Appendix F

F. Appendix F: Flood Damages Assessment

F.1. Quantification of Damages

The quantification of flood damages is an important part of the floodplain risk management process. Flood damages can be defined as actual or potential where actual damage refers to the damage incurred during known flood events while potential damage is an estimation of the damage that could occur. Calculating potential flood damages gives a potential value of damage per property per design flood event and an overall average annual damages value which is the average cost to property owners per year owing to flood damages. By quantifying flood damage for a range of design events, appropriate cost effective management measures can be analysed in terms of their benefits (reduction in damages) versus the cost of implementation. The cost of damage and the degree of disruption to the community caused by flooding depends upon many factors including;

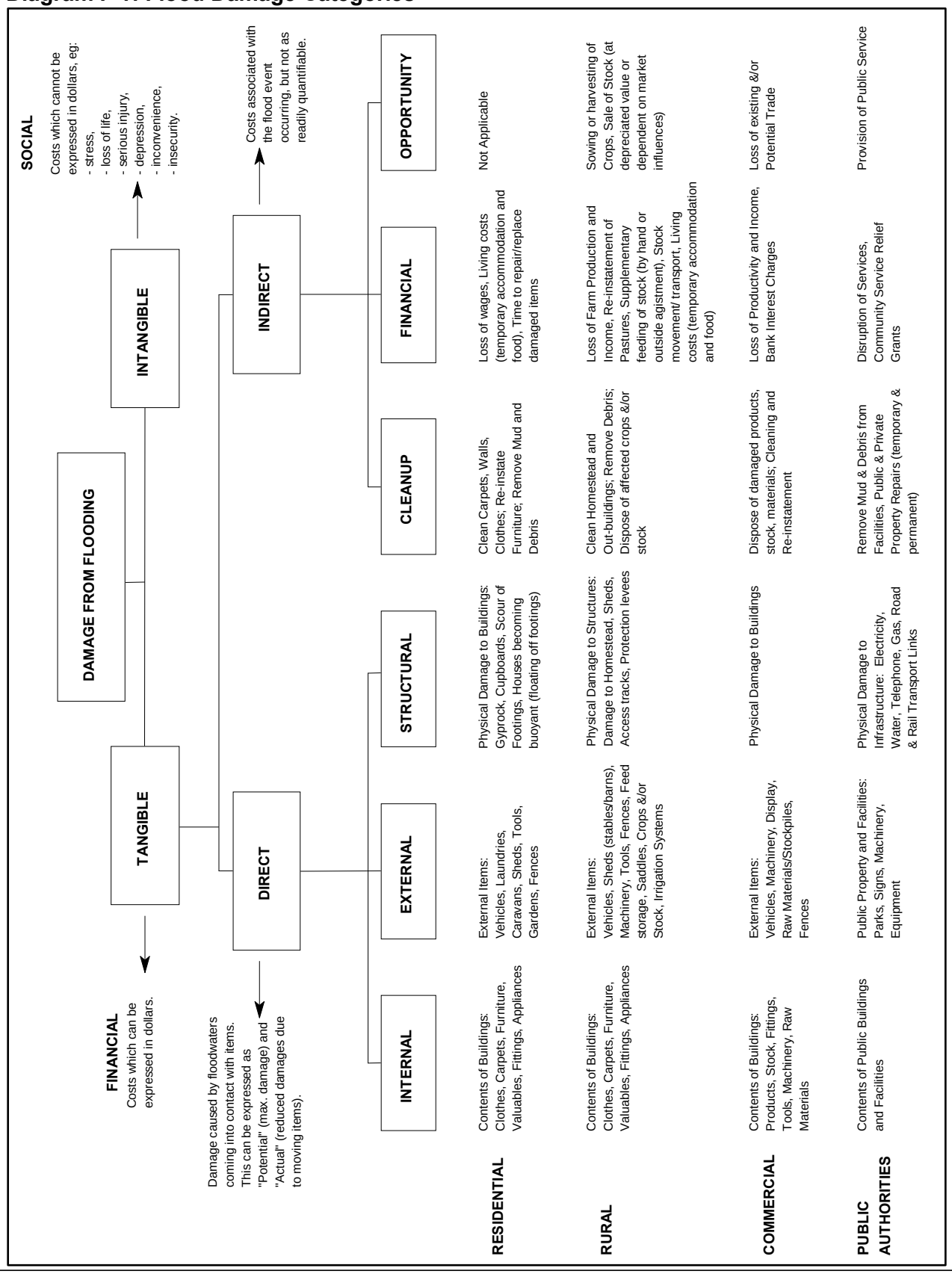
- The magnitude (depth, velocity and duration) of the flood;
- Land use and susceptibility to damages;
- Awareness of the community to flooding;
- Effective warning time;
- The availability of an evacuation plan or damage minimisation program;
- Physical factors such failure of services (sewerage), flood borne debris; and
- The types of asset and infrastructure affected.

