



Residential Flood Damages

Summary

This guideline has been developed to provide both a more appropriate level of flood damage (adjustable with time) and more consistent residential flood damage calculations, whilst allowing for variability between floodplains. The guideline does not address either house failure or non-residential damages.

Introduction

Whilst no definitive data exists on flood damages, consistent assessment across NSW is necessary for fair comparison of projects.

This guideline outlines an approach to the development of a representative damage curve for a typical house in the floodplain using a residential flood damage spreadsheet developed by DECC that is based upon work undertaken for it by Risk Frontiers in the Natural Hazards Research Centre at Macquarie University. This approach uses a typical damage curve rather than approaches (such as FLDAMAGE) which allow damages to be estimated for individual dwellings on the basis of their size (small, medium and large) and age (new, old).

This guideline outlines the process and use of the typical damages curve to enable assessment of mitigation options in the following sections and provides an outline and examples of how to do annual average damage (AAD) and net present value (NPV) calculations:

- Section 1. Discusses derivation of a damage curve for a typical house in the floodplain using DECC's spreadsheet.
- Section 2. Compares DECC and Risk Frontiers work with other historic work.
- Section 3. Discusses specific issues with other approaches or curves that have been used.
- Section 4. Discusses AAD and NPV calculations.

Impacts on Assessments Using Other Methods and for Other Types of Development

Section 3 provides an adjustment for FLDAMAGE calculations on top of the inclusion of GST (where applicable) and average weekly earning (AWE) adjustments to bring damages more in line with those calculated using the approach outlined in this guideline.

No specific advice is provided in relation to commercial or industrial properties or multi-unit residential developments. However, no matter the model used the base data should be adjusted to current day by using AWE and including GST, where applicable.

Recommendations

It is recommended that flood damage calculations for studies undertaken with either technical or financial assistance from DECC be undertaken in accordance with this guideline. Reports should include a specific section of flood damages to document the assumptions made and findings of the damages assessment.

References

- Department of Infrastructure Planning and Natural Resources. "Floodplain Development Manual: the management of flood liable land", gazetted May 2005.
- Blong, R McAneney, J. Risk Frontiers (for DECC). "Residential Flood Damage" November 2002.

Section 1 Derivation of a Typical Curve for House on a Floodplain

This approach does not purport to provide a definitive assessment of damages but instead provides consistent basis for calculation of flood damage between different projects across NSW whilst allowing consideration for local variation through the scale of a typical house and the value of its contents.

This information can be used to derive total damages across the floodplain for specific events, and for derivation of average annual damages (AAD) and net present values (NPV) of damages to enable comparisons of management options in management studies. A consistent approach to damage calculations helps ensure a level playing field when projects are being prioritised for funding purposes.

This section describes a spreadsheet tool developed by and available from DECC which assists in deriving average residential damage curves for slab on ground, low set and high set houses for a specific floodplain. The background to the development of the spreadsheet is outlined in Section 2.

The spreadsheet also provides an example of the linkage between generation of flood damage curves and tables for houses discussed below and typical residential flood damage, AAD and NPV of damages calculations, as discussed in Section 4.

Developing Location Specific Residential Damage Curves

When using the spreadsheet the following should be noted:

- All input cells are highlighted with red text.
- All other cells are locked and cannot be altered.
- Blue text is typically descriptive/informative or relevant to iterative calculations.
- Black text is to do with outcomes of calculations or descriptions.

The spreadsheet including a number of worksheets as follows:

- **Typical Curve Input:** provides the base input for curve development. This involves location

specific factors for buildings, contents, additional factors and two storey house adjustments and provides the Risk Frontiers base curves upon which variations are based. The required input is outlined below:

