QUEENSLAND FLOODS COMMISSION OF INQUIRY

Department of Innovation, Industry, Science and Research

28 October 2011

The National Construction Code and Flooding

The following submission is provided by the Commonwealth Department of Innovation, Industry, Science and Research in response to the Queensland Floods Commission of Inquiry request for information to the Commonwealth dated 24 October 2011. It also provides some additional contextual information which may be of use to the Commission.

ABCB – Administration and the operation of the NCC

1. The Australian Building Codes Board (**ABCB**) was established in 1994 under an Intergovernmental Agreement (**IGA**) for the ABCB. The Building Ministers' Forum (**BMF**), an ad hoc collective of Commonwealth, state and territory ministers responsible for building and plumbing regulation, is responsible for oversight of the implementation of the IGA.

2. The ABCB is a joint initiative of all three spheres of government in Australia and includes representatives from the building, construction and plumbing industries.

3. The mission of the ABCB is to address issues relating to safety, health, amenity and sustainability in the design and performance of buildings through the National Construction Code (**NCC**) Series, and the development of effective regulatory systems and appropriate non-regulatory solutions. This is set out in the current IGA for the existence and operation of the ABCB[1] between the Commonwealth, States and Territories.

4. The work of the ABCB is supported by an office housed within the Commonwealth Department of Innovation, Industry, Science and Research and by a peak national technical body, the Building Codes Committee, and project specific committees. Through these avenues the ABCB obtains input from government stakeholders as well as advice and assistance from building professionals, industry peak bodies, research communities with technical expertise including CSIRO, local government, special interest groups and the community on a wide range of strategic, policy, technical, administrative and social issues.

5. Each of the Commonwealth, States and Territories and the Australian Local Government Association is represented on the Board of the ABCB with a

[1] Inter-Government Agreement on the Operation of the Australian Building Codes Board, April 2006, Section 4.3, referenced at **Annexure 1**.

number of industry representatives and an independent Chair. There are currently 15 members on the Board, including the Chair, with each member exercising one deliberative vote. The Board is given authority to make decisions within the remit of the IGA or as directed by the BMF or the Council of Australian Governments (**COAG**). The COAG Guidelines for Best Practice Regulation[2] (**COAG** Guidelines) provide guidance for undertaking regulatory impact assessment and preparing a Regulation Impact Statement (**RIS**) including assistance on undertaking risk analysis, cost-benefit analysis, assessments of compliance costs, assessments of competition effects, and consultation to maximise the efficiency of new and amended regulation and avoid unnecessary compliance costs and restrictions on competition.

NCC

6. The NCC comprises the Building Code of Australia (**BCA**), Volume One and Two; and the Plumbing Code of Australia (**PCA**), as Volume Three. The NCC, as a performance-based code, sets the minimum requirements for the design, construction and performance of buildings throughout Australia.

7. The NCC is released annually for adoption by states and territories from 1 May. There is a long lead time to develop the relevant amendments, mainly due to requirements, under the IGA and COAG Guidelines, to consider the full impact of proposed regulatory changes. This includes the need for public consultation on the impact of proposed changes and dissemination of agreed changes prior to release. The aim is for a consistent application of the NCC across and within all States and Territories, allowing for variations in climate and geological or geographical conditions.

8. The responsibility for regulations about the health, safety and amenity of occupants of buildings lies with individual States and Territories. Every State and Territory has legislation which establishes the system for obtaining approvals for building work, for dealing with disputes, for other administrative requirements and for calling up the Building Code of Australia.

9. The NCC is a model code that is given legal effect when referenced in state and territory building law. The relevant legislation that gives the NCC legal effect in Queensland is the *Building Act (Qld) 1975*.

BCA

10. The BCA is specifically concerned with life safety, health, amenity and sustainability issues.[3] The overriding objective of life safety is addressed in the BCA by, among other things, the inclusion of measures to protect building occupants from structural collapse of the building. More specifically, the life safety objective in the BCA includes safeguarding people from illness or injury from threats of natural disasters such as bushfires, earthquakes and cyclones. This has been part of the ABCB's mission since its inception.

[2] Council of Australian Governments Guidelines for Best Practice Regulation October 2007, referenced at **Annexure 2**. **(**http://www.finance.gov.au/obpr/docs/COAG_best_practice_guide_2007.pdf)

[3] Inter-Government Agreement on the Operation of the Australian Building Codes Board, April 2006, Recital D.

11. Currently, the BCA does not contain detailed construction practice or prescriptive deemed-to-satisfy provisions for buildings in flood hazard areas in addition to the generic structural provisions. This is because, as a general rule, planning authorities have the power to prohibit building within flood prone areas, or require habitable floors (i.e. living areas) of buildings to be constructed above a specified flood level. This is normally defined in flood maps that identify an exclusion zone based on a 1 in 100 year flood event.

12. The requirement for a building or structure to withstand the combination of loads and other actions to which it may be reasonably subjected to (including flood actions), is defined in Volumes One and Two of the Building Code of Australia of the National Construction Code series.

13. BCA 2011 Volume One: Part B1 - Structural Provisions, and BCA 2011 Volume Two: Part 2.1 – Structure, contain a performance requirement which specifies that:

    (a) A building or structure, during construction and use, with appropriate degrees of reliability, must—

        (i) perform adequately under all reasonably expected design actions

        (ii) withstand extreme or frequently repeated design actions

        (iii) be designed to sustain local damage, with the structural system as a whole remaining stable and not being damaged to an extent disproportionate to the original local damage

        (iv) avoid causing damage to other properties

    by resisting the actions to which it may reasonably be subjected.

14. The Structural Provisions in Part B references AS 1170.1: 2002 *Structural design actions Part 1: Permanent, imposed and other actions.* This Standard specifies appropriate building design requirements to be used in the design of structures (and parts of structures), to resist permanent imposed actions including, but not limited to, the action of static liquid pressure, ground water and rainwater ponding. Although these imposed actions could be generated during a flood, the design requirements in AS 1170.1 have been designed to mitigate the impact of static liquid pressure, and not moving flood water, wave action or debris loading.

