guidance to highlight this.
- Care is needed with 'other roads' where these only provide access to properties that would be written-off. This significantly reduced the indirect damages.
- **Response:** Needs to be addressed for each IDB specifically. No change to default assumptions, but additional information included in guidance to highlight this.
- Default time for road transport delay was reduced from 12 hours to 4 hours. The default assumption has also been reduced in the toolkit so this is now set at 4 hours.
- **Response:** default assumption reduced from 12 hours to 4 hours in the spreadsheet, and updated in the guidance.
- The category of arable agriculture needed to be split into combinable, non-combinable and other crops. This change has been made to the toolkit.
- **Response:** the food production worksheet has been revised to allow this breakdown to be included. The guidance has also been updated.
- **KEY ISSUE:** the use of write-off values for agricultural land with a probability of impacts of 50% or 100% seemed to result in a very low estimate of damages and was considered to be a poor reflection of the likely damages. Annual estimates were included as an alternative and these were considered a much more reliable estimate of the likely scale of damages. This raised the question of whether annual damages should be used for agricultural land where the land cannot be substituted for land elsewhere.
- **Response:** this issue cannot be addressed by this study as the approach used in the toolkit is in line with Defra policy for assessing agricultural damages. The results of the trial suggest that the damages to agriculture assessed appear to be underestimated using this approach. A note has been added to the guidance.
- Consideration needs to be given to the extent that power lines might actually be impacted by a change in water levels/waterlogging as this may be limited.
- **Response:** Needs to be addressed for each IDB specifically. No change to default assumptions, but additional information included in guidance to highlight this.
- Linkages can be made between the food production, biodiversity (designated and non-designated) and carbon worksheets to make it easier to ensure consistency between these worksheets.

- **Response:** Carbon worksheet moved to after biodiversity non-designated but differences between land types used on each worksheet means it is not possible to include links between the worksheets themselves.

The River Hull trial comments have been addressed as follows:

- Initial impression that the spreadsheet looked complicated, and difficult to identify what each worksheet was doing and how it all linked together. A flowchart in the instructions tab would help.
- **Response:** Simple flowchart/diagram added to the instructions worksheet and calculation worksheet tabs.
- Questionnaire type data entry field might speed up the start.
- **Response:** This would require restructuring of the spreadsheet and so is not appropriate at this stage of the project. However, this could be something that could be developed in the future to help IDBs who are finding it difficult to use the spreadsheet.
- Useful to have something to highlight where you are in the process at each level of assessment (like the Multi-Coloured Handbook).
- **Response:** Again, this would require restructuring of the guidance (and also spreadsheet) so is not possible within the current project. However, a simple bar highlighting progress through the calculation worksheets has been added to the spreadsheet.
- User will have to have done some leg work before any round table discussions with stakeholders, a more specific list of data than is included in Table 4-1 of the guidance would be helpful.
- **Response:** A more detailed table of data has been included in the guidance (Table 6-1 to relate specifically to the calculation worksheets), linked to which data are included within the default assumptions and which data are needed to use the spreadsheet.
- Web-links for the data sources in Table 4-1 would be useful.
- **Response:** Web-links have been added where available. Where no web-links have been found, the data owner has been identified.
- There is no mention of the National Receptors Dataset in Table 4-1; this could be a source that may require less analysis than the datasets mentioned.
- **Response:** The focus was on freely available datasets. However, the NRD is now mentioned in Table 4-1, with the caveat that this may not be freely available.
- Should there be a mention of threshold levels in relation to properties.
- **Response:** At the level of detail being used, it is unlikely that this information would be available. However, a note has been added to the guidance stating that threshold levels should ideally be used but that these data may not be available for most assessments, with the risk that this may over-estimate damages.
- Length of roads would be easier to quantify than area.
- **Response:** the calculation worksheets use length (km). The guidance has been checked to make sure this refers to measuring length of road affected rather than area.

- Blue to blue colour range in the map of magnitude-significance makes it difficult to see what it is showing.
- **Response:** As the qualitative assessment is completed the colour range changes from blue-red-green to highlight differences.

## 4 Action Plan for Toolkit

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### 4.1 Overview

The following section sets out a range of possible actions to encourage the uptake of the toolkit that Defra and ADA may wish to consider.

### 4.2 Action Plan

The draft Action Plan is set out in Table 4-1. This identifies activities that could be undertaken to encourage awareness and/or uptake of the toolkit as it is rolled out. Figure 4-1 shows how the different types of actions set out in Table 4-1 could be combined to deliver the greatest level of awareness and familiarity. The figure also gives an illustrative indication of the time and resources required, with actions requiring the lowest level of time/resources shown in green, those with moderate requirements in orange, and those with the highest requirements in red.

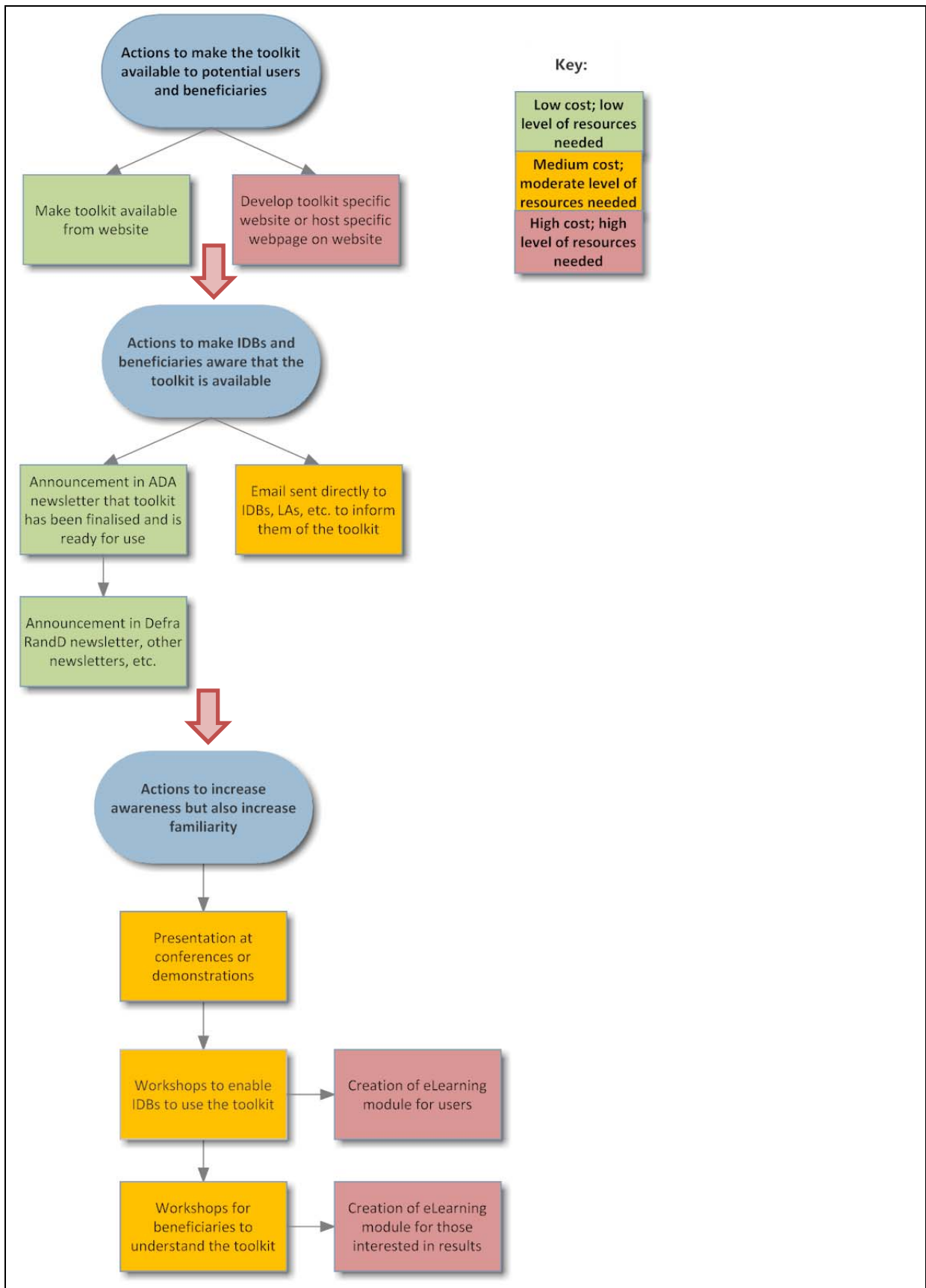


Figure 4-1: Links between the different actions and activities to promote awareness and familiarity