Buildings

- **Regional Cost Variation Factor.** This can be derived from Rawlinsons.
- **Post Late 2001 Adjustments.** This can be derived from changes in AWE from the “AWE stats” worksheet in the damage calculation spreadsheet. More up to date figures may be able to be sourced from the Australian Bureau of Statistics web site (www.abs.gov.au).
- **Post Flood Inflation Factor.** This is a real factor resulting from the cost of house repairs (not contents) being significantly higher than predicted by insurance assessors. Judgement is required here so indicative rather than definitive guidance is provided. The factor should be considered on the basis of what happens in a 1% AEP event.
- **Typical Duration of Immersion.** This is for input information only for later reference.
- **Building Damage Repair Limitation Factor.** A typical reduction factor for longer duration immersion is 0.85, whilst 0.75 is used for short duration immersion (<12 hours) as some materials recover from short periods of inundation and do not need replacement.
- **Typical Building Size.** An indicative figure can be used for adjustment of total building damage and value of contents (this can be directly overridden). To estimate this figure it may be expedient to note the relative sizes of dwellings (small, medium, large) during the “drive-by” survey and use the relative proportions of each to estimate the “typical” or average building size.
- **Total Building Adjustment Factor.** The above figures combine to give a total building adjustment factor which is used to adjust the base curves on this worksheet to derive the revised curves on the equations worksheet.

Contents

- **Average Contents Relevant to Location.** This is adjusted on the basis of \$60,000 for a 240sqm house reducing to a minimum of \$30,000 for a 120sqm house. This figure can be overridden, if better information is available or is considered more valid for the location.
- **Post Late 2001 Adjustments.** This is automatically transferred from the entry under "Buildings" above.
- **Contents Damage Repair Limitation Factor.** A typical reduction factor for longer duration immersion would be 0.90, with 0.75 used for short duration immersion (<12 hours) as some materials can recover from short periods of inundation and may not need replacement.
- **Level of Flood Awareness.** Indicates whether the community's flood awareness is likely to be high or low. Low should be used as a default unless a level of high can be justified.
- **Effective Warning Time.** The minimum warning time available for the community to react.
- **Interpolated DRF adjustment.** A damage reduction factor (DRF) adjustment derived from the effective warning time in conjunction with the level of flood awareness automatically from the table in the spreadsheet.
- **Typical Table/Bench Height.** The height above which the Interpolated DRF is negated as goods are raised onsite rather than removed. a height of 0.9m should be used unless another height can be justified. If houses are typically 2 storey then 2.6m can be used where contents can be removed to the second floor.
- **Total Contents Adjustment Factors.** Two factors are given, one for above and one for below the typical table/bench height which considers all the above factors in deriving the floodplain specific equations on the equations worksheet from the base curve.

Additional Factors

- **Post Late 2001 Adjustments.** This is directly obtained from the entry under "Buildings" above.
 - **External Damage.** A figure of \$6,700 is acceptable without justification, where above floor flooding occurs. Any extra amount needs significant justification.
 - **Clean up Costs.** A figure of \$4,000 is acceptable without justification, where above floor flooding occurs. Any extra amount needs significant justification.
 - **Likely Time for Alternate Accommodation.** This needs to be estimated based upon the immersion, clean up and recovery times i.e. the estimated time for houses to be habitable.
 - **Extra Accommodation Costs/Loss of Rent.** This relates to extra not total costs. The default figure of \$220 per week is acceptable without justification, where above floor flooding occurs. Any extra amount needs justification.
- These factors are used in deriving the floodplain specific damage equations in the equations worksheet.

Two Storey Houses

- **Flood Depth Adjustment Factors.** Different factors are applied depending upon whether or not water overtops the second storey. The factors of 70% below and 115% above the second floor depth are recommended unless otherwise justified.
- **Typical Curve Equations:** provides equations for a typical house on the floodplain based upon the input and base curves from the *input* worksheet.
- **Typical Curve Output.** Provides tabulated and graphical representation for single storey slab on ground/low set, high set and two storey houses. These curves are generated based upon worksheet input including steps in curves and starting point for single storey slab on ground and high set input into this worksheet.
- **AWE Stats.** This provides average weekly earnings (AWE) statistics for total full time earnings from 1983 to 2006.
- **Terms.** This provides a summary of some of the key terms used in the spreadsheet.

Section 2 Work by DECC and Risk Frontiers

What Residential Damage Figures Should We Use?