Draft Flood Standard and Handbook

15. The BMF, at its 1 July 2010 meeting, noted a draft scoping study to prepare a standard and handbook for building in flood prone areas. The BMF agreed to the Board of the ABCB assuming responsibility for the matter under its usual assessment processes, consistent with COAG Guidelines. The matter was subsequently added to the ABCB's 2010-11 work program for scheduled completion in early 2012.

16. The ABCB is currently undertaking a project investigating the construction of new buildings in flood hazard areas. Flood hazard areas are determined by state, territory or local government planning authorities, and can include flash-

flood risk areas. The project would look to reduce the risk of death or injury of building occupants as a result of structural failure of buildings when subjected to certain flood loads.

17. With the assistance of an expert reference group (refer **Annexure 3** for membership), the ABCB produced on 30 June 2011 a draft Flood Standard (**Standard**) for the construction of certain buildings in flood hazard areas that would be suitable for referencing in BCA Volumes One and Two. An accompanying information handbook has also been produced. The current draft Flood Standard is referenced at **Annexure 4**, and the current draft Flood Handbook is referenced at **Annexure 5**.

18. The Standard is intended to be adopted into the NCC as a mandatory requirement. It contains performance based requirements with deemed-to-satisfy solutions, but would need to be triggered by planning authorities that have responsibility for designating at-risk flood areas.

19. The information handbook is not mandatory. It provides:
    - background information and commentary on the provisions in the Standard
    - information on the performance of types of construction under flooding conditions
    - information on the performance of materials under flooding conditions
    - guidance on rehabilitation of buildings after a flood event, and
    - sources of further information.

20. The Standard is only applicable to buildings in which people sleep, which reflects the NCC priority objective relating to life safety. These buildings include houses, apartments, hotels, motels, boarding houses, hospitals and aged care buildings (ie Class 1, 2, 3, 4, 9a and 9c buildings as defined in the NCC Volumes One and Two).

21. The deemed-to-satisfy provisions of the Standard are applicable only to buildings in flood hazard areas where the maximum flow rate does not exceed 1.5m/s, and the maximum depth of inundation of the lowest non-habitable floor is 1.0m (a design flood event). Habitable floors (i.e. living areas) must be above the design flood level, which is typically the 1 in 100 year event plus 0.5m freeboard. The limitations of 1m inundation and 1.5m/s flow rate are consistent with international standards[4] and current construction practice. For situations where these limits are exceeded, for example in cases of fast flowing floods or severe inundation, and local authorities allow new building,

[4] ASCE Standard ASCE/SEI 24-05, Flood Resistant Design and Construction, American Society of Civil Engineers
FEMA Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program Technical Bulletin 2 / August 2008 (http://www.fema.gov/library/viewRecord.do?id=1580)
FEMA 348 Protecting Building Utilities from Flood Damage: Principles and Practices for the Design and Construction of Food Resistant Building Utility Systems (http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1750)

an alternative solution in accordance with the performance requirements is possible.

22. On 30 June 2011, the Board agreed that a Consultation Regulation Impact Statement (**RIS**) would be released for public comment in late 2011.

Risks from increased stringency and property protection

23. The primary goals of the NCC are to provide life safety for building occupants and to reasonably protect other buildings on the same, or adjoining, allotment. This primary focus often achieves as a consequence, some degree of property protection.

24. However, property protection is not a primary objective of the NCC. The comprehensive protection of a building is an issue to be resolved between the owner of a building and their insurer. Consideration by the BMF or the ABCB to address property protection through the NCC would add to construction costs, and such consideration may conflict with other policy objectives of governments, such as housing affordability.

Status report on standard and handbook

25. As mentioned above, the draft standard and handbook was completed in June 2011 and is not yet suitable for referencing in the NCC and has not been approved by the Board.

26. In accordance with the COAG Guidelines, the Standard will be subject to regulation impact assessment and public consultation. A final RIS following public consultation is expected to be tabled for consideration by the Board in February 2012.

27. Subject to favourable outcomes from this process and Board agreement, it is anticipated the Standard could be adopted into the NCC in 2013. This is consistent with the ABCB's timetable for its annual release of the public comment draft NCC in August 2012.

28. Once the standard and handbook have been finalised, it is open to individual jurisdictions to reference the standard in their respective building regulations, generally by way of variation to the NCC, prior to its formal inclusion in the NCC. This would be a decision for individual jurisdictions to make.

Holistic approach

29. It must also be emphasised that the draft standard is not a stand-alone solution to mitigating life safety risk due to flooding. Reducing life safety risk due to flooding requires a comprehensive set of measures that consider flood hazard and aim to reduce risk to a manageable level. This set of measures generally includes a combination of effective land use planning considering flood hazard, flood mitigation measures, flood warning and emergency response strategies for flooding, and building standards.

30. Planning regulations may prohibit development in flood prone areas thereby removing the risk to life safety through lack of building integrity. Alternatively, where prohibition is not practical, planning regulations may place conditions on development such as controlled fill and establishing minimum floor heights.

31. Sufficient awareness of the flood risk and the safety measures required by the occupants and those assisting them during a flood emergency are important.

32. Therefore, in the absence of comprehensive disaster mitigation, the application of the Standard within flood hazard areas alone does not provide a guarantee that buildings constructed in accordance with the Standard will eliminate the risk of serious injury or fatality. Even floods of the scale of the design flood event can vary in behaviour and could exceed the design parameters and limitations in the Standard. In addition, larger floods than the design flood event can and do occur, due to the limits of statistical modelling and available data. The availability of emergency response and mitigation measures are considerations not contemplated by the Standard.