Table 4-1: Draft Action Plan for rollout of the toolkit					
Potential action	Potential lead	Resources needed	Intended audience	Expected benefits	Follow-up actions, including opportunity for feedback
<b>Actions to make the toolkit available to potential users and beneficiaries</b>					
Make toolkit available from website (decision needs to be taken on whether to create a specific website or use an existing one)	Defra	Limited, needs time to upload reports and toolkit to website (would probably be undertaken anyway as part of publicising research outputs), estimated maximum of 1 day	IDBs, others can also access the reports and toolkit from Defra site	Makes toolkit publicly available	Does not publicise availability of toolkit in itself, needs to be combined with some awareness raising activities as well
Develop toolkit specific website or host specific webpage on website (e.g. ADA)	Defra and/or ADA	Hosting webpage on ADA website would require development of page and upkeep, estimated 2-5 days. Specific website may require purchase of domain and development of website, plus upkeep, estimated 10-20 days to develop plus 2-5 days upkeep, plus costs of website	IDBs, but would be publicly available so could be used by others too, including beneficiaries (note though that if beneficiaries are to be included within the intended audience, additional information may have to be included, increasing resource needs)	Makes toolkit publicly available, but can also provide some information to help increase familiarity and potentially encourage uptake and use	Opportunity to include method for receiving feedback, questions, comments, etc. that could be available to other uses of the website
<b>Actions to make IDBs and beneficiaries aware that the toolkit is available</b>					
Announcement in ADA Newsletter (or Gazette) that toolkit has been finalised and is ready for use by IDBs	ADA	Limited, needs time to write article and would need to link to location where IDBs can obtain toolkit (e.g. website link and/or QR code), estimated 1-2 days	IDBs	Raises awareness of toolkit and that it is available for use	Does not necessarily encourage use of toolkit, may need some actions to encourage uptake through increasing familiarity

**Table 4-1: Draft Action Plan for rollout of the toolkit**

Potential action	Potential lead	Resources needed	Intended audience	Expected benefits	Follow-up actions, including opportunity for feedback
Announcement in Defra RandD newsletter, other widely read and circulated newsletters, etc.	Defra	As above, may be 2-3 days if article needs to be written from scratch for specific newsletter, reviewed, etc.	This will depend on the newsletter audience, but is likely to be wider than the ADA Newsletter, but could be used to target LAs and other beneficiaries of IDB activities	More for raising awareness of the research and its outputs	Does not necessarily encourage use of toolkit by IDBs, may need some actions to encourage uptake through increasing familiarity. May also require action to help beneficiaries understand outputs from toolkit



**Table 4-1: Draft Action Plan for rollout of the toolkit**

Potential action	Potential lead	Resources needed	Intended audience	Expected benefits	Follow-up actions, including opportunity for feedback
Email sent directly to IDBs, LAs, etc. to inform them of availability of the toolkit	Defra/ADA	Time to develop and circulate email. Could be piggybacked on another email to reduce resources, although this may not result in the full benefits of awareness raising. Estimated 2-3 days for email specific to toolkit, plus time to deal with replies. The replies would have to be dealt with by the organisation sending out the emails. This organisation (responsibility for sending the emails will have to be determined) would also have to identify an individual responsible for dealing with the emails and determine if a named individual will use their email address or if a generic email address would be used	Email could be targeted at IDBs and LAs and other beneficiaries that might be interested in the outputs	Raises awareness and provides access to the toolkit, is active in that IDBs would be informed directly so might be more likely to encourage them to obtain the toolkit than a more passive approach such as publicity through newsletters (a combination of the two approaches may be the most effective)	Likely to generate replies from those receiving emails, which could be used to identify what additional actions users and beneficiaries would like/need to encourage them to use the toolkit or help them understand the outputs

Table 4-1: Draft Action Plan for rollout of the toolkit					
Potential action	Potential lead	Resources needed	Intended audience	Expected benefits	Follow-up actions, including opportunity for feedback
<b><i>Actions to increase awareness but also increase familiarity of the toolkit for users and beneficiaries</i></b>					
Presentation at conferences or demonstrations	Defra and/or ADA	Time to prepare for presentation (note toolkit slide pack has already been prepared and could be used as basis); time to identify appropriate conference(s) and attend/present, estimated at 2-5 days	IDBs but could also target Local Authorities (depending on conference) and the outputs that could be provided to them	Raises awareness of toolkit and can be used to begin introducing the toolkit, increasing familiarity which may be more likely to result in uptake and use	Provides an opportunity for IDBs/LAs, etc. to ask questions, to get feedback and to obtain views on further actions/assistance that might be needed/ requested. This will depend on identifying conference (s) with the right audience
Workshops to enable IDBs to use the toolkit	ADA and/or IDBs involved in trials and/or consultants	Time for development of workshop plan and activities (again can utilise materials prepared during the study: slide pack, trial materials, etc.); organisation of workshop; invitation of attendees; delivery, estimated at 5-10 days	IDBs, potential users of the toolkit	Enables IDBs to try the toolkit and to get more familiar with it in an environment where they can ask questions of those running the workshop and of their peers	Workshop materials made available for download, etc. in case IDBs do not need to use the toolkit for some time after the workshop. Development of FAQs, potential identification of IDBs that have used the toolkit and can provide assistance to others (cascading). Could also include provision of Webinar (lead by ADA or Defra) to demonstrate the materials

Table 4-1: Draft Action Plan for rollout of the toolkit					
Potential action	Potential lead	Resources needed	Intended audience	Expected benefits	Follow-up actions, including opportunity for feedback
Workshop for beneficiaries to help them understand the outputs from the toolkit	Defra/ADA and/or IDBs involved in trials and/or consultants	As above, but could be half-day workshop for LAs, reducing time needed to potentially 4-7 days	Beneficiaries of IDB activities, such as LAs	Enables LAs to understand the outputs and ask questions about how the results have been derived, etc.	As above, but tailored to beneficiaries. Webinar developed for IDBs could also be made available to other audiences
Creation of eLearning module covering use of the toolkit	Defra/ADA and/or consultants	Time to develop eLearning modules (e.g. using PowerPoint). This can take a considerable amount of time as an effective eLearning course need to be structured from the viewpoint of the learners, thus, it can be difficult to reuse materials already developed. Instead, it is better to develop new materials. The time required is likely to be in the range of 20-40 days	IDBs, potential users of the toolkit	Enables IDBs to try the toolkit and to get more familiar with it in their own time and in a way that suits them; provides resources that are available as and when required so can be used by IDBs as they use the toolkit (unlike a workshop where they may have forgotten how to use it if there is a long delay between the workshop and their first use)	Development of FAQs that can be added to the eLearning module to help future users

Table 4-1: Draft Action Plan for rollout of the toolkit					
Potential action	Potential lead	Resources needed	Intended audience	Expected benefits	Follow-up actions, including opportunity for feedback
Addition of eLearning module for those interested in the results of the toolkit (this could be combined with the eLearning module for users)	Defra/ADA and/or consultants	Time to add additional module for those interested in the outputs. This may be less time intensive than the module to help users but is likely to require 10-20 days to develop, trial, etc.	Beneficiaries of IDB activities who are interested in understanding the outputs from the toolkit	Will help IDBs when they come to explain the outputs. Will help beneficiaries as they will be able to investigate what the outputs mean, how they have been derived, etc. and can investigate this to the level that they need in their own time	Development of FAQs that can be added to the eLearning module to help other beneficiaries better understand the outputs

## 5 Conclusions and Acknowledgements

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### 5.1 Conclusions

The North Level IDB trial enabled discussion around the data that had been used to populate the original estimates and some of the default assumptions that are used to enable quick estimates of the benefits to be made. It was not possible to investigate all of the default assumptions, however, the key assumptions underlying the estimates that could be queried using local knowledge were discussed. The main conclusions were:

1. Assumptions surrounding the number/percentage of residential and business properties that are written-off need to be checked, for example, using LiDAR data.
2. The approach to estimating food production benefits seems to result in very low benefits which seem unrealistic and would be difficult messages to discuss with IDB Boards. Consideration needs to be given as to whether one-off damages should be used in all cases or whether relocation costs should be included when considering permanent losses, as with other assets. This is considered to be more consistent with benefits estimated for other categories, such as biodiversity, that are based on willingness to pay values.
3. There is a need to expand the food production calculation worksheet to include combinable and non-combinable crops and space for 'other' crops.
4. The delay (hours) for the road transport calculation worksheet seems too high at 12 hours; 4 hours may be a better default assumption.
5. There is a need for further investigation of the approach to estimating the value of non-designated biodiversity. The approach looks very detailed and could be considered more reliable than it actually may be.
6. Some of the relocation costs look high, for example, for recreation and tourism. This could skew the results, although in the North Level IDB trial, the benefits for recreation and tourism were low (£0.5 million per year).
7. Use of the benefits assessment spreadsheet requires knowledge of how the spreadsheet works. This could be difficult for a Board without a detailed introduction session and an opportunity to have a first go at working through the spreadsheet with assistance.
8. Investigation is needed into if and how the approaches set out in the spreadsheet could be used in other projects where monetary values of benefits and damages are needed. The trial needs to investigate whether the approaches are likely to be accepted in other contexts.

The River Hull trial provided comments on accessibility of the toolkit and suggestions on how to improve this. Although not all of the changes suggested could be made within this project, a number of revisions to both the spreadsheet and guidance have been made. These include improving the table of data sources within the guidance and adding flowcharts to the spreadsheet.