There is no definitive data available on flood damage. Flood damage would ideally be calculated based on a combination of immersion or contact and velocity damage components. However, no NSW studies have been undertaken that separate the damage from these affects. Without this kind of study for a range of types of buildings, of different ages, after a reasonably large flood event, calculation of flood damages will continue to rely on the current flawed data sets.

This section considers the use of current information to establish an effective method of deriving flood damages for houses in the floodplain based upon the available information and makes recommendations on an approach to adopt until better data is available.

Basis of this Discussion

This section considers:

- the Floodplain Development Manual 2005, requiring consideration of the PMF and including major drainage. Flood damage calculations need to consider more than just older style houses on the traditional floodplains as more modern style dwellings are affected.
- Risk Frontiers analysis of available data from Katherine with reference to Brisbane data to examine whether the quantum of damages from these events resulted in significantly different figures from other methods and made recommendations on curves for the future use. This analysis relies on insurance payout information.
- Updated FLDAMAGE analysis and ANUFLOOD damages figures.
- Itemised damage assessment to cross check results.

It also discusses reasons for differences in these figures.

Background on Available Data

Risk Frontiers (2002) Report

This report proposed changes in the quantum and methods of calculating flood damage for residential property. These calculations are based around flood damages from Katherine in 1998, with reference to the 1974 data from Brisbane flooding. This advice is likely to be skewed to the high side due to its reliance on insurance payout figures. Some important points on this data are noted below.

- It is based upon 361 insurance claims from Katherine.
- It is based upon actual claims paid rather than loss estimates.
- Introduces the concept of post event inflation into analyses for building damages. This relates to the difference in actual relative to estimated reconstruction costs which was very evident in Katherine where a large-scale event in a relatively small community inflated repairs around 50% above assessor's estimates. This factor can be significant in large-scale events, particularly outside metropolitan areas.
- Introduces consideration of regional building factors to allow for variation in costs with location. This can be derived from Rawlinsons and applies to building damages.
- Uses AWE to update damage figures rather than CPI as this is a better indicator of growth in societal wealth. Figures are provided in the spreadsheet.
- Brisbane 1974 data was derived from the 1975 SMEC report. There was reportedly little external damage in Brisbane, and not enough information to consider post event inflation in building claims.
- Average Katherine contents damages were 2.5 times those of Brisbane, even allowing for AWE changes since 1974. Three possible reasons were put forward for the difference:
 - Brisbane involved estimates for restoring or replacing with a similar standard article (average remaining value). Actual replacement cost is twice as high as this value.



- Average home sizes in Brisbane in 2000 are 1.8 times larger than in 1974 (Table 1). More floor areas means more contents.
- AWE may not reflect the real change in household goods adequately. This could reflect increased investment of private income into households.

Multiplication of the first 2 factors equates to 3.6, almost 50% higher than the difference after AWE adjustments. Therefore the reason may fall within these factors or extra factors may be present.

FLDAMAGE

FLDAMAGE data is based around actual damage assessments from a number of towns in NSW including Forbes, Eugowra and Nyngan, Inverell with reference to Georges River damage data from western Sydney. Typical information from Forbes Flood Damages Study (1990 flood) by Water Studies is given below.

- 18 houses surveyed, 3 (relatively new houses) of which were not affected above floor level and bedrooms weren't flooded in 3 others.
- The newest house would be 36 years old with 83% of the sample over 50 years old in 2001.
- The average house size was 167sqm. The average size of a house from 1985/86, Table 1, well above the average house size in the 1950's when they

were build (<135sqm) and only slightly lower than average size of new houses around 1992, the year of the study. This may reflect larger than average house sizes to begin with or extensions to houses over time.

- The average above floor depth of flooding (AFD) was 0.54m. It was only > 0.9m in 2 cases. Therefore local lifting of goods would have been effective in reducing damages.
- 3 houses were slab on ground, 1 mid set, 2 were two storey, and the remaining 12 were low set.
- Only 4 houses had gyprock lining, 6 had AC sheeting, 4 brick and 1 timber. Only gyprock was damaged by immersion and was replaced, ie 4 houses, significantly less than it would be today.
- Swollen doors were trimmed and rehung, not possible with current hollow core doors.
- Built in cupboards (kitchen and bathroom) were significant sources of damage to the structure, though most houses did not have any built-in cupboards in bedrooms.
- Little serious structural damage was noted.