28 October 2011.

Annexure 3

The following organisations were represented on the Reference Group:

- Australian Building Codes Board
- Australian Government Attorney-General's Department
- Brisbane City Council
- Bureau of Meteorology
- Geoscience Australia
- Gold Coast City Council
- Hawkesbury City Council
- Housing Industry Association
- Insurance Australia Group
- Master Builders Australia
- NSW Department of Planning and Infrastructure
- NSW Office of Environment and Heritage
- Queensland Department of Local Government and Planning
- Risk Frontiers
- Tasmania Department of Justice

An Agreement

between

the Governments of

the Commonwealth of Australia, the States and the Territories

to continue in existence and provide for the operation of the

AUSTRALIAN BUILDING CODES BOARD

April 2006

CONTENTS

An Agreement made this 26th day of April, 2006 to continue in existence and provide for the operation of the Australian Building Codes Board.

SIGNATORIES FOR EACH OF THE PARTIES

The Hon Ian Macfarlane, MP	Minister for Industry, Tourism and Resources Commonwealth of Australia
The Hon Bryan Green, MHA	Minister for Infrastructure, Energy and Resources State of Tasmania
The Hon Rob Hulls, MP	Minister for Planning State of Victoria
Mr Simon Corbell, MLA	Minister for Planning Australian Capital Territory
The Hon Frank Sartor, MP	Minister for Planning State of New South Wales
The Hon Desley Boyle, MP	Minister for Environment, Local Government, Planning and Women State of Queensland
Dr Chris Burns, MLA	Minister for Planning and Lands Northern Territory
The Hon Francis Logan, MLA	Minister for Housing and Works; Heritage; Assisting in Planning and Infrastructure State of Western Australia
The Hon Paul Holloway, MLC	Minister for Urban Development & Planning South Australia

AN AGREEMENT made this 26th day of April, 2006 between —

THE COMMONWEALTH OF AUSTRALIA (in this Agreement called 'the Commonwealth'),

THE STATES OF NEW SOUTH WALES, VICTORIA, QUEENSLAND, SOUTH AUSTRALIA, WESTERN AUSTRALIA AND TASMANIA (in this agreement called individually a 'State' and collectively 'the States'); and

THE NORTHERN TERRITORY AND THE AUSTRALIAN CAPITAL TERRITORY (in this agreement called individually a 'Territory' and collectively 'the Territories').

Recitals

A. The Commonwealth, the States and the Territories wish to facilitate the development of a more efficient, internationally competitive building and construction industry through reforms to building regulation nationally.

B. The State and Territory governments are responsible for regulating building.

C. To strengthen reforms to building regulation nationally, the respective governments of the Commonwealth, the States and the Territories commit to:

i. continuing in existence the Australian Building Codes Board ('the Board') established by the agreement of the respective governments on 1 March 1994, as amended on 27 July 2001;

ii. the Building Code of Australia (BCA) setting the minimum requirements for the design, construction and performance of buildings throughout Australia;

iii. the adoption of the BCA by reference on a national basis through relevant State and Territory legislation;

iv. restricting any New Variations from the BCA by State and Territory governments by, as far as practicable:

   A. limiting variations to those arising from particular geographical, geological or climatic factors, as defined in the BCA;

   B. requiring that any variations be subject to a Regulatory Impact Assessment; and

   C. requiring that any variation be approved by the State or Territory Minister;

v. on the part of the States and Territories, identifying New Variations from the BCA (including New Variations that are not within the categories listed in recital C (iv)) and the non-adoption of BCA amendments in their respective jurisdictions and reporting this information to the Board on an annual basis.

vi. the reporting by the Board on an annual basis of those variations from the BCA reported by the States and Territories (refer recital C(v)) to Ministers. In particular, this report will:

A. highlight any New Variations from the BCA and the non-adoption of BCA amendments by the States and Territories;

B. identify areas of duplication and inconsistency in State and Territory legislation; and

C. identify opportunities for greater consistency in building regulations between the States and Territories;

vii. the consistent application of the BCA across and within each State and Territory;

viii. harmonising the approach to the administration of the BCA across Australia; and

ix. on the part of the States and Territories, seeking similar commitments from their local governments where they have any administrative responsibility for regulating the building industry.

D. The Board's mission will be to address issues relating to health, safety, amenity and sustainability by providing for efficiency in the design, construction and performance of buildings through the BCA and the development of effective regulatory systems.

E. The objectives of the Board will be to (collectively 'the Objectives'):

i. develop building codes and standards that accord with strategic priorities established by Ministers from time to time, having regard to societal needs and expectations;

ii. establish building codes and standards that are the minimum necessary to achieve relevant health, safety, amenity and sustainability objectives efficiently;

iii. ensure that, in determining the area of regulation and the level of the requirements:

A. there is a rigorously tested rationale for the regulation;

B. the regulation would generate benefits to society greater than the costs (that is, net benefits);

C. there is no regulatory or non-regulatory alternative (whether under the responsibility of the Board or not) that would generate higher net benefits; and

D. the competitive effects of the regulation have been considered and the regulation is no more restrictive than necessary in the public interest.

iv. ensure that BCA requirements are consistent across the States and the Territories, except for circumstances provided for in recital C(iv);

v. ensure that BCA requirements are:

A. performance-based;

B. verifiable;

C. based on appropriate international standards; and

D. expressed in plain English;

vi. harmonise the approach to administering the BCA across Australia and identify and encourage the implementation of improvements to compliance and administrative systems for building regulation, including through improvements to the licensing, accreditation and audit of building practitioners;

vii. encourage reduced reliance on regulation by providing a forum to explore alternative mechanisms for delivering outcomes, including:

A. non-mandatory guidelines;

B. training to increase skill levels of building practitioners; and

C. improvements to the licensing, accreditation and audit of building practitioners.

F. The Board will develop an Annual Business Plan for presentation to Ministers.

G. The Ministers have agreed to meet periodically to:

i. review outcomes and progress against the objectives and the Annual Business Plan(s); and

ii. review the annual reports, referred to in recital C(vi).

H. The Commonwealth, the States and the Territories will contribute towards the costs of the Board's operations in accordance with the provisions of this Agreement.