## 5.2 Next Steps

The North Level IDB trial highlighted key issues over the approach to estimating food production benefits. The low benefits that were estimated when local land values were used look wrong and are likely to be questioned by Board members. Hence, ***further investigation is needed into whether use of the Defra guidance approach to estimating food production benefits is appropriate, especially if this is comparable to approaches to other categories that use willingness to pay values.***

Further investigation is needed to make sure that the damages being calculated for non-designated biodiversity are reliable, especially where IDBs are already undertaking a lot of activities to try to improve and enhance biodiversity. ***Further investigation is needed into whether the simple scoring system is appropriate as the basis for monetising these impacts and how the calculated damages might be viewed.***

The North Level IDB trial also highlighted that there may be a need for training of IDBs to enable them to better understand how the spreadsheet works, what data are needed and how they can be entered. In developing materials for the trial, RPA has prepared a short note setting out the key assumptions and data needs for each calculation worksheet. It may be beneficial to consider the ***need for training workshops where IDB staff can work through the spreadsheet with the assistance of the trainers.***

Investigation should also be taken into the extent to which the approaches included in the spreadsheet could be used in other projects and appraisals. ***Opportunities for use of the spreadsheet as a method for estimating the benefits of activities need to be explored.***

Other suggestions were made in the River Hull trial that could not be incorporated as part of this study due to the time and resources that would be required. These include:

- updating the guidance so it is more like the Multi-Coloured Handbook in that it is easier to see where you are; the spreadsheet could also be aligned with this structure; and
- including a questionnaire type data entry approach to the spreadsheet to make it easier to begin using.

***The desire for these changes amongst IDBs could be explored as the toolkit is rolled out and perhaps included in a subsequent revision to the toolkit to help IDBs use the spreadsheet as far as possible.***

## 5.3 Acknowledgements

Thank you to our trial IDBs, North Level District IDB and York Consortium of IDBs, members of the River Hull Project Board and Philip Raynor of Capita for their time spent discussing the potential use of the toolkit and for their comments and feedback.

## **Annex 1 Results: North Level District IDB**

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### **A1.1 Assumptions discussed and revised**

#### **A1.1.1 Qualitative assessment**

A record of the additional data and results of discussions has been recorded in the 'describe and quantify assets' worksheet. These are reiterated below for each of the calculation worksheets.

#### **A1.1.2 Residential properties**

The main assumptions discussed were:

- Number of residential properties at risk: the total number of properties identified as being at risk was unchanged (10,894).
- Change in probability of impacts (baseline to current): the percentage of properties within each of the probability bands was changed to better reflect the topography of the North level area. The percentage of properties in the 100% and 50% probability of impacts ratings was amended to 25% each. The percentage of properties allocated to the 20% to 0.1% bands was adjusted so that the total did not exceed 50%.
- Number of properties allocated to each probability band: the number of properties was allocated based on the revised percentages. This could be checked using LiDAR data.
- Regional market value (e.g. from Land Registry data): the regional average market value of properties was reduced to £160,000 (from £250,000).
- Comparison of percentage of properties at different probability bands (against the generic assumptions taken from the Multi-Coloured Handbook): see above.

The impact of these changes was to increase the benefits from £3.7 million per year to £27.7 million per year. This is because of the increase in number of properties that would be written-off under the 100% and 50% ratings (218 in the original estimates and 5,448 in the revised estimates). Given the significance of the change and the large increase in benefits, the need to obtain additional data to support the assumptions was discussed. This could be done using LiDAR data.

#### **A1.1.3 Business properties**

The main assumptions discussed were:

- Number of business properties at risk: the total number of business properties at risk was unchanged (2,675).
- Change in probability of impacts (baseline to current): the percentage of business properties at risk in each band was assumed to be the same as for residential properties, hence, the assumptions were changed so they were consistent (25% at 100%, 25% at 50% and 50% allocated across the remaining bands).
- Number of properties allocated to each probability band: the number of properties at risk was changed in line with the percentage assigned to each band.
- Regional market value (e.g. from Rateable Value data, Valuation Office Agency): no change was made to the market value of business properties.

- Comparison of percentage of properties at different probability bands (against the generic assumptions taken from the Multi-Coloured Handbook): see above.
- Number of years over which business properties are annualised (25 years is default): it was discussed and agreed that 25 years seemed an appropriate average life, recognising that this may be longer for some properties and shorter for others.
- Breakdown of business properties into specific types (by number and floor area): the default assumptions were used in the absence of specific data. The time taken to collect these data would be considerable given the large number of businesses within the Board's area.

The impact of these changes was to increase the benefits from £2.3 million per year to £9.2 million per year. As with residential properties, this is because of the significant increase in the number of business properties that are written-off (54 in the original estimates and 1,338 in the revised estimates). Again, this could be verified based on LiDAR data.

### **A1.1.4 Social infrastructure**

The main assumptions discussed were:

- Number of social infrastructure assets at risk by type (schools, universities; hospitals, surgeries; day centres, care homes, nurseries; local authority depots; village halls; post offices, sorting offices): additional surgeries were added based on local knowledge, 15 nurseries were added assuming these were associated with schools, 15 village halls were added (one for each village), with these distributed across the probability bands as for schools.
- Need for inclusion of any other types of social infrastructure: no other types of social infrastructure were identified.
- Change in probability of impacts (baseline to current): given the small number of assets (when compared with residential and business properties), these have been allocated based on their likely probability of impact, using local knowledge.
- Number of assets allocated to each probability band: as above, specific probabilities were identified rather than the percentages assigned to each band.
- Regional market value (e.g. possibly from Rateable Value data, Valuation Office Agency): no data were available so these values have not been changed.
- Typical floor areas (or actual): again these were not varied. Data could be found but the low value of the benefits for social infrastructure means this was not considered proportionate.
- Comparison of percentage of assets at different probability bands (against the generic assumptions taken from the Multi-Coloured Handbook): see above, the default assumptions from the Multi-Coloured Handbook have not been used in this worksheet.
- Number of years over which social infrastructure assets are annualised (25 years is default): the time over which assets are annualised has not been changed.
- Breakdown of social infrastructure assets into specific types (by number and floor area): average floor areas were used, again due to the time and resources that would be needed to obtain specific data not being proportionate to the level of benefits.

The impact of these changes is a small increase in the benefits from £2.299 million per year to £2.312 million per year (the additional significant figures are given to show the small increase). This is due to the increase in the number of assets affected, although many of these would see only a small change in their probability of impacts. Therefore, the change in level of benefits is small.



### **A1.1.5 Emergency services**

The main assumptions discussed were:

- Number of emergency service assets at risk by type (only one police station had been identified in the original estimates): the police station was closed down, therefore, no emergency service assets were thought to be located in the Board's area. As a result no further discussion of other assumptions was made.

The impact of this change was to reduce the benefits to £0. However, they had previously been just £900 per year, such that the change is negligible.

### **A1.1.6 Utilities**

The main assumptions discussed were:

- Number of utility assets at risk by type (sewage treatment works, water treatment works, phone masts, electricity sub-stations, telephone exchanges, gas works/pipelines, oil refineries plus any others): the number of gas works/pipelines was increased from 3 to 7 (to also include gas sub-stations), one 'other' asset was also added: the Anglian Water pumping station to Flag Fen, all 'other' assets that had been recorded in the worksheet were removed as not being affected.
- Change in probability of impacts (baseline to current): the probability of impacts on the sewage treatment works was increased from 50% to 100% under the baseline. No other changes were made to the probability of impacts.
- Number of assets allocated to each probability band: as with social infrastructure, the assets were assigned to probability of impact bands based on local knowledge.
- Regional market value (e.g. possibly from Rateable Value data, Valuation Office Agency): no changes were made to these values.
- Typical floor areas (or actual): no changes were made to these values.
- Comparison of percentage of assets at different probability bands (against the generic assumptions taken from the Multi-Coloured Handbook): see above, these default assumptions were not used as probability of impacts were discussed and identified for individual assets.
- Number of years over which utilities are annualised (25 years is default): the annualisation period was not changed.

The impact of these changes was a small decrease in the damages from £1.6 million per year in the original estimates to £1.4 million per year in the estimates based on discussions during the trial. This was largely due to the removal of the 'other' assets as there had been 70 of these. Many of these related to IDB assets so would no longer be required under the baseline, therefore, should not be included in the benefit calculations.

### **A1.1.7 Transport (road)**

The main assumptions discussed were:

- Length of A roads and critical B roads, and other roads affected: this was assumed to be okay for A roads and critical B roads. The 81km that was assumed to be written-off at 100%

and 81km at 50% were removed from the calculation as they would most likely be providing access to properties that had been written-off (under residential properties) and, as such, there would be no requirement to relocate these roads.

- Change in probability of impacts (baseline to current): it was assumed that the probability of impacts on roads was likely to reflect the probability of impacts on properties. Hence, the same percentages were used as for residential and business properties (50% at 100%, 50% at 50%, with the remaining 50% allocated over the 20% to 0.1% bands).
- Length of road (by type) allocated to each probability band: the length of road allocated to each band was calculated using the revised percentages, above.
- Breakdown of traffic impacts (by type, car, LGV, OGV, etc.): the roads in North Level are used by a lot of HGVs. Therefore, specific data on the breakdown of traffic per type was found on the Cambridgeshire County Council web-site. This showed that there is a much higher proportion of OGV2 traffic (6.5% on A roads in North Level<sup>2</sup> compared with 3.7% for England as a whole). The proportion by type was changed for all vehicles to reflect the specific traffic data.
- Number of vehicles per hour by type of road: traffic count data were used to provide average hourly usage of A roads, critical B roads and other roads (although data were limited for other roads). This resulted in revised hourly rates of 1,288 for A roads in North Level<sup>3</sup> (compared with 579 average for England) and 211 for other roads in North Level<sup>4</sup> (compared with 167 average for England).
- Total number of vehicles affected per hour (by type): the default assumptions were automatically varied due to the change in input data (percentage by type of vehicle and number of vehicles per hour).
- Estimated delay that would be caused: this was reduced to four hours (from a default of 12). It was thought that a default of 12 hours was too long and suggested that this be changed to four. This has been done in the 'template' spreadsheet.
- Estimated change in free flow speeds along affected roads: this changes automatically when the delay is changed, therefore, the reduction in free flow speed is reduced due to the delay being reduced.
- Relocation/rebuild and repair costs: no changes were made to these costs.
- Number of years over which roads are annualised (25 years is default): no changes were made to the annualisation period.
- Comparison of percentage of roads at different probability bands (against the generic assumptions taken from the Multi-Coloured Handbook): as above, this was changed for consistency with residential and business properties.