The estimation of flood damages tends to focus on the physical impact of damages on the human environment and can be defined as being tangible or intangible. Tangible damages are those for which a monetary value can be easily assigned, while intangible damages are those to which a monetary value cannot easily be attributed. Types of flood damages are shown on Diagram F 1 over.

To undertake the damages assessment floor level data is required. Floor level survey was performed by Hydrographic & Cadastral Survey Pty. Ltd. for 91 residential properties in Holbrook. The floor levels of the remaining properties were estimated. Further details are presented in Section 1.5.3.

The non-residential damages are more complex than residential damages and have different damages associated with flooding. In Holbrook 23 commercial properties were surveyed Damages for commercial properties have been assessed using separate damage curves to residential damages.

Diagram F 1: Flood Damage Categories



F.2. Identifying Flood Affected Properties

The damages assessment does not only look at potential costs due to flooding but also identifies when properties are likely to become flood affected by either flooding on the property or by over floor flooding. Figure 15 of the main report show in which design event buildings are first flooded above floor level.

Diagram F 2 and Diagram F 3 show the number of flood prone residential properties in Holbrook and the number of residential properties liable to above floor flooding. Diagram F 4 and Diagram F 5 show the number of flood prone non-residential properties in Holbrook and the number of non-residential properties liable to above floor flooding.