The study was based upon practices of the early 1990's and resident expectations of the time. The FLDAMAGE manual was written in 1992 and its input data was bought up to date using AWE to reflect changes over time. A GST component was also added.

Table 1 Average Floor Area of New Houses (sqm) by State/Territory from various ABS reports

Year	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	Aus
1971	135	132	115	124	126	130		143	
1972	137	135	117	128	125	132		148	
1973	145	137	121	131	132	137		159	
1975-76	145	146	129	132	142	150		146	141
1976-77	139	149	133	136	144	145	130	159	142
1977-78	143	145	132	145	143	146	147	145	142
1978-79	146	142	135	155	146	134	136	144	144
1979-80	152	151	144	160	160	140	140	153	152
1985-86	169	169	165	166	196	151	147	149	170
1995-96	199	190	201	192	221	177	184	174	200
1999-00	241	212	224	207	219	194	185	214	222

ANUFLOOD

The Victorian Natural Resources and Environment, Rapid Assessment Method (RAM) for Floodplain Management, May 2000, indicates that ANUFLOOD estimates needed to be increased by 60% to be in the vicinity of Water Studies damages surveys. Even with this adjustment ANUFLOOD estimates are still well below those determined using this guideline.

Discussion of Differences between Guideline and FLDAMAGE Estimates

Damage figures for a slab on ground house and a breakdown into 5 relevant components are provided in Table 2 for comparison between FLDAMAGE and the methodology in this guideline in December 2006 terms. The differences are discussed below considering the data used to derive the estimating formulae. Figure 1, indicates the difference on damage quantum between the guideline and adjusted FLDAMAGE.

Structural Damages

These are damages to the structure as it remains when sold, rather than any insurance definition. There is a significant difference (61% for 1m deep) in the structural damage estimates between FLDAMAGE and the Guideline. Some differences between the methods and their basis are discussed below.

- FLDAMAGE calculations are based upon studies, such as Forbes with older style houses. The main components of structural damage were built-in cupboards, internal linings, floors, external linings, doors, and foundations. However, most built-in cupboards were in the kitchen and bathroom, whereas modern houses often have built in cupboards in bedrooms and the laundry and the total damage to the structure is well below the replacement cost of a kitchen and bathroom fittings in today's dollars which may reflect size, material and technology changes. Clean up practice at Forbes is unlikely to have included removing wall panels as gyprock lining only (4 of 14 houses) had to be replaced, along with lifting wall tiles, bowing timber and repainting or repapering of damaged surfaces. Walls in the remaining houses were not removed or replaced.

Advice out of the United States indicates that mould may have a significant health risk and flooding of homes can provide ideal conditions for its growth. It can be found in wallpaper, behind tiles, carpets, under floor coverings, insulation, wall linings, within wall cavities and in paper products. Given the nature of above floor flooding in flood affected properties, mould may be a significant health risk. This needs to be considered in recommendations for best practice for post flood clean up. Drying out cavities is therefore important and may mean that linings, whether deteriorating or not, are removed, at least partially to allow for more effective drying, inspection and treatment. This change in practice would increase labour and material costs.