Operative provisions

Now it is hereby agreed as follows –

1. Preliminary

1.1. This Agreement shall commence on the Commencement Date.

1.2. On the Commencement Date this Agreement replaces all Prior Agreements.

1.3. The proceedings, decisions or actions taken by the Board under the Prior Agreements are adopted and confirmed as proceedings, decisions or actions of the Board continued in existence by this Agreement.

1.4. Nothing in this Agreement affects the continued operation of an Intellectual Property Deed or an Indemnity Deed.

2. Interpretation

Definitions and Acronyms

2.1. In this Agreement, unless the context indicates otherwise:

ABCB Account	means the Australian Building Codes Board Account, a special account created by a determination of the Finance Minister under section 20 of the FMA Act;
ABCB Office	means the part of the Department that is responsible for assisting the Board in undertaking its functions and exercising its powers under this Agreement;
Administration	means the Department, or the relevant department, statutory body or agency that has administrative responsibility for the subject matter of this agreement in a State or Territory government;
Agreement	includes a reference to the clauses and recitals;
ALGA	means the Australian Local Government Association
Annual Business Plan	means the plan required by clause 4.2.c;
Annual Report	means the report required by clause 4.2.d;
APS	means the Australian Public Service;
BCA	means the Building Code of Australia;
Board	means the Australian Building Codes Board continued in existence by this Agreement;
Chair	means the Chair of the Board;
COAG	means the Council of Australian Governments;
COAG Principles	means the *Principles and Guidelines for National Standard Setting and Regulatory Action by Ministerial Councils and Standard-Setting Bodies* (April 1995, as amended in November 1997 and June 2004);
Commencement Date	means the date on which this Agreement has been executed by all of the Parties;

Committee	means the Building Codes Committee established by clause 11;
Conflict-of-Interest declaration	means a declaration in a form determined by the Commonwealth Minister;
Conflict-of-Interest guidelines	means any guidelines adopted by the Board that deal with the management of conflicts of interest with regard to members of the Board;
Department	means the Commonwealth department or agency responsible for administering this Agreement;
FMA Act	means the *Financial Management and Accountability Act 1997* (Cth);
FMA Regulations	means the Financial Management and Accountability Regulations 1997 (Cth);
General Manager	means the person occupying the position of General Manager established by clause 16 or a person acting in that role;
Indemnity Deed	means the indemnity deeds entered into by the parties on 7 November 2000, as amended or replaced from time to time;
Industry Representatives	means the four representatives of the building and construction industry who are members of the Board;
Intellectual Property Deed	means the intellectual property deeds entered into by the parties on 11 October 1996, as amended or replaced from time to time;
Minister	means: a. for the Commonwealth: a Minister of State or other member of the Federal Executive Council; b. for a State or Territory: a Minister of the relevant State or Territory; or c. for the Commonwealth, a State or a Territory: a person nominated by a Minister as his or her representative from time to time;
Mission	means the mission stated at recital D;
New Variation	means an amendment to the BCA or any requirement additional to the BCA; except those arising from the process of consolidation in the BCA;

Objectives	means the objectives stated at recital E;
Office of Regulation Review	means the Office of Regulation Review in the Productivity Commission;
Parties	means the Commonwealth of Australia, the States of New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania, and the Australian Capital Territory and the Northern Territory;
Prior Agreements	means the Agreement of the Parties on 1 March 1994, as amended on 27 July 2001 by the Parties;
Productivity Commission	means the Productivity Commission established by section 5 of the *Productivity Commission Act 1998* (Cth);
Regulatory Impact Assessment	means a Regulatory Impact Assessment process as defined by the COAG Principles;
Regulatory Impact Statement	means a Regulatory Impact Statement as defined by the COAG Principles;
Secretary	means the Secretary of the Department;
State	means the government of a State; and
Territory	means the government of a Territory.

Interpretation

2.2. In this Agreement, unless the contrary intention appears:

a. words importing a gender include any other gender;

b. words in the singular include the plural and words in the plural include the singular;

c. clause headings are for convenient reference only and have no effect in limiting or extending the language of provisions to which they refer;

d. words importing a person includes a partnership and a body whether corporate or otherwise;

e. a reference to any legislation or legislative provision includes any statutory modification, substitution or re-enactment of that legislation or legislative provision;

f. if any word or phrase is given a defined meaning, any other part of speech or other grammatical form of that word or phrase has a corresponding meaning;

g. a reference to writing is a reference to any representation of words, figures or symbols, whether or not in a visible form.

3. Establishment of the Board

3.1. The Board established by the Prior Agreements is continued in existence by this clause 3.

3.2. The Board shall consist of between ten and fifteen members including:

a. a Chair;

b. the head of each Commonwealth, State and Territory Administration or their delegate;

c. a representative of the Australian Local Government Association (ALGA) or their delegate; and

d. four representatives of the building and construction industry ('Industry Representatives').

3.3. The Chair and the Industry Representatives shall be appointed in accordance with clauses 6 and 7. All other appointments to the Board are ex-officio.

4. Functions and powers of the Board

4.1. The proceedings and operations of the Board established by this Agreement shall be directed to the achievement of the Mission and Objectives.

Functions

4.2. To achieve the Mission and Objectives the Board will:

a. develop, advise and make recommendations to the Ministers on policy and other matters consistent with the Objectives;

b. make decisions on matters relevant to the BCA :

A. in accordance with the COAG principles and any other Ministerial direction; and

B. that are consistent with the Objectives;

c. prepare and furnish in respect of each financial year to the respective Ministers, an Annual Business Plan (including a forward work program for the following two financial years) which shall give details of progress, projects, priorities, expenditure and overall performance in the achievement of Objectives;

d. prepare and furnish an Annual Report to Ministers regarding the variations from the BCA reported by the States and Territories under clause 5.4. In particular, this report must:

A. highlight any New Variations from the BCA (including New Variations that are not within the categories listed in recital C (iv)) and the non-adoption of BCA amendments, by the States and Territories;

B. identify areas of duplication and inconsistency in State and Territory legislation; and

C. identify opportunities for greater consistency in building regulations between the States and Territories;

e. provide overall direction, approve work programs, approve and monitor annual budgets, and determine priorities;

f. reach agreement on an annual timetable for the development and delivery of amendments to the BCA;

g. provide for a work program of consultation with governments, industry, consumer groups and other organisations; and

h. provide strategic guidance to the General Manager in the fulfilment of his or her duties.