Diagram F 2: Number of Flood Prone Residential Properties by Street

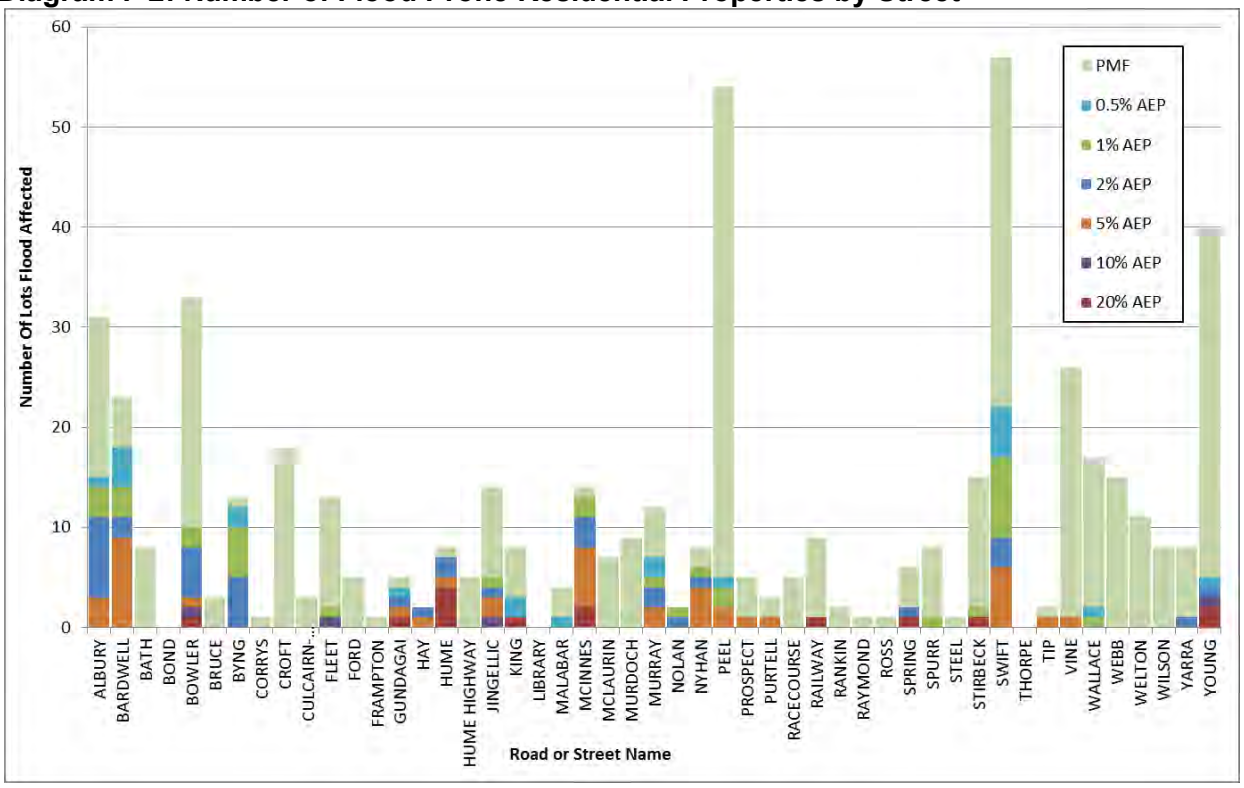


Diagram F 3: Number of Residential Properties Flooded Above Floor Level by Street