The impact of these changes is an increase in the direct impacts (due to costs of relocation and repair of roads) from £6.8 million per year in the original estimates and £7.0 million per year in the revised estimates. The indirect damages, however, are significantly reduced following the changes made at the trial (from £2.2 million per year to just £15,000 per year). This mainly occurs because 50% of the roads have been written-off in the trial due to the change in percentage of roads allocated to the 50% and 100% probability bands. It is assumed that there are no indirect impacts

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<sup>2</sup> Based on road traffic statistics for the A47, A1101, and B198. Data from: [ww.dft.gov.uk/traffic-counts/cp.php?la=Cambridgeshire#countpointstable](http://ww.dft.gov.uk/traffic-counts/cp.php?la=Cambridgeshire#countpointstable), accessed 21 October 2013.

<sup>3</sup> Based on the average for the A47 and A1101. Data from: <http://my.cambridgeshire.gov.uk/?tab=maps&layers=Traffic%20Counts&z=200000&x=537035&y=277222>, accessed 21 October 2013.

<sup>4</sup> Based on the value for the B1187. Data taken from the same source as above.

where roads are written-off as the benefits are based on avoided relocation costs (and when the road is relocated there would be no impacts due to increased water levels).

### **A1.1.8 Transport (rail)**

The main assumptions discussed were:

- Length of mainline and branch line and number of stations affected: although the 1km length of mainline was recognised as being within the Board's area, it was felt that the probability of impacts was unlikely to change. Hence, this was 2% under the baseline and 2% under the current. This change meant that there were no benefits to rail and no further discussion on any other assumptions was held.

The impact of this change was to reduce the benefits from £0.7 million per year in the original estimates to £0 following the trial.

### **A1.1.9 Food production**

The main assumptions discussed were:

- Area of land affected by type (arable, livestock land, pigs/poultry, and horticulture): the area of land by type was obtained from drainage rates. This changed the areas to 29,814 ha of arable land (from 25,836 ha) and 1,417 ha livestock land (from 1,591 ha).
- Change in probability of impacts (baseline to current): all of the arable land was moved to the 100% probability band under the baseline (previously 75% had been allocated to the 100% band and 25% to the 50% band). All livestock land was allocated to 2% under the baseline and current situation as it is associated with washlands, therefore, no change in extent to which the land is used was expected.
- Area of land (by use) allocated to each probability band: see above, the changes between the baseline and current were based on local knowledge.
- Whether land would be permanently affected under the different probability of impacts: no change was made to these default assumptions initially. However, the results provided when actual land values were used were considered to be too low and to not reflect the value and importance of agriculture in the area. See below for further discussion on this issue.
- Land values (these are national averages and do not reflect the different uses of land): actual land values of £12,000 per ha were used for arable land, based on valuations by the district valuer. The use of the Defra method for assessing permanent losses and the subtraction of £600 per ha per year for the single payment adjustment has a significant impact on the benefits as the adjusted annualised value decreases from £738 per ha per year (using the England average) to £216 per ha per year (using the district valuer's land values). See below for further discussion on this issue.
- Gross margins (by land use type): these were not changed as all the arable land was assumed to be written-off, hence using the approach suggested by Defra for estimating damages to agricultural land is based on the land value, not the gross margin.
- Number of years over which agricultural land is annualised (20 years is default): this was not changed.
- Comparison of percentage of agricultural land at different probability bands (against the generic assumptions taken from the Multi-Coloured Handbook): land was allocated to

probability bands based on local knowledge. Therefore, the default assumptions were not used here, so no changes were made to the percentages taken from the Multi-Coloured Handbook.

- In addition, consideration needs to be given as to whether further categories are needed for food production ('other', division of arable into combinable, non-combinable, specialist/niche crops): it was considered useful to have combinable and non-combinable crops and an 'other' category. These have now been added to the 'template' spreadsheet.

The main issue arising from the estimated benefits to food production was the decrease in annual damages that arises when the actual land values were included. This change resulted in annual benefits of £4.6 million per year in the trial, compared with £18.6 million in the original estimates. It was felt that the revised figures significantly under-estimated the benefits to food production. The reduction is driven by the subtraction of the £600 per ha single area payment, which changed the annualised benefit from £738 per ha per year to £216 per ha per year. It was felt that this approach did not reflect the losses that would be incurred year-on-year as the land could not be replaced (transferred) elsewhere in the UK such that the annual losses would continue to occur, potentially replaced by imports from outside the UK. In addition, it was noted that there are no relocation costs associated with permanent loss of agricultural land; which there are for all the other categories. Hence, the damages associated with impacts on agricultural land are considered to be under-estimated. Relocation costs may be difficult to estimate for agriculture, although it could be assumed that there would need to be a change in land use to enable increased food production. Given constraints on land availability, it is unclear how this change in land use would occur.

If the benefits are calculated assuming the food production would be lost and continue to be lost annually (i.e. if the benefits are based on one-off damages being avoided, rather than being capped at the land value), the benefits in the trial are estimated at £21.3 million. This was felt to be a much fairer reflection of the likely scale and distribution of benefits when the food production category is compared against other categories (such as residential property for example).

Loss of agricultural production across the IDB district would have a significant knock-on effect on the agricultural supply chain, with many local businesses being significantly impacted. This could result in the loss of a lot of jobs in the local area and a considerable effect on the local economy. This needs to be reflected in the benefits provided by the IDB. At present, there is no method for monetising these benefits, however, they are captured in the qualitative assessment.

#### **KEY ISSUE**

The use of permanent impacts as the basis for estimating benefits following Defra's guidance seems to significantly under-estimate benefits to food production. The single area payment adjustment has a disproportionate effect on the benefits when the actual land values are used (rather than national averages). There are also no relocation costs associated with permanent effects on agricultural land, which is therefore a different approach from that used for other assets.

Using one-off damages is considered to better reflect the annual benefits that are delivered.

### **A1.1.10 Energy (direct)**

The main assumptions discussed were:

- Number of power stations and length of power lines affected: no change was made to the number/length of these assets.
- Change in probability of impacts (baseline to current): it was considered that the 42km of power lines would not suffer any significant change in probability of impacts between the baseline and current situation. Therefore, the probability of impacts was changed such that there were no direct benefits to energy.

This change results in a reduction in benefits from £7.4 million in the original estimates to £0 in the trial. As there are no benefits for this category, no further discussion of assumptions was held.

### **A1.1.11 Energy (indirect)**

Although this worksheet is linked to other worksheets, the actual number of sub-stations can be used as the basis for the estimates. Therefore, the main assumptions discussed were:

- Number of electricity sub-stations by type affected: no changes were made to the default assumptions.
- Typical customer distribution across the sub-stations: no changes were made to the default assumptions.
- Typical cost of power outage: no changes were made to the default assumptions.
- Number of hours per power outage: no changes were made to the default assumptions.
- Comparison of percentage of sub-stations at different probability bands (against the generic assumptions taken from the Multi-Coloured Handbook): no changes were made to the default assumptions, although the trial did identify the need to check the calculations, as the benefits seemed to be the same as in the original estimates even though the number of properties at each risk band had changed. A check was made and the reason for the change in benefits (reduction) is that many of the residential properties were now written-off, hence would not benefit from a reduction in power outages due to less frequent inundation of electricity sub-stations. Also, there was a need for a correction to the numbers of businesses affected to ensure that this reflected the number of business properties allocated to each probability band. This has now been revised and corrected in the 'template' spreadsheet.

The impact of the changes to number of residential and business properties at risk is a reduction in the benefits from £17.9 million per year to £6.1 million per year (note that much of this change is due to the correction to business properties).

### **A1.1.12 Designated biodiversity sites**

The main assumptions discussed were:

- Area of habitat (by designation: international, national and other/local) affected: the area of international designations was revised from 1,517 ha to 1,417 ha in line with drainage rate data.
- Change in probability of impacts (baseline to current): no changes were made.
- Area (by designation) allocated to each probability band: no changes were made.