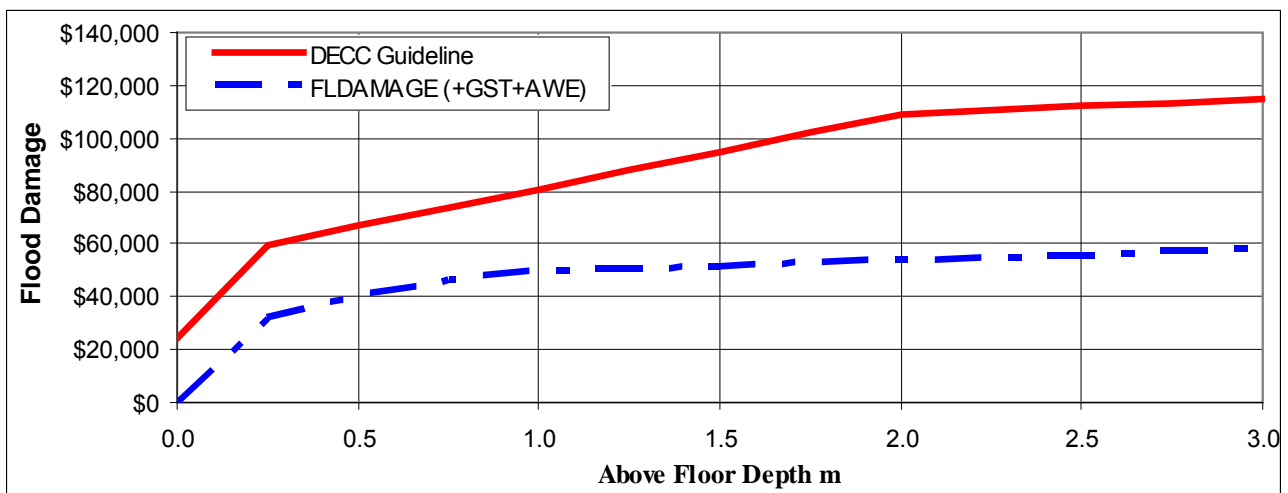
- Doors at Forbes were trimmed and rehung. This is not possible with modern hollow core doors.
- The average house size was 167sqm. The average new house size in NSW in 1999/2000 is 240sqm (Table 1). More floor area equates to more wall length, doors, probably a larger kitchen, more bathrooms and bedrooms and therefore more structural damage. Increasing FLDAMAGE damages by 33% (1992 to 2001) reduces the differences from 61% to 48%.
- All 14 houses in Forbes were >36 years old. The building materials and practices used in construction are different from modern houses. Modern materials are generally less water-resistant as new houses generally rely on adequate protection levels, due to appropriate planning decisions, for flood protection. Extensions to houses below the FPL may not be of flood resistant materials.
- FLDAMAGE assumes structure damage is constant above 0.2m depth. This appears inconsistent with additional damages to items such as kitchens, wall linings, etc.

Considering these points, the quantum of repairing and replacing material damage to the building is likely to be higher than the Forbes estimates. As the Katherine data set is larger and more modern and considering the health issues associated with mould, the higher structural damage estimates of the guideline are likely to be more realistic.

Table 2. Damage Comparison — DECC Guideline and FLDAMAGE Estimates at December 2006

	Above floor depth	0.25m	0.75m	1.25m	1.75m	2.25m	2.75m
FLDAMAGE	Structure	\$11,077	\$11,077	\$11,077	\$11,077	\$11,077	\$11,077
Guideline	Structure	\$21,908	\$26,334	\$30,760	\$30,154	\$39,611	\$44,036
% difference		49%	58%	64%	69%	72%	75%
FLDAMAGE	Contents	\$10,436	\$21,652	\$24,923	\$26,584	\$28,246	\$29,907
Guideline	Contents	\$27,778	\$39,375	\$50,625	\$61,875	\$67,500	\$67,500
% difference		63%	45%	51%	57%	58%	56%
FLDAMAGE	External damage	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000
Guideline	External damage	\$8,375	\$8,375	\$8,375	\$8,375	\$8,375	\$8,375
% difference		28%	28%	28%	28%	28%	28%
FLDAMAGE	Clean up	\$4,543	\$7,442	\$8,288	\$8,717	\$9,146	\$9,576
Guideline	Clean up	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
% difference		9%	-49%	-66%	-74%	-83%	-92%
FLDAMAGE	Accommodation	\$11,133	\$11,133	\$11,133	\$11,133	\$11,133	\$11,133
Guideline	Addit accom	\$825	\$825	\$825	\$825	\$825	\$825
% difference		-912%	-912%	-912%	-912%	-912%	-912%
FLDAMAGE	Total	\$32,113	\$46,226	\$50,343	\$52,434	\$54,525	\$56,616
Guideline	Total	\$64,508	\$80,184	\$95,860	\$111,535	\$121,586	\$126,011
% difference		50%	42%	47%	53%	55%	55%

Figure 1. DECC Guideline vs FLDAMAGE (December 2006) for Single Storey Slab on Ground





Contents Damages

Contents are those items that are removed from the house if sold. This is where there is the biggest quantum difference (around 48% for 1m deep) in damages between methods.