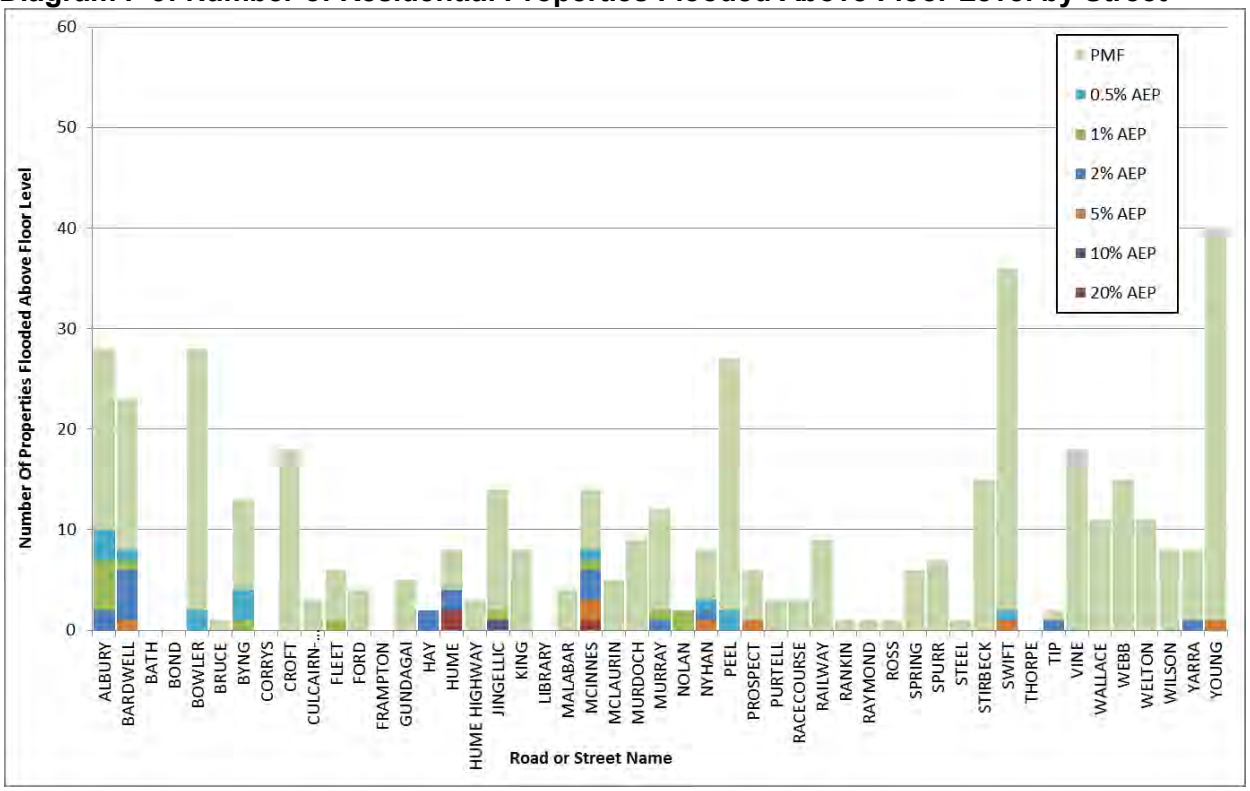


Diagram F 4: Number of Flood Prone Non-Residential Properties