- Whether designations would be permanently affected under the different probability of impacts: no changes were made.
- Relocation costs: no other costs were identified.
- Willingness to pay values used as damage costs: there was discussion over the use of willingness to pay values and relocation costs for biodiversity, and land values for food production. This means that the two calculations are very different from each other and may not be comparable. If actual land values were used for biodiversity benefits, then the benefits would be much lower. For example, land values of £12,000 per ha per year (as for agriculture) compared with relocation costs for international designations of £50,000 per ha per year.
- Number of years over which habitats are annualised (20 years is default, for consistency with agricultural land): no change was made.
- Comparison of percentage of area of designations at different probability bands (against the generic assumptions taken from the Multi-Coloured Handbook): the areas of designated habitats were allocated to probability of impact bands based on local knowledge, hence, the percentages from the MCH were not used.

The estimated benefits from the trial are £4.8 million per year, slightly reduced from the original estimates of £5.1 million. This is because of the reduction in area of international designations.

### **A1.1.13 Biodiversity non-designated**

The main assumptions discussed were:

- Change in habitat and areas allocated to different management or habitats: information on agri-environment payments for Cambridgeshire was included (where 'intensive arable' under agri-environment payments was allocated to 'intensive arable, managed to enhance biodiversity'). Areas of land were corrected to align with those used for food production. All grassland was changed from 'intensive grassland' to 'extensive grassland managed to enhance biodiversity' as it is all part of the wash habitat.
- Change in length of watercourse by management: all watercourses were moved to 'managed to enhance biodiversity where possible' under the current situation and to 'other watercourses' under the baseline.
- Appropriateness of scores allocated to change in biodiversity value from change in habitat or watercourse management (this is a simple approach from -2 to +2): the score for a change from 'extensive grassland' to 'intensive arable managed to enhance biodiversity' was changed from -1 to 0. The score for a change from 'extensive grassland managed to enhance biodiversity' to 'intensive arable managed to enhance biodiversity' was changed from -2 to -1.
- Willingness to pay values used as basis for estimating benefits of protecting biodiversity: no change was made, although there was a question as to whether use of willingness to pay for biodiversity was comparable with the approach being used to value food production benefits (especially when compared with the Defra guidance approach to estimating benefits to food production).
- Average width of a watercourse (default is 1m, used to convert km of watercourses to an area so the willingness to pay value can be applied): no change was made.

The impact of these changes is a small reduction in the damages caused to non-designated biodiversity from -£3.9 million per year in the original estimates to -£3.4 million for year in the trial.

This is mainly associated with the change to land areas and inclusion of the agri-environment payments that moved 53% of 'intensive arable' land to 'intensive arable managed to enhance biodiversity'. There are questions over the reliability of this assessment and whether the damages that are estimated are really damages at all. There is a risk that by monetising these damages that they become accepted, when in reality they are highly uncertain. It was considered that further exploration is required of the assumptions on the non-designated biodiversity calculation worksheet given the transient nature of biodiversity and, hence, biodiversity value.

#### **A1.1.14 Carbon**

The assumptions for carbon are very similar to those required for non-designated biodiversity, although the management aspect of habitats is not considered in the carbon worksheet. The main assumptions discussed were:

- Change in habitat and areas allocated to different habitats: the areas allocated to each land use were revised to be consistent with the areas used in the food production and non-designated biodiversity worksheets. This resulted in 12,918 ha being identified as moving from grassland (baseline) to cropland (current situation), and 12,918 ha moving from marsh (baseline) to cropland (current situation). There was no change for grassland. This compares with 6,459 moving from grassland to cropland, 19,377 ha moving from marsh to cropland and 795 ha moving from marsh to grassland in the original estimates.
- Appropriateness of carbon sequestration values allocated to each habitat type (these are based on a review of the available scientific literature): no change was made.
- Value attributed to CO<sub>2</sub> (this is based on the untraded value for CO<sub>2</sub> from DECC): no change was made.

The result of the change in land areas allocated to each land use was a slight reduction in damages from -£5.5 million per year (original estimates) to -£5.4 million (trial). The change is small because the change in carbon sequestered in grassland and marsh soils is the same in the default assumption. Therefore, there is no impact on the damages if land is moved between the marsh and grassland land use categories.

#### **A1.1.15 Water supply**

The main assumptions discussed were:

- Number of licences by type (public water supply, spray irrigation, other agriculture, electricity supply, other industry, fish farming, private water supply): following discussions it was agreed that there were no abstraction licences in the area that were used to provide water for use outside the area.

As there are no licences, no further discussion was held on this worksheet. The original estimates included two Public Water Supply licences and five spray irrigation licences, hence the benefits reduced to £0 (trial) from £36,000 per year direct benefits (linked to the spray irrigation licences) and £1.2 million per year indirect benefits (linked to the Public Water Supply licences).



### **A1.1.16 Heritage**

The main assumptions discussed were:

- Number of heritage designations present (international (World Heritage Sites), national (listed buildings, scheduled monuments, registered parks and gardens, registered battlefields), local (conservation areas, local listing/local heritage assets)): discussions were held on the type of sites that were included but no change was made.
- Number of heritage assets by type affected: as above, discussions were held on the sites that were included (based on English Heritage data) but no change was made to the numbers.
- Change in probability of impacts (baseline to current) and number of heritage assets (by type) allocated to each probability band: no change was made to the allocation of listed building assets as this had been done based on their location. However, it was considered that there would be no impacts on scheduled monuments as these were all prehistoric sites so would have been present before the IDB existed, hence, they would be likely to survive under a baseline of no IDB.
- Typical number of visitors to heritage assets (could be replaced by actual number of visitors, where known): no change was made.
- Value per visitor of a trip to a heritage asset: no change was made.
- Whether impacts are likely to be permanent or occasional: no change was made.
- Relocation costs: no change was made.
- Number of years over which the relocation costs are annualised (default is 25 years): no change was made.
- Comparison of percentage of heritage assets at different probability bands (against the generic assumptions taken from the Multi-Coloured Handbook): these percentages were not used as the location of the sites was taken as the basis for allocating sites to the probability of impact bands.

The impact of the changes to probability of impacts on scheduled monuments was a reduction in heritage benefits from £4.9 million per year (original estimates) to £4.4 million per year (trial).

### **A1.1.17 Recreation and tourism**

The main assumptions discussed were:

- Number of recreational assets present by type: the number of horse riding centres was increased to three, eight sports grounds were also added as an 'other'.
- Number of recreational assets by type affected: the additional recreational assets increased the total to 56 (from 46).
- Change in probability of impacts (baseline to current) and number of recreational assets (by type) allocated to each probability band: the number of assets allocated to each probability of impacts band was increased in proportion to the number of additional assets (10).
- Weight assigned to each type of recreational asset: sports grounds were allocated a weight of 2 (assets that visitors may have identified as being of interest once they have decided to visit the area).
- Typical number of visitors to the area (could be replaced by actual number of visitors, where known): no change was made, no actual visitor numbers were available.
- Value per visitor of a trip for recreational purposes: no change was made.



- Whether impacts are likely to be permanent or occasional: no change was made.
- Relocation costs: no change was made, although it was thought that the values included looked high.
- Number of years over which the relocation costs are annualised (default is 25 years): no changes were made.
- Comparison of percentage of recreational assets at different probability bands (against the generic assumptions taken from the Multi-Coloured Handbook) no change was made.

The impact of including an additional ten recreational assets is an increase in benefits from £0.4 million per year (original estimates) to £0.5 million per year (trial). This is much lower than many of the other categories.

### **A1.1.18 Jobs**

The calculations undertaken in this worksheet include estimates of the indirect benefits resulting from IDB expenditure on the number of jobs supported in the area. This does not cover jobs supported by IDB activities to manage water levels (this can only currently be picked up in the qualitative assessment). The main assumptions discussed were:

- Leakage (percentage of money that the IDB spends that is spent outside the IDB district), this is set at a default value of 70%: it was decided to reduce the leakage value to 20% as almost all of the money spent by the Board is in the local area, using local employees and local contractors. Some consultants are employed that are outside the area.
- Multiplier (this is based on generic data for the UK as a whole and for an aggregated sector spend that may not reflect IDB spend): no change was made.
- Expenditure per 1 staff (this is based on average across all IDBs): no change was made.

The impact of changing the leakage assumption is an increase in indirect benefits from £0.8 million per year (original estimates) to £2.2 million per year (trial).

## **A1.2 Results and comparison with original estimates**

### **A1.2.1 Overview**

This Section provides an indication of the overall benefits that are estimated to be provided by North Level IDB. It also describes the changes in benefits from the original estimates and how revisions to the data and assumptions used have resulted in these changes. The tables and graphs shown below are taken from the benefits assessment spreadsheet.

### **A1.2.2 Results of the trial**

The overall benefits provided by North Level IDB compared with the baseline of no IDB are shown in Table A1-1 (taken from the 'summary by category' worksheet). The table shows that the total benefits are estimated at £68 million per year, with £8 million per year of damages. This gives overall benefits from IDB activities of £60 million per year.