- FLDAMAGE figures are based around repair and replacement costs. The major damage was to floor coverings with minor damage to furniture and electricals. Given that the flood depths averaged 0.54m, with only 2 above 0.9m, it enabled most (non-fixed) goods to be lifted onto table or benchtops to mitigate damages. This was assisted by the significant warning time available. Average internal damages at Forbes were only \$5,500, well below typical levels of contents insurance today.
- Increasing FLDAMAGE figures based upon average house size increases (33% from 1992 to 2001) would reduce this difference to 32%

Considering the Guideline is based upon insurance data and therefore replacement costs and FLDAMAGE is based upon actual and therefore residual values, the adjusted difference of 32% is reasonable.

External Damage

Constant values are similar between the models.

Clean Up

The guideline's constant clean up figure is significantly lower than the values calculated from FLDAMAGE. However, relative to structural and contents damages this figure and the associated difference is not considered significant.

Additional Accommodation Costs

The two approaches are significantly different with the guideline based on extra cost, whereas FLDAMAGE considered all costs and not just accommodation. The guideline figures may under-estimate the extra cost of meals away from home, travel, etc. However, this figure is relatively minor in the context of overall damage.

Examination of Other Data

A range of other curves are available for particular areas including Lismore, Wollongong, Nerang, and the Gold Coast. Curves for these areas have been derived from previous studies.

These curves need to be multiplied by between 0.95 and 1.33 to get a least squares fit to Risk Frontiers data. This suggests that Risk Frontiers data remains close to an upper bound of damage.

In addition, a preliminary elemental analysis for a house examining damages versus depth and the rectification costs for cases was undertaken for comparison with Risk Frontiers. The figures are in the same ballpark as the Risk Frontiers data.

What to Adopt?

The answer probably lies somewhere between the quantum of the two approaches of Risk Frontiers and FLDAMAGE but without better quality data it is difficult to provide a single recommendation. However, given the extent of Katherine and Brisbane datasets relative to other available information and that the Katherine data is significantly more recent, it is recommended that the quantum of the Risk Frontiers curves be used, but with the following adjustments:

- That the contents damages from Risk Frontiers be multiplied by a factor of between 0.75 and 0.90. Structural damage costs may also be reduced by a factor of between 0.85 and 1.0. Damage is larger for longer inundation duration.
- Structural damages and contents figures be altered considering the average house size in the study area, where information is known or can be interpreted.
- Adjust figure for AWE to alter between timeframes.
- Adjust structural damage figures for post event inflation, where the event is significant in relation to the size of the community.



SECTION 3 Advice on Specific Concerns with Damage Curves

Damage Reduction Factor

The actual to potential damage reduction factor (DRF) has been assumed to operate over the entire range of flood depth in all methods.

This is not considered reasonable in the majority of cases given the limited capacity of people to remove materials from the site to somewhere dry in most cases and that goods can only be generally raised onto benchtops or tables. Most people will only have a car and perhaps a trailer and may not have anywhere to store removed goods.

As such, unless there is a documented reason to continue the DRF past 0.9m above floor depth, AFD of flooding, the typical height of table or benches, onto which goods would be raised, it should be negated.

Curves with Significant External and Below Floor Damage Components

There are a number of curves being used with significant external and below floor damage components. The danger in the use of such curves is that management measures could be justifiable based on external benefits, which appear to include motor vehicles in some cases, rather than reduction to damages to the house and contents and the associated flood impacts.

External benefits should be limited in accordance with the recommendations, unless it can be justified otherwise.

Consideration of Damage to Vehicles

The calculations in this guideline do not allow any specific inclusion for vehicles. However, if it is felt that an allowance for vehicles is necessary due to the inability to effectively remove vehicles from the flood affected area this can be considered. However, it should only be considered as a sensitivity analysis to base damage calculations which exclude specific vehicle damage costs.