by Street

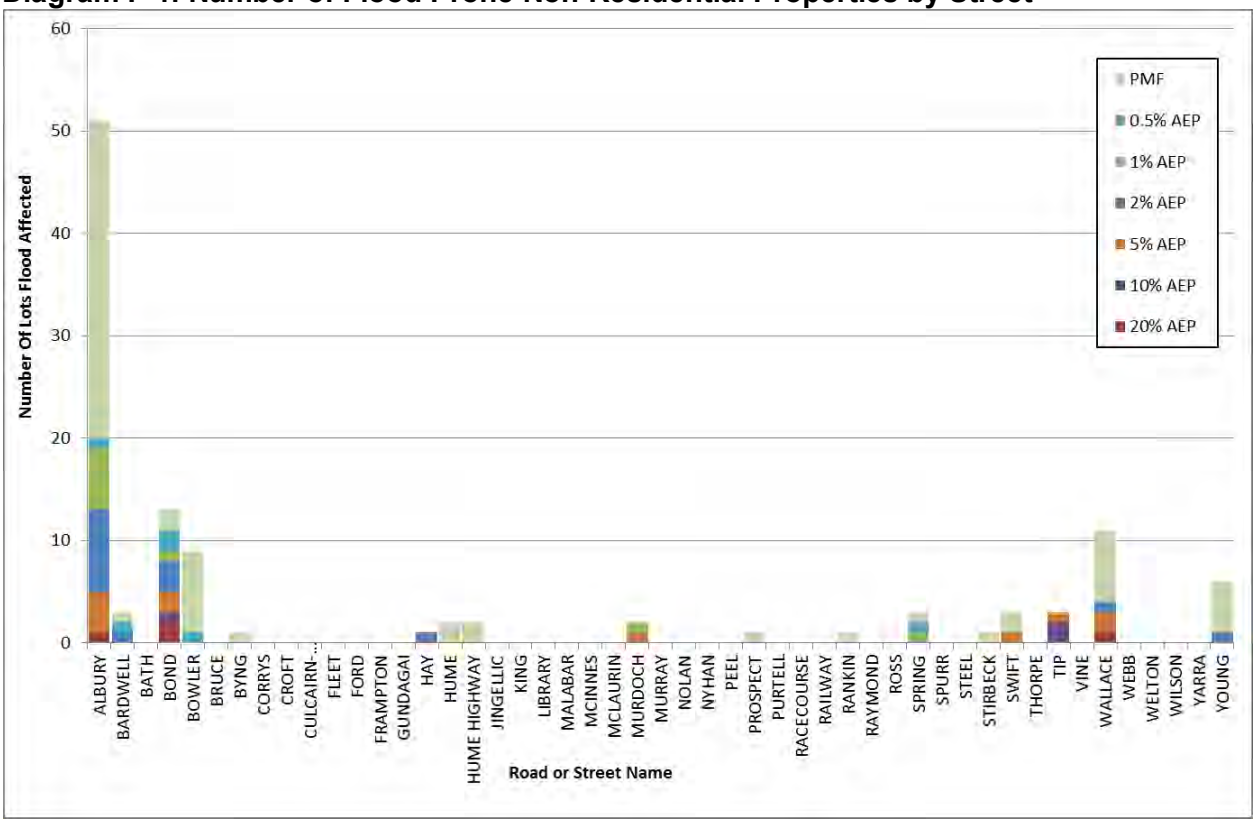
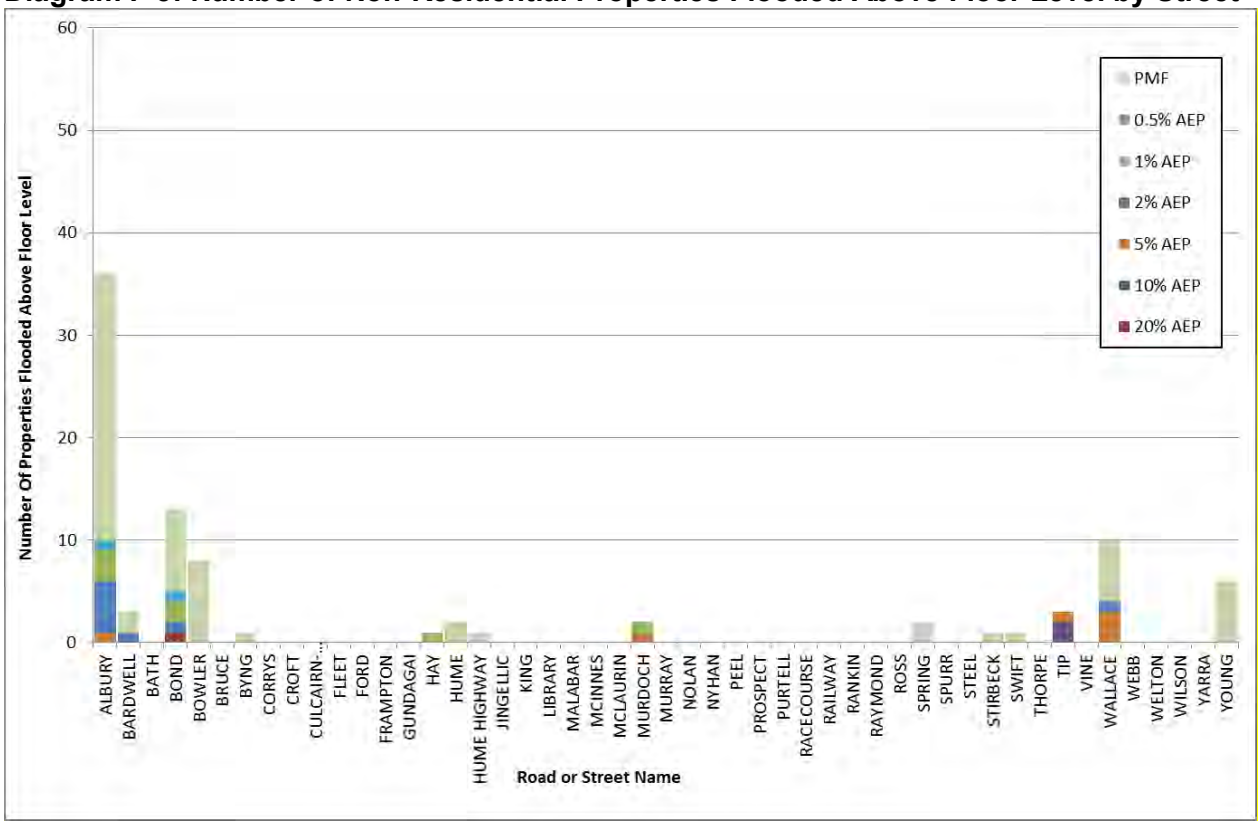