<b>Table A1-1: Benefits by category</b>				
<b>IDB benefits (to two significant figures)</b>				
<b>Category</b>	<b>IDB Benefits</b>	<b>IDB damages</b>	<b>% total benefits</b>	<b>% total damages</b>
Carbon	£0	-£5,000,000	0%	63%
Residential properties	£28,000,000	£0	41%	0%
Business properties	£9,200,000	£0	14%	0%
Social infrastructure	£2,300,000	£0	3%	0%
Emergency services	£0	£0	0%	0%
Utilities	£1,400,000	£0	2%	0%
Transport (road) direct	£7,000,000	£0	10%	0%
Transport (road) indirect	£15,000	£0	0%	0%
Transport (rail) direct	£0	£0	0%	0%
Transport (rail) indirect	£0	£0	0%	0%
Food production	£4,600,000	£0	7%	0%
Energy (direct)	£0	£0	0%	0%
Energy (indirect)	£6,100,000	£0	9%	0%
Designated biodiversity sites	£4,800,000	£0	7%	0%
Non-designated biodiversity sites	£0	-£3,000,000	0%	38%
Water supply	£0	£0	0%	0%
Recreation and tourism	£510,000	£0	1%	0%
Heritage	£4,400,000	£0	6%	0%
<b>TOTAL</b>	<b>£68,000,000</b>	<b>-£8,000,000</b>	<b>100%</b>	<b>100%</b>
<b>OVERALL</b>	<b>£60,000,000</b>	<b>annual benefits from IDB activities</b>		

Most of the benefits come from protection of residential properties (41%). Benefits from food production are estimated at just £4.6 million per year, or 7% of the total. If an alternative approach to food production benefits is used, based on one-off benefits rather than land values, the benefits to food production increase to £21 million per year; total benefits increase to £85 million per year and overall benefits (benefits minus damages) to £77 million per year. Food production benefits then make up 25% of the total benefits, with residential properties making up 33%, as shown in Table A1-2.

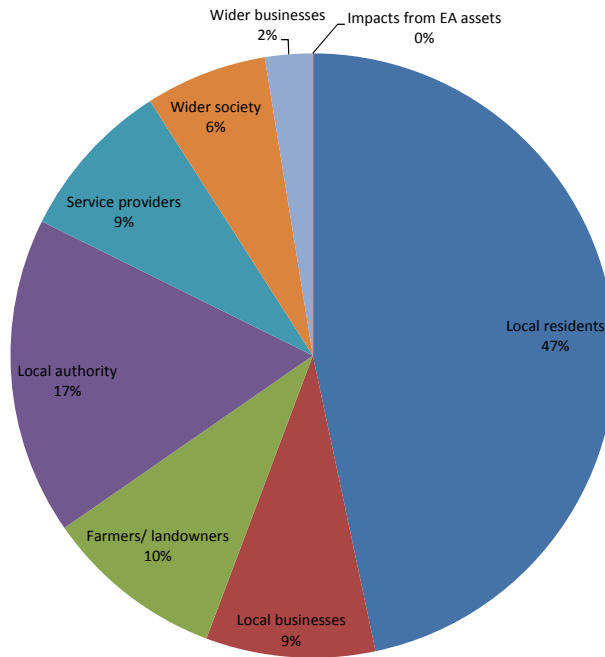
<b>Table A1-2: Benefits by category (revised approach to food production benefits)</b>				
<b>IDB benefits (to two significant figures)</b>				
<b>Category</b>	<b>IDB Benefits</b>	<b>IDB damages</b>	<b>% total benefits</b>	<b>% total damages</b>
Carbon	£0	-£5,000,000	0%	63%
Residential properties	£28,000,000	£0	33%	0%
Business properties	£9,200,000	£0	11%	0%
Social infrastructure	£2,300,000	£0	3%	0%
Emergency services	£0	£0	0%	0%

<b>Table A1-2: Benefits by category (revised approach to food production benefits)</b>				
<b>IDB benefits (to two significant figures)</b>				
Utilities	£1,400,000	£0	2%	0%
Transport (road) direct	£7,000,000	£0	8%	0%
Transport (road) indirect	£15,000	£0	0%	0%
Transport (rail) direct	£0	£0	0%	0%
Transport (rail) indirect	£0	£0	0%	0%
<b>Food production</b>	<b>£21,000,000</b>	<b>£0</b>	<b>25%</b>	<b>0%</b>
Energy (direct)	£0	£0	0%	0%
Energy (indirect)	£6,100,000	£0	7%	0%
Designated biodiversity sites	£4,800,000	£0	6%	0%
Non-designated biodiversity sites	£0	-£3,000,000	0%	38%
Water supply	£0	£0	0%	0%
Recreation and tourism	£510,000	£0	1%	0%
Heritage	£4,400,000	£0	5%	0%
<b>TOTAL</b>	<b>£85,000,000</b>	<b>-£8,000,000</b>	<b>100%</b>	<b>100%</b>
<b>OVERALL</b>	<b>£77,000,000</b>	<b>annual benefits from IDB activities</b>		

Allocation of benefits across beneficiaries is significantly affected by the approach used for food production. Figure A1-1 shows the distribution when the Defra guidance approach to estimating food production benefits is applied (figure taken from the 'chart-benefits by beneficiary' worksheet). Figure A1-2 presents the distribution when it is assumed that food production benefits are better represented using the gross margin losses (one-off). In both cases, local residents are the main beneficiaries but this varies from 47% (Defra approach) to 38% (one-off, gross margin approach). Benefits to farmers/landowners increase from 10% to 27% (one-off, gross margin approach).

**Chart showing proportion of benefits by beneficiary**

These benefits are for one IDB only. It is not appropriate to add benefits from IDBs as this is likely to significantly under-estimate cumulative benefits

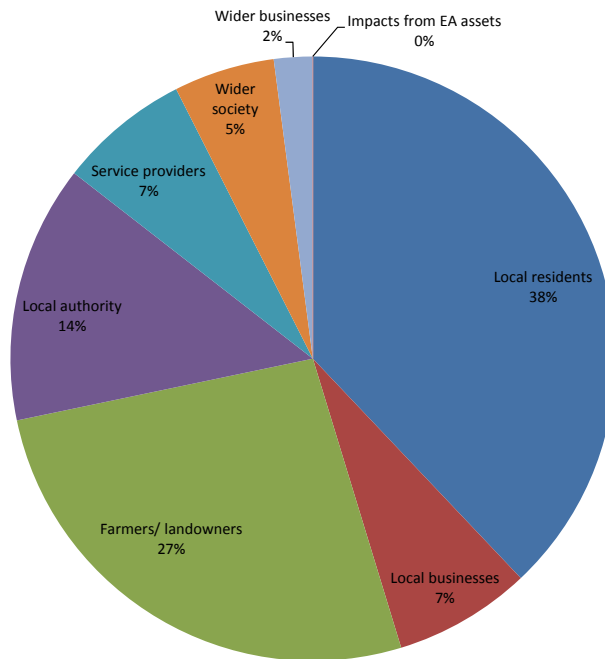


**Monetised benefits only (excludes qualitative benefits)**  
 Note: benefit values ignore the timing of benefits. If benefits were to occur some time into the future they could be significantly smaller (in Present Value terms) than those used to estimate the proportion of benefits by beneficiary

**Figure A1-1: Distribution of benefits across beneficiaries (Defra guidance approach to food production benefits)**

**Chart showing proportion of benefits by beneficiary**

These benefits are for one IDB only. It is not appropriate to add benefits from IDBs as this is likely to significantly under-estimate cumulative benefits



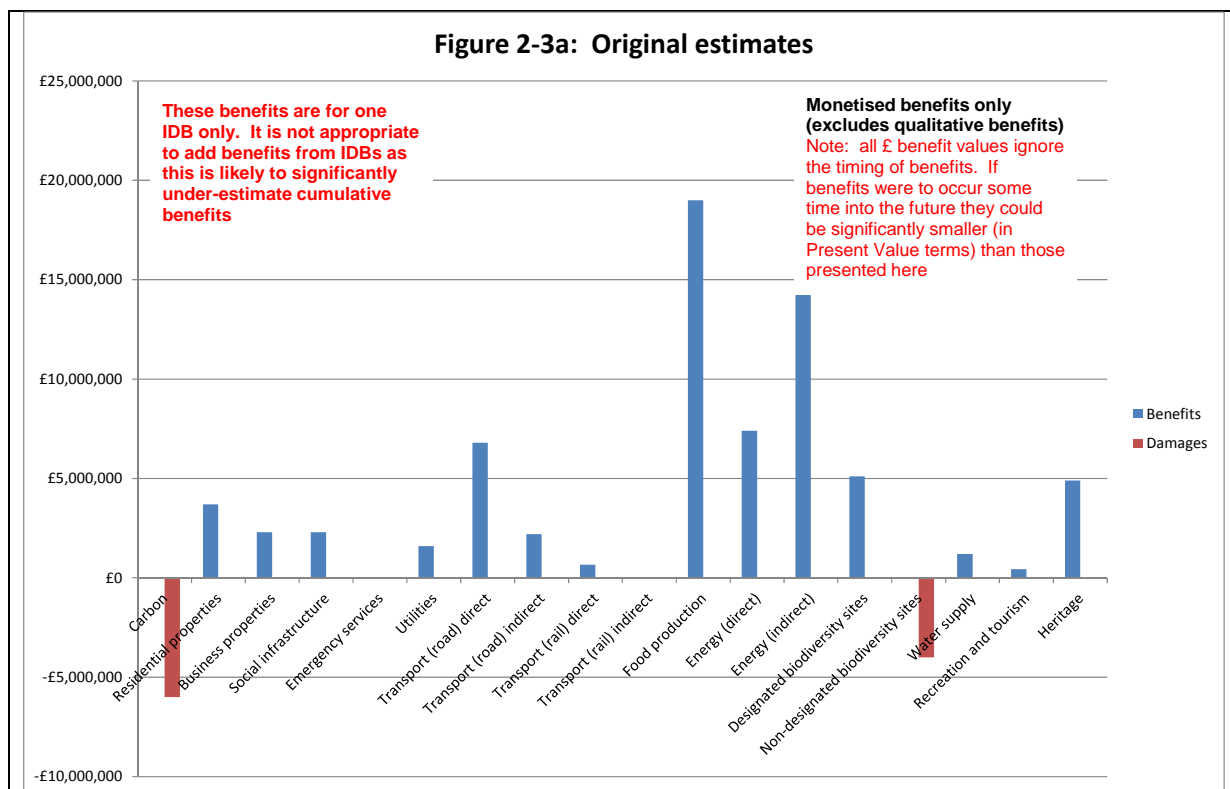
**Monetised benefits only (excludes qualitative benefits)**  
 Note: benefit values ignore the timing of benefits. If benefits were to occur some time into the future they could be significantly smaller (in Present Value terms) than those used to estimate the proportion of benefits by beneficiary