Powers

4.3. The Board:

a. may, subject to clause 4.4, deal with such matters or arrange for the performance of such tasks related to the Objectives as the Board may, from time to time, deem necessary; and

b. may, subject to clause 4.5, make amendments to the BCA.

Limits on the exercise of powers

4.4. The Board may not act in a manner that is inconsistent with the FMA Act and delegated legislation, in particular the Board cannot:

a. approve spending proposals under Regulation 9 of the FMA Regulations;

b. approve the consideration of spending proposals where there is insufficient available appropriation under Regulation 10 of the FMA Regulations; or

c. enter into contracts or other arrangements under which public money is or may become payable in the name of the Commonwealth or in the name of the Board.

4.5. The Board will comply with the COAG Principles in addressing regulatory reform. In particular, the ABCB Office under the direction of the Board will:

a. conduct Regulatory Impact Assessments, which will:

A. assess whether government intervention is necessary or desirable; and

B. quantify the impact of government action;

b. prepare Regulatory Impact Statements, which will consider the following matters (where relevant):

A. a statement of the problem being addressed;

B. the objective of the proposed regulatory change;

C. a statement of the proposed regulation and any alternatives;

D. the costs and benefits of the proposal;

E. the consultation process that has been or will be undertaken;

F. an evaluation of the relative impacts of the proposal and any alternatives (especially on business and the community at large); and/or

G. the method of and timing for review of the regulation.

c. and consult with the Office of Regulation Review in the Productivity Commission.

5. Assistance to be provided to the Board by State and Territory Administrations

5.1. Each of the State and Territory Administrations will take reasonable steps to consolidate all of their mandatory requirements affecting the design, construction and performance of buildings into the consolidated version of the BCA.

5.2. Each of the Administrations shall have the general responsibility for providing support appropriate to facilitate, within that State or Territory, the work of the Board, including:

a. liaison and co-operation with the General Manager; and

b. timely advice on:

A. the implications of proposals of the Board which affect or are affected by legislation of the State or Territory; and

B. other matters as requested by the Board.

5.3. Each of the Administrations will meet a mutually agreed timetable for development and delivery of amendments to the BCA.

5.4. Each Administration will identify New Variations from the BCA (including New Variations that are not within the categories listed in recital C (iv)) and the non-adoption of BCA amendments, in their respective jurisdictions and report this information to the Board on an annual basis.

6. Appointment of the Chair

6.1. The Chair must be:

a. independent from sectional interests; and

b. have a demonstrated capacity to advance the work of the Board.

6.2. If the position of Chair is vacant or is likely to become vacant, the Commonwealth Minister is responsible for nominating a person as his or her preferred candidate for the position of Chair.

6.3. The Commonwealth Minister must advise the State and Territory Ministers of their nomination.

6.4. In the event a State or Territory Minister disagrees with the Commonwealth Minister's preferred candidate, the State or the Territory Minister may nominate an additional person and will advise the Commonwealth Minister and the other State and Territory Ministers of the nomination.

6.5. A preferred candidate will be required to make a Conflict-of-Interest declaration to the Commonwealth Minister prior to being appointed.

6.6. Where a majority of Ministers agree on a candidate to be appointed as the Chair, the Commonwealth Minister will appoint that person as Chair for a period of up to five years.

6.7. In the event a majority of Ministers are unable to agree on a candidate to be appointed as Chair, the process described in clauses 6.1 to 6.6 shall be repeated until a candidate is agreed.

6.8. A person ceases to be the Chair and a member of the Board if he or she:

a. resigns the office by instrument in writing to the Commonwealth Minister; or

b. is otherwise removed from office by the Commonwealth Minister, after consultation with the State and the Territory Ministers.

7. Appointment of industry representatives

7.1. If the position of one or more of the industry representatives is vacant or is likely to become vacant, the Commonwealth Minister will request a list of persons from the Australian Construction Industry Forum (ACIF) for selection as a member or members of the Board ('list of recommended persons').

7.2. The Commonwealth Minister shall provide the State and the Territory Ministers with the list of recommended persons.

7.3. The Commonwealth Minister shall nominate one or more persons depending upon the number of vacancies on the Board:

a. either from the list of recommended persons provided by ACIF; or

b. any other person as his or her preferred candidate(s); and

shall advise the State and the Territory Ministers of their nomination of a preferred candidate ('preferred candidate').

7.4. In the event a State or Territory Minister disagrees with the nomination of one or more of the Commonwealth's preferred candidates that State or Territory Minister:

a. may nominate an alternative candidate (including a person on the list of recommended persons who has not been nominated by the Commonwealth); and

b. must advise the Commonwealth Minister and the other States and Territories of their nomination of an alternative candidate.

7.5. Each candidate will be required to make a Conflict-of-Interest declaration to the Commonwealth Minister prior to being appointed.

7.6. Where a majority of Ministers agree on a candidate, that person will be appointed to the Board by the Commonwealth Minister for a period of up to five years.

7.7. In the event a majority of Ministers are unable to agree, the process described at clauses 7.3 to 7.6 shall be repeated until a candidate is agreed.

7.8. A person ceases to be a member of the Board if:

a. he or she ceases to retain the qualification by which membership was attained;

b. if the member resigns the office by instrument in writing; or

c. is otherwise removed from office by the Commonwealth Minister, after consultation with the State and Territory Ministers.

8. Meetings of the Board

Timing and number of meetings

8.1. The Board shall meet at least once in each financial year.

8.2. The times and dates of meeting shall be determined by the Board.

Conduct of meetings

8.3. Each member of the Board or their delegate (refer clause 8.10) is entitled to exercise one deliberative vote on any matter for decision.