Diagram F 5: Number of Non-Residential Properties Flooded Above Floor Level by Street



F.3. Tangible Flood Damages

Tangible flood damages are comprised of two basic categories; direct and indirect damages (Diagram F 1). Direct damages are caused by floodwaters wetting goods and possessions thereby damaging them and resulting in either costs to replace or repair or in a reduction to their value. Direct damages are further classified as either internal (damage to the contents of a building including carpets, furniture), structural (referring to the structural fabric of a building such as foundations, walls, floors, windows) or external (damage to all items outside the building such as cars, garages). Indirect damages are the additional financial losses caused by the flood for example the cost of temporary accommodation, loss of wages by employees etc.

Given the variability of flooding and property and content values, the total likely damages figure in any given flood event is useful to get a feel for the magnitude of the flood problem, however it is of little value for absolute economic evaluation. However, considering damages estimates is useful when studying the economic effectiveness of proposed mitigation options. Understanding the total damages prevented over the life of the option in relation to current damages, or to an alternative option, can assist in the decision making process.

F.4. Expressing Flood Damages

Average Annual Damages (AAD) is equal to the damage caused by all floods over a period of time divided by the number of years in that period and represents the equivalent average damages that would be experienced by the community on an annual basis. This means that the smaller floods, which occur more frequently, are given a greater weighting than the rare catastrophic floods total potential damage refers to the total damage estimated for a given flood event. Average

damage per property is the Total damage estimated for a particular flood event divided by the number of properties flood affected in this event; either by flooding on the yard and/or above floor level of a building.

F.5. Calculating Tangible Flood Damages

The flood damages assessment was undertaken for existing development in accordance with current OEH guidelines (Reference 20) and the Floodplain Development Manual (Reference 1). Potential flood damages were calculated with the use of a height-damage curves which relate the depth of water above the floor with tangible damages. The height-damage curves were established in accordance with OEH guidelines (Reference 20).

For residential damages the values used are based on the recommendations in the guidance with a post late 2001 adjustment factor was applied to increase damage values according to changes in Average Weekly Earnings (AWE) since 2001. Separate curves were established for non-residential damages. The resultant curves are shown in Diagram F 6 and F 7.

Structural damages vary on whether the property is slab/low set or high set. For the purpose of this study, any property with a floor level of 0.5 m or more above ground level was assumed to be high set.

In calculating AAD, it was assumed that there would be no flood damages in events smaller than the 2-year ARI event. The ARI of the PMF has been estimated to be 100,000 years.

As it is usual that commercial and industrial damages are higher than residential damages a multiplier was applied to the total damage per property for each event by adjusting the typical building size value within the curve development calculations. Other factors including the clean-up costs and external damages were adjusted to reflect the differences between commercial and residential properties.

To adjust the residential damage curve to be applicable to non-residential development, the average contents damages for a business was estimated to be $150,000 and the clean-up cost have been estimated at $4,000. This was done to take account the higher costs that businesses would incur compared to residential dwellings when flooded above floor level. The commercial damages curves were also amended to reduce the bench height based on the assumption that many commercial premises would have stock from floor level. External damage was set at $1,250 as per residential properties.

The parameters mentioned above have been kept consistent with the recently completed Lockhart and The Rock FRMS&P (Reference 21).