**Figure A1-2: Distribution of benefits across beneficiaries (using one-off, gross margin, as basis for food production benefits)**

### A1.2.3 Comparison with the original estimates

The original estimates result in overall benefits of £66 million per year (£76 million per year benefits and £10 million per year damages). This is slightly higher than the £60 million per year overall benefits (Defra approach to food production) or slightly lower than the £77 million per year overall benefits (one-off, gross margin approach to food production). There are though, significant differences between the distribution of benefits and damages across the various categories. Figure A1-3 provides bar charts showing the spread of benefits and damages for the original estimates (A1-3a), the trial estimates based on the Defra approach to food production benefits (A1-3b) and the trial estimates based on the one-off, gross margin approach to food production benefits (A1-3c).

A comparison of these three charts shows the significant changes to the residential properties, business properties and food production ‘bars’. Energy (indirect) also decreases significantly in the trial estimates (due to the assumption that there would be no impact on power lines from occasional inundation). Transport damages (indirect road, direct rail, indirect rail) all become £0 in the trial estimates, but there is only a small change in direct road benefits.



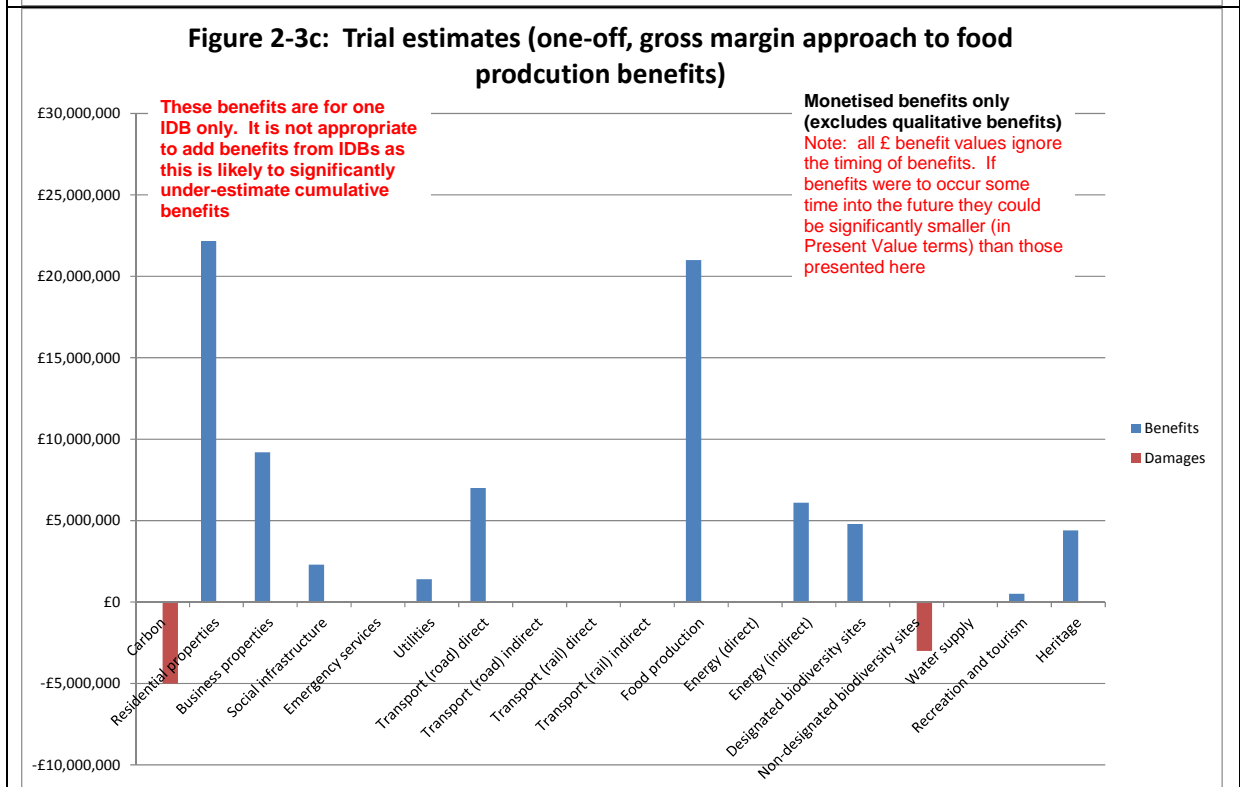
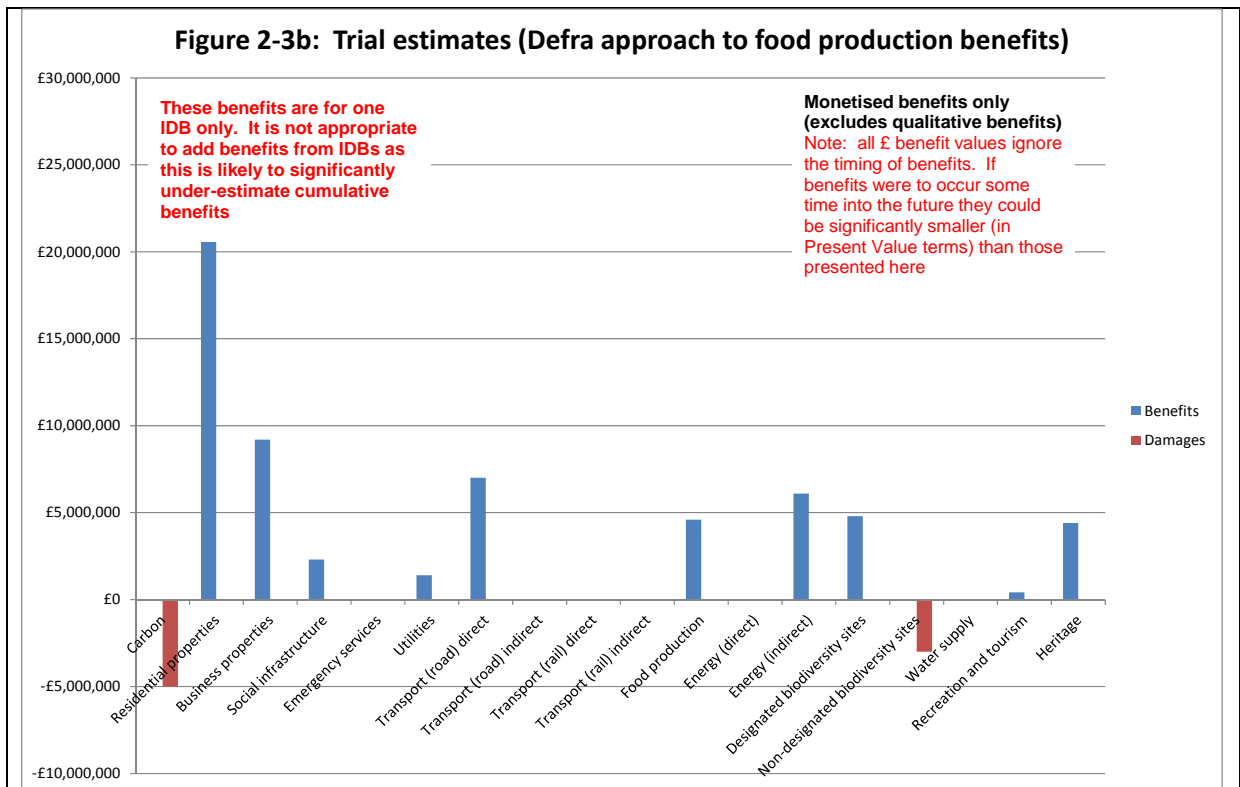


Figure A1-3: Comparison of benefits and damages by category from the original estimates (A1--3a), the trial based on the Defra guidance approach to estimating food production benefits (A1--3b) and the trial estimates using one-off, gross margin approach to estimating food production benefits (A1--3c)

## A1.3 Conclusions and recommendations

### A1.3.1 Conclusions

The trial enabled discussion around the data that had been used to populate the original estimates and some of the default assumptions that are used to enable quick estimates of the benefits to be made. It was not possible to investigate all of the default assumptions, however, the key assumptions underlying the estimates that could be queried using local knowledge were discussed. The main conclusions were:

9. Assumptions surrounding the number/percentage of residential and business properties that are written-off need to be checked, for example, using LiDAR data.
10. The approach to estimating food production benefits seems to result in very low benefits which seem unrealistic and would be difficult messages to discuss with IDB Boards. Consideration needs to be given as to whether one-off damages should be used in all cases or whether relocation costs should be included when considering permanent losses, as with other assets. This is considered to be more consistent with benefits estimated for other categories, such as biodiversity, that are based on willingness to pay values.
11. There is a need to expand the food production calculation worksheet to include combinable and non-combinable crops and space for 'other' crops.
12. The delay (hours) for the road transport calculation worksheet seems too high at 12 hours; 4 hours may be a better default assumption.
13. There is a need for further investigation of the approach to estimating the value of non-designated biodiversity. The approach looks very detailed and could be considered more reliable than it actually may be.
14. Some of the relocation costs look high, for example, for recreation and tourism. This could skew the results, although in the North Level IDB trial, the benefits for recreation and tourism were low (£0.5 million per year).
15. Use of the benefits assessment spreadsheet requires knowledge of how the spreadsheet works. This could be difficult for a Board without a detailed introduction session and an opportunity to have a first go at working through the spreadsheet with assistance.
16. Investigation is needed into if and how the approaches set out in the spreadsheet could be used in other projects where monetary values of benefits and damages are needed. The trial needs to investigate whether the approaches are likely to be accepted in other contexts.

### A1.3.2 Recommendations

The trial highlighted key issues over the approach to estimating food production benefits. The low benefits that were estimated when local land values were used look wrong and are likely to be questioned by Board members. Hence, ***further investigation is needed into whether use of the***

***Defra guidance approach to estimating food production benefits is appropriate, especially if this is comparable to approaches to other categories that use willingness to pay values.***

Further investigation is needed to make sure that the damages being calculated for non-designated biodiversity are reliable, especially where IDBs are already undertaking a lot of activities to try to improve and enhance biodiversity. ***Further investigation is needed into whether the simple scoring system is appropriate as the basis for monetising these impacts and how the calculated damages might be viewed.***

The trial also highlighted that there may be a need for training of IDBs to enable them to better understand how the spreadsheet works, what data are needed and how they can be entered. In developing materials for the trial, RPA has prepared a short note setting out the key assumptions and data needs for each calculation worksheet. It may be beneficial to consider the ***need for training workshops where IDB staff can work through the spreadsheet with the assistance of the trainers.***

Investigation should also be taken into the extent to which the approaches included in the spreadsheet could be used in other projects and appraisals. ***Opportunities for use of the spreadsheet as a method for estimating the benefits of activities need to be explored.***

Some modifications are needed to the benefits assessment spreadsheet, including addition of extra categories to the food production worksheet and changes to the default assumption for delay (hours) for the road transport worksheet. These changes have already been made to the 'template' spreadsheet and will be made available for use by other IDBs in subsequent trials.



## Annex 2 Results: River Hull Strategy

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### A2.1 Comments received (slightly abridged)

First impressions of the spreadsheet were that it looked complicated. I could pick out various strands of the appraisal method but found it difficult to figure out what each worksheet was doing and how it all linked together, even after reading the 'Instructions' tab.

After viewing the slide pack and reading the guidelines the worksheet became a lot more understandable but in my opinion the 'Instructions' tab could do with having some of this additional information in it, to help the user get a quick start. Perhaps a flow chart or something in the Instructions tab would help? The remainder of the worksheets might also benefit from additional information, to help the intuitiveness of completing the spreadsheet – Not everyone likes reading and then following written instructions. Maybe a questionnaire type data entry field might speed up the start and something to highlight where you are in the process at each level of assessment (like the MCH)?

It seemed that to apply this quickly the user would need to have done some leg work before any round table discussion with stakeholders, to have input some of the basic data and to have identified some of the assets that are present within the 'Assets' worksheet. There is a data list in Table 4.1 of the Guidance document but perhaps a more specific list of data may help the user. Taking Carbon for example: Table 4.1 lists sources of potential data and the example provided for the North Level provides quantitative and qualitative information on different types of habitats and their areas. Perhaps a checklist of the key habitats to include might help the user gather all the information required beforehand and make the application of the spreadsheet itself quicker and easier. The same could be applied to the different types of households, businesses etc.

Some other comments on the worksheets and guidelines.

- The Data sources in Table 4.1 could do with links to websites to ease sourcing the data required.
- Corine Land Cover Maps – dated 2000 for latest technical addendum. Is the actual data newer, e.g. 2009?
- Data sources doesn't make a mention of the NRD, which has its limitations obviously, but why is that when it could be a quick source of information on many of the assets to be included? There are references to datasets that are more easily accessible but perhaps which take significantly longer to collate on a layer by layer basis and may therefore require much further analysis.
- Should there be a mention of threshold levels in relation to properties – particularly at the high level of application, as properties that are not affected internally wouldn't be taken into account in detailed appraisals under FCERM-AG.
- Length of roads easier to quantify than area.
- The blue to blue colour range in the map of magnitude-significance makes it a little difficult to quickly see what it is showing.

Thinking about the application of this to the RHICS specifically, I understand that there is one workbook per IDB, that it is a framework of assessment based on an ecosystem services approach (monetised where possible using best-practice methods) and that it seeks to distribute benefits between EA and the IDB to quantify the benefits and damages associated with the work that the IDB does.

The approach seems complimentary to the RHICS study and particularly may be useful in assessing benefits from strategy options that fall outside of the current MCM/MCH approach and FCERM-AG. The ecosystem services approach to the appraisal is something that I'm not particularly familiar with and which I believe is not included in the methods advocated in the MCM/MCH, however, there may be good reason to incorporate this type of analysis into the overall RHICS assessment in a manner similar to that shown in the worksheet.

We've yet to get any model outputs so I haven't been able to start populating the spreadsheet in any meaningful way so I haven't really been able to get into the detail of applying the spreadsheet but as you can tell from the above I can see the benefits of applying some of the approaches within our study but they may not strictly be within the boundaries of what the method was developed for.

## A2.2 Questions raised and responses

Without wanting to push the boundaries of the spreadsheets capabilities, I have a couple of questions though and perhaps you might be able to help answer them:

- Could it be applied to a catchment rather than a specific IDB in order to define ecosystem services benefits and costs of different flood risk management scenarios?

RPA response: There is no reason why you couldn't apply the spreadsheet to a catchment. The terminology is linked to IDB districts because this was the original intention of the spreadsheet. However, the identification of assets is linked to the area under consideration and this can be defined by the user. We tried to design the spreadsheet so it had more potential uses than just the IDB district. For example, we considered that it might be used for specific areas within a district. As long as these are defined and the assets within the defined area identified, then the spreadsheet should still work!

- Could it be applied to identifying the effect of different flood risk management interventions on existing IDB benefits? So that the baseline would be a 'with change in Flood Risk Management' rather than 'without IDB'.

RPA response: Again, we tried to design the spreadsheet so it could be used for more than just the with/without IDB scenario. The matrices allow you to identify the number of assets whose probability of impacts changes, so this could be a change due to different flood risk management scenarios where the impacts would not necessarily be as great as a move to a 'no IDB' scenario. In some ways, the 'no IDB' scenario is analogous to the 'do nothing' baseline used for most appraisals but you could also look at do-minimum (in fact we have used the spreadsheet in this way on a project for the Environment Agency to get some quick estimates of the benefits of improving rather than just maintaining defences).

- If applied in parallel to the standard FCERM-AG approach would there be double counting of benefits – I'm thinking particularly to people and properties, social infrastructure, emergency services, utilities and transport – and could these be omitted from the spreadsheet to define those additional ecosystem services benefits without double counting?

RPA response: Where we could we have used approaches that are consistent with the MCM/MCH, especially in terms of those benefit categories that are more typically monetised (property damages for example). For transport and agricultural damages, we used the approaches set out in the MCM/MCH as the basis for the calculations but automated many of the steps so they are easier and quicker to undertake. We have also included categories that follow other approaches as these weren't included in the MCM/MCH, such as recreation\*, heritage and energy. Since the approach is the same as in the MCM/MCH (albeit simplified/generalised to reduce the time needed to calculate the benefits) if you also calculate the benefits for the same categories outside the spreadsheet you would be double counting. The aim of the spreadsheet was to provide a quick method for assessing the types of benefits including in the FCERM-AG supplemented by other benefit categories that are not typically included in an FCERM-AG analysis (although there is no reason why these additional categories could not be included in a FCERM appraisal if they could be monetised). The main risk with recreation and heritage is that the impacts might just be local, i.e. they may not be impacts at the national level as visitors could go elsewhere. The energy calculations are uncertain as they are based on a willingness to pay value from the United States, so might not be accepted in a FCERM appraisal as being sufficiently robust. However, all the approaches are consistent with the FCERM-AG guidance; care just needs to be taken with the potential transfer payments when looking to obtain Grant-in-Aid.

\* Recreation is included in the MCM/MCH but not in a way that you could easily automate much of the calculation, so we took a slightly different approach based on a method we developed for the Environment Agency for the benefits of schemes to address water quality/water availability issues which calculates typical visitor numbers to different types of area based on the number of attractions, quality of the site for visitors, etc.



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