This approach ensures that decision makers understand what they are protecting in making decisions on mitigation measures and can instigate mitigation measures appropriate to the problem, such as appropriate parking restrictions where feasible (for example having no parking zones adjacent to culverts and causeways) to reduce the potential for damage to vehicles or their potential impacts in blocking downstream structures.

Building destruction

Brisbane and Katherine data does not indicate the flow velocities at the site. Therefore building destruction is excluded from the above table.

Its calculation needs to consider average regional building costs from Rawlinsons, average house sizes from the Australian Bureau of Statistics (where information on house sizes is not available for the study) and potential for destruction, depending upon flow velocities and depths and the structure type.

SECTION 4 TYPICAL RESIDENTIAL DAMAGE CALCULATIONS

This section includes some general guidance on residential damage calculation and the associated parameters used. In addition, the spreadsheet incorporates the following example worksheets relevant to this section:

- Eg House Damage Calcs
- Fixed Eg AAD & NPV Calcs
- Open Eg AAD & NPV Calcs

DECC has provided these examples to demonstrate the linkage between typical damage curve development and damage calculations including AADs and NPV. Use outside this purpose is at the users own risk.

Example House Damage Calculations

This provides an example linking typical damage curve derivation (Section 1) and some example house stock. Some key points for the example and damages in general are outlined below.

The freeboard allocated in the FPL needs to be considered where this may impact upon damages. Freeboard is not to be relied upon to provide protection above the design event to which it is applied as it is there to account for uncertainties in flood behaviour, factors which are not dealt with in modelling, and uncertainties relating to performance of flood mitigation structures, see Appendix K of the Floodplain Development Manual. The freeboard should be entered in location provided.

This may result in the "Protection Level" being less than the ground level in some cases. However, this is an artificial level for calculation of damages not a real level. The decision was made to adjust floor levels by the freeboard rather than add the freeboard to each of the various flood levels to reduce the potential for confusion and errors in quoting flood levels from the spreadsheet and to reduce the number of additional columns in the spreadsheet.

Base information such as Survey No, Street, House No, Lot Section, No Storeys, whether the house is able to be raised, floor level and ground level, and property type are included in the example to indicate the typical minimum information required. For vacant properties the number of storeys and the floor level should both be equal to zero for existing cases. For full development cases vacant properties should be classified as 1 or 2 storey dependant upon current development trends in the area and flood levels set at the FPL relevant to the particular location.

Flood levels for various events, eg PMF, 0.2% AEP, 0.5% AEP, 1% AEP, 2% AEP, 5% AEP and 10% AEP should be added as relevant. Damages are calculated based upon depths of inundation in these events, considering the freeboard, and accessing the typical damage curve derived for the floodplain in question.

AAD & NPV Calculations

AADs are calculated on the basis of area under the damage versus probability curve. A fixed example is provided in the worksheet Fixed Eg AAD & NPV Calculations.

General points for all AAD and NPV calculations include:

- It is important to have points above the FPL, say a 0.2% or 0.5% event as this will be a point where damages may rise suddenly even with effective development controls as well as an extreme flood.
- AAD is based upon the area under the damage versus probability curve. AAD per annum in today's terms is then assumed to apply for each year of the NPV of damages calculations.
- AAD per annum in today's terms are assumed to apply for each year of the NPV of damages calculations. NPV calculations should be based on a reasonable project lifespan, say 50 years for mitigation works.
- Discount factors of 4%, 7% and 11% should be used based upon Treasury guidance. The range of NPV should be provided to indicate its sensitivity to the discount rate.

Fixed Eg AAD/NPV of Damages Worksheet

This fixed example assumes a typical damage curve from a previous project.

Open EG AAD/NPV of Damages Calc Worksheet

This is an editable example of AAD, NPV and benefit cost ratio calculations based upon damages for different events. The user could, at their own risk, use this with project figures, but they should first ensure they understand the associated assumptions.

This spreadsheet requires the user to enter the relevant floods to be assessed. Errors will result if there are gaps between events and zeros are not placed in any spare ARI spaces. An ARI event for which damage can be considered zero also needs to be entered.