Diagram F 6: Flood Damages Curves – Residential Property

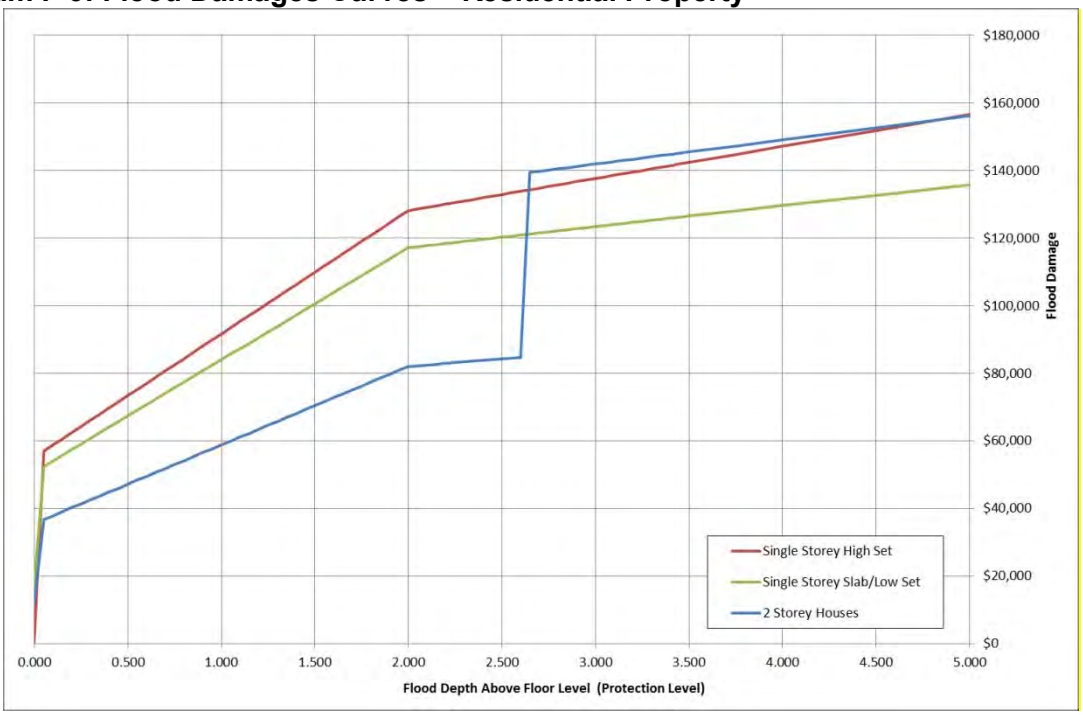
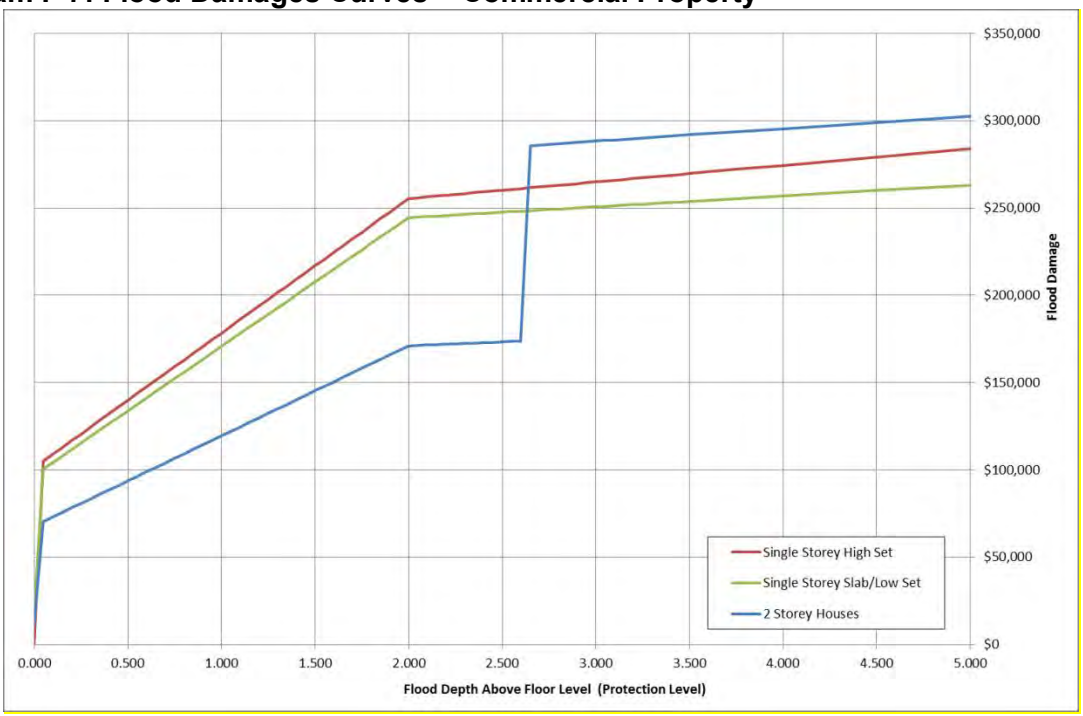