8.4. Decisions of the Board will be by simple voting majority of those members entitled to vote.

8.5. In the event of an equality of votes the Chair will exercise a casting vote.

8.6. The Chair of the Board, with the agreement of the majority of Administration Board members, may invite observers to Board meetings from time to time.

8.7. The deliberations and decisions of the Board will be recorded in writing.

8.8. The quorum for a meeting is ten Board Members, with the parties to this Agreement being in the majority.

8.9. Members of the Board, including the Chair, must not participate in any discussions or vote in any matters in which they may have or may be perceived to have a conflict-of-interest (refer clause 9).

Delegates

8.10. Subject to clause 8.11, each member of the Board who is the head of a Commonwealth, State or Territory Administration, or ALGA (refer clauses 3.2.b and 3.2.c) may appoint a delegate.

8.11. Any delegate appointed must be delegated the power to make decisions on behalf of their Administration or, in the case of ALGA, their Association.

Decisions without meetings

8.12. Decisions of the Board may be made by communication between its members without calling a formal meeting, provided that:

a. there is agreement of a majority of those entitled to attend and vote at any meeting of the Board;

b. all members have been consulted on each matter for decision; and

c. all members have been informed of the decision.

9. Conduct of the Board

Code of Conduct

9.1. The members of the Board will, to the extent they are applicable, conduct themselves in accordance with the APS Code of Conduct and APS Values (see sections 10 and 13 of the *Public Service Act 1999* (Cth) respectively).

Conflict-of-Interest

9.2. The Chair and Industry Representatives are responsible for keeping their respective Conflict-of-Interest declarations to the Commonwealth Minister up-to-date.

9.3. The Chair and Industry Representatives must make a further Conflict-of-Interest declaration should an actual or perceived conflict-of-interest of an ongoing nature arise during the term of their appointment.

9.4. Subject to clause 8.9, the Board will adopt Conflict-of-Interest guidelines to deal with conflicts as they arise in exercising the Board's functions and powers.

10. Representation on other Bodies

10.1. The Board may be represented on another body or bodies in accordance with resolutions of the Board.

11. Building Codes Committee

11.1. There shall be a Building Codes Committee ('the Committee') to provide technical advice to the Board. The composition of the Committee shall be determined by the Board.

11.2. The operation of the Committee shall be determined by the Board.

11.3. The Committee cannot make decisions that vary the BCA. Such matters, if considered by the Committee, must be referred to the Board which will make the ultimate decision.

12. Review

12.1. A review of the operations of the Board and the administration of this Agreement shall be conducted by the end of 2010 in accordance with both the Objectives of the Agreement and performance indicators developed as part of the Board's Annual Business Plans.

13. Intellectual Property

13.1. This Agreement does not affect the ownership of Intellectual Property in any materials created by, under, or for the purposes of the Board.

13.2. Intellectual Property shall continue to be dealt with in accordance with an Intellectual Property Deed between the Parties.

14. Indemnity Issues

14.1. This Agreement does not provide an indemnity in favour of any member of the Board or the manner in which costs will be apportioned under an indemnity.

14.2. Any indemnities or apportionment of costs of the kind referred to in clause 14.1 will be dealt with in separate deeds between the relevant parties.

15. Funding

Funding formula

15.1. The Ministers will determine an amount of funding required to support the operation of the Board for each financial year after reviewing the Annual Business Plan.

15.2. The amount determined by the Ministers under clause 15.1 will be used to calculate the amount of annual contributions from the Commonwealth, State and Territory governments under clauses 15.5 and 15.6.

15.3. The Board's funding shall be provided by:

a. annual appropriation by the Commonwealth to the Australian Building Codes Board Account (ABCB Account); and

b. crediting of payments made by the States and Territories to the Commonwealth for the purposes of the ABCB Account to the ABCB Account.

15.4. The Commonwealth may receive payments from other sources for the purposes of the Board or arising from the activities of the Board, and these amounts are to be credited to the ABCB Account.

15.5. The amount of annual contributions, as agreed in this clause 15 by the parties, shall be determined using the following formula:

a. the Commonwealth contribution shall be one half of the amount; and

b. the States and the Territories shall contribute one half of the amount.

15.6. The contributions for each State and Territory will comprise:

a. an equal minimum amount; and

b. an amount that is proportionate to the respective share of total building approvals for the financial year two years preceding the determination (as determined by the Australian Bureau of Statistics).

15.7. Annual contributions of funds are payable by the Parties once an appropriation is available, or as soon as practicable after the commencement of each financial year, whichever is the later.

ABCB Account

15.8. The annual contributions of each Party determined under this clause 15 and any other payments paid to the Commonwealth for the purposes of the Board will be credited to the ABCB Account.

15.9. Amounts standing to the credit of the ABCB Account may only be drawn down and spent for the following purposes:

a. for the purpose of the expenditure for research, investigation and development (including the engagement of consultants) and the dissemination of information directed towards the achievement and maintenance of uniform building regulations;

b. development of a national system of accreditation; and

c. development of comparable legislative control procedures in the building approval process among the States and Territories.

15.10. Amounts that may be paid to the Commonwealth and credited to the ABCB Account are any amounts:

a. that are held in trust for, or otherwise for the benefit of, a person other than the Commonwealth;

b. appropriated by law for the purpose of crediting the ABCB Account;

c. received in consideration for any service, benefit, activity, transaction or other matter which is congruent with the expenditure purpose of the ABCB Account; and

d. paid to the Commonwealth by any person for the expenditure purposes for the relevant account.

16. General Manager

Appointment

16.1. A General Manager shall be appointed by the Commonwealth by the Secretary.

16.2. The Secretary will consult with the Chair of the Board on the appointment of the General Manager.

16.3. The General Manager will be an APS employee.

Functions and powers

16.4. The General Manager will manage the day to day activities of the ABCB Office, including coordinating the activities of the Board, and carrying out and managing the implementation of Board directives and decisions in accordance with this Agreement.

16.5. The Board may delegate some functions and powers to the General Manager.

16.6. The General Manager shall, with the strategic guidance of the Board and in a manner consistent with the FMA Act, co-ordinate, manage and facilitate the

implementation of the Board's decisions regarding the Objectives. In particular, the General Manager will have responsibility for:

a. Financial management;

b. Technical support services;

c. Administrative and operational support;

d. Management of research projects;

e. Consultation and liaison;

f. Information dissemination;

g. Advice on policy development;

h. Management and co-ordination of committee activities; and

i. Other matters as determined by the Board.

16.7. The General Manager shall, on request and at least once a year, report to the Board on the achievement of the Objectives of the Agreement.

17. Administration

Delegations and authorisations

17.1. In the absence of a delegation from the Secretary, the General Manager does not have the power to approve spending proposals under Regulation 9 of the FMA Regulations.

17.2. The Secretary may issue the General Manager a limited delegation to approve spending proposals and a drawing right to draw down the funds appropriated to the ABCB Account.

17.3. The General Manager may, provided that the General Manager has been issued an appropriate delegation by the Secretary:

a. approve spending proposals to the limit of that delegation; and

b. draw down the funds appropriated to the ABCB Account under a drawing right issued by the Secretary to the General Manager;

consistent with the requirements of the FMA Act and FMA Regulations.

17.4. The General Manager shall discharge duties and functions in the administration of the ABCB Office and the Board's Annual Business Plan in an efficient, effective and ethical manner.

Engagement of Consultants

17.5. Consultants may be engaged by the Secretary (or the delegate of the Secretary) on behalf of the Board to carry out tasks associated with the functions of the Board.

17.6. The terms and conditions on which consultants are engaged under clause 17.5 must:

a. be an efficient and effective use of public money for the purposes of the FMA Act;

b. be in accordance with the Department's Chief Executive Instructions;

c. be in accordance with the Commonwealth Procurement Guidelines; and

d. if the engagement is not by the Secretary, any delegation by the Secretary of their powers under the FMA Act.

Travel and Meeting Costs

17.7. Subject to clause 17.8, travel and other costs incurred by members or members' delegates, members of the Committee, or consultants in pursuit of the business of the Board may only be paid if approved by the General Manager.

17.8. Costs for travel will only be approved in accordance with the Department's normal travel arrangements and policies.

17.9. Subject to any restrictions in any delegation from the Secretary or the Department's Chief Executive Instructions, the General Manager may, where he or she is requested by the Board to appoint a particular person to conduct research or act as a consultant to the Board, agree to pay the travel and other costs associated with the services of that person as part of the terms of their engagement.

18. Transitional arrangements

18.1. The members of the Board appointed under the Prior Agreements will continue as members of the Board under this Agreement as if they were appointed under this Agreement.

COUNCIL OF AUSTRALIAN GOVERNMENTS

BEST PRACTICE REGULATION

A GUIDE FOR MINISTERIAL COUNCILS AND NATIONAL STANDARD SETTING BODIES

OCTOBER 2007

Contents

INTRODUCTION

Over 40 Commonwealth-State Ministerial Councils and other inter-governmental decision making fora facilitate consultation and cooperation between the Commonwealth Government and state and territory and local governments in specific policy areas. The councils initiate, develop and monitor policy reform jointly in these areas, and take joint action in the resolution of issues that arise between governments. In particular, Ministerial Councils develop policy reforms for consideration by the Council of Australian Governments (COAG), and oversee the implementation of policy reforms agreed by COAG. Ministerial Council agreements are commonly translated into law and regulation, and it is important that all councils follow consistent principles in developing all proposals which have a regulatory impact.

This document provides guidance to Ministerial Councils and other standard setting bodies (hereafter referred to collectively as "Ministerial Councils") on best-practice regulation making and review by outlining:

- principles for best-practice regulation making agreed by COAG; and
- guidance for undertaking regulatory impact assessment and preparing a Regulation Impact Statement (RIS) including assistance on undertaking:-
  - risk analysis,
  - cost-benefit analysis,
  - assessments of compliance costs,
  - assessments of competition effects, and
  - consultation.

Importantly, the Guide reflects the commitment to establish and maintain effective arrangements to maximise the efficiency of new and amended regulation and avoid unnecessary compliance costs and restrictions on competition made by COAG at its 10 February 2006 meeting. COAG also agreed to apply these enhanced arrangements to Ministerial Councils. The Guide ensures that regulatory processes at the national level are consistent with principles of best practice regulatory process agreed by COAG.

Governments will establish and maintain effective arrangements at each level of government that maximise the efficiency of new and amended regulation and avoid unnecessary compliance costs and restrictions on competition by:

(a) establishing and maintaining "gate keeping mechanisms" as part of the decision-making process to ensure that the regulatory impact of proposed regulatory instruments are made fully transparent to decision makers in advance of decisions being made and to the public as soon as possible;

(b) improving the quality of regulation impact analysis through the use, where appropriate, of cost-benefit analysis;

(c) better measurement of compliance costs flowing from new and amended regulation, such as through the use of the Commonwealth Office of Small Business' costing model;

(d) broadening the scope of regulation impact analysis, where appropriate, to recognise the effect of regulation on individuals and the cumulative burden on business and, as part of the consideration of alternatives to new regulation, have regard to whether the existing regulatory regimes of other jurisdictions might offer a viable alternative; and

(e) applying these arrangements to Ministerial Councils.

COAG acknowledges that a large quantity of guidance material has also been developed on best practice regulation at the jurisdictional level that can assist Ministerial Councils to undertake regulatory impact assessment and make sound regulatory decisions. In the case of Ministerial Councils, however, this Guide should act as the primary source of direction.

This Guide replaces the previous COAG document entitled *Principles and Guidelines for National Standard Setting and Regulatory Action by Ministerial Councils and Standard-Setting Bodies*.

APPLICATION

Regulation refers to the broad range of legally enforceable instruments which impose mandatory requirements upon business and the community, as well as to those government voluntary codes and advisory instruments for which there is a reasonable expectation of widespread compliance.

The principles of good regulatory practice and regulatory assessment requirements outlined in this Guide apply to decisions of COAG, Ministerial Councils and intergovernmental standard-setting bodies, however they are constituted. This includes bodies established by statute, or administratively by government, to deal with national regulatory problems.

The principles and assessment requirements apply to agreements or decisions to be given effect, whether at the Commonwealth or State/Territory level, or both, through principal and delegated legislation, administrative directions or other measures which, when implemented, would encourage or force businesses or individuals to pursue their interests in ways they would not otherwise have done. This does not include purchasing policy or industry assistance schemes.

The principles and assessment requirements do not apply to agreements or decisions that result in regulation that is minor or machinery in nature and do not substantially alter existing arrangements. Nor do the principles apply to early "brainstorming" discussions of Ministerial Councils which are not supported by *written* submissions outlining regulatory options or recommendations regarding regulatory action.

Development of voluntary codes and other advisory instruments should take account of these principles and assessment requirements where there is a reasonable expectation that their promotion and dissemination by standard-setting bodies or by government could be interpreted as requiring compliance. For example, should non-compliance with provisions of a voluntary code be considered as evidence by a court or an administrative body when determining compliance with statutory obligations, such advisory documents are subject to the review process.

The Commonwealth Office of Best Practice Regulation (OBPR) will provide advice and assistance on regulation impact assessment, the preparation of RISs for Ministerial Councils and monitor and report on compliance with the requirements of this COAG Guide. Contact details for the OBPR are available at http://www.obpr.gov.au. Process requirements for the preparation of RIS are outlined in this document.

PRINCIPLES OF BEST PRACTICE REGULATION

Principles of Best Practice Regulation

COAG has agreed that all governments will ensure that regulatory processes in their jurisdiction are consistent with the following principles:

1. establishing a case for action before addressing a problem;
2. a range of feasible policy options must be considered, including self-regulatory, co-regulatory and non-regulatory approaches, and their benefits and costs assessed;
3. adopting the option that generates the greatest net benefit for the community;
4. in accordance with the Competition Principles Agreement, legislation should not restrict competition unless it can be demonstrated that:-
   a. the benefits of the restrictions to the community as a whole outweigh the costs, and
   b. the objectives of the regulation can only be achieved by restricting competition;
5. providing effective guidance to relevant regulators and regulated parties in order to ensure that the policy intent and expected compliance requirements of the regulation are clear;
6. ensuring that regulation remains relevant and effective over time;
7. consulting effectively with affected key stakeholders at all stages of the regulatory cycle; and
8. government action should be effective and proportional to the issue being addressed.

A discussion of the above principles, and some of the factors Ministerial Councils should consider in applying these principles to the regulation making process when assessing potential responses to policy problems, is included below.

Principle 1: Establishing a case for action before addressing a problem.

An important first step before considering any action is to examine closely whether there is a problem, and to make an initial decision on whether any action is required.

Principle 2: A range of feasible policy options must be considered, including self-regulatory, co-regulatory and non-regulatory approaches, and their benefits and costs considered.

Once the problem has been examined and a case for government intervention has been established, officers should identify the objectives for any intervention and consider all feasible options, of both a regulatory and non-regulatory nature, that could wholly or partly achieve these objectives. Working from an initial presumption against new or increased regulation, the overall goal is the effective and efficient achievement of the stated objectives. The ‘status quo’ and effectiveness of existing regulations should be considered as an option for meeting the objectives.

Principle 3: Adopting the option that generates the greatest net benefit for the community.

This requires a rigorous regulation impact assessment of all the feasible policy options available to address the identified problem. Decision makers should adopt the option which provides the greatest net benefit to the community. Decisions about whether regulatory action is in the public interest should be informed by an assessment of the effectiveness of the proposed action in meeting the identified objective, and the costs and benefits of the proposed action for the community as a whole.

Principle 4: In accordance with the Competition Principles Agreement, legislation should not restrict competition unless it can be demonstrated that:

- the benefits of the restrictions to the community as a whole outweigh the costs; and
- the objectives of the regulation can only be achieved by restricting competition.

Many existing and proposed regulations and requirements restrict competition, including by imposing barriers to entry, exit, or innovation, and can have the effect of restricting consumer choice, raising prices and reducing overall economic efficiency and productivity.

As far as possible, restrictions on competition should be avoided or minimised. Regulation should only restrict competition where this is necessary to achieve the objective, and the benefits of restricting competition outweigh the costs.

Principle 5: Providing effective guidance to relevant regulators and regulated parties in order to ensure that the policy intent and expected compliance requirements of the regulation are clear.

When making a decision to adopt a regulatory solution to a problem in order to deliver the greatest net benefit for the community, it is necessary to clearly articulate any decision and new regulations for the benefit of regulators administering the solution as well as regulated parties.

Regulation should have clearly identifiable outcomes and unless prescriptive requirements are unavoidable in order to ensure public safety in high-risk situations, performance-based requirements that specify outcomes rather than inputs or other prescriptive requirements should be used.

Good regulation should attempt to standardise the exercise of bureaucratic discretion, so as to reduce discrepancies between government regulators, reduce uncertainty and lower compliance costs. Regulatory measures should contain compliance strategies which ensure the greatest degree of compliance at the lowest cost to all parties.

Where possible, regulatory instruments should be drafted in ‘plain language’ to improve clarity and simplicity, reduce uncertainty and enable the public to understand better the implications of regulatory measures.

Appendix A sets out the key features of good regulation in more detail.

Principle 6: Ensuring that regulation remains relevant and effective over time.

To ensure regulation remains relevant and effective over time it is important that all regulation be reviewed periodically. All governments have committed to reviewing annually existing regulations with a view to encouraging competition and efficiency, streamlining the regulatory environment, and reducing the regulatory burden on business arising from the stock of regulation.

Ensuring that regulation remains relevant and effective over time may be achieved through planning for monitoring and review of regulation as part of the development of new regulatory proposals, or by incorporating sunset provisions or review requirements in legislative instruments.

Principle 7: Consulting effectively with affected key stakeholders at all stages of the regulatory cycle.

There should be effective consultation