Diagram F 7: Flood Damages Curves – Commercial Property



The OEH guidelines suggest a protection level be applied when calculating damages. This effectively reduces the floor level by the given amount (usually 0.5 m). The level of protection is considered overly conservative and has not been applied in this instance. Applying a level of protection of 0.5 m at Holbrook would increase AAD by 500% and the number of properties flooded above floor level in the 5-year ARI event from 3 to 154. Incorporating this would lead to Council financing flood management measures that provide little benefit.

F.6. Intangible Flood Damages

The intangible damages associated with flooding, by their nature, are inherently more difficult to estimate in monetary terms. In addition to the tangible damages discussed above, additional costs/damages are incurred by residents affected by flooding, such as stress, risk/loss to life, injury, loss of sentimental items etc. It is not possible to put a monetary value on the intangible damages as they are likely to vary dramatically between each flood (from a negligible amount to several hundred times greater than the tangible damages) and depend on a range of factors such as the size of flood, the individuals affected, and community preparedness. However, it is still important that the consideration of intangible damages is included when considering the impacts of flooding on a community.

Post flood damages surveys have linked flooding to stress, ill-health and trauma for the residents. For example the loss of memorabilia, pets, insurance papers and other items without fixed costs and of sentimental value may cause stress and subsequent ill-health. In addition flooding may affect personal relationships and lead to stress in domestic and work situations. In addition to the stress caused during an event (from concern over property damage, risk to life for the individuals or their family, clean up etc.) many residents who have experienced a major flood are fearful of the occurrence of another flood event and the associated damage. The extent of the stress depends on the individual and although the majority of flood victims recover, these effects can lead to a reduction in quality of life for the flood victims.

During any flood event there is the potential for injury as well as loss of life due to causes such as drowning, floating debris or illness from polluted water. Generally, the higher the flood velocities and depths the higher the risk. Holbrook study area generally is classified as low hazard within the built up areas. However, there will always be local high risk (high hazard) areas where flows may be concentrated around buildings or other structures within low hazard areas.

F.7. Benefit/Cost Analyses for Management Options

To assess the full monetary benefits, including taking into account costs of construction and maintenance, Net Present Value (NPV) calculations were used and the B/C ratio established. The B/C approach is used to quantify the economic worth of each option enabling the ranking against other options. A B/C ratio is the benefits expressed in monetary terms, i.e. the reduction in AAD, compared to the actual likely cost of achieving those benefits, i.e. construction and maintenance costs.

The AAD per annum in today's monetary terms was assumed to apply for each year of the NPV damage calculation and was established for each year based on a discount rate of 7% as per the recommendation in the Residential Flood Damages FRM Guidelines (Reference 20). A construction cost was estimated and, using the NPV of the AAD assuming lifetime of 50-years, the B/C ratio was established for each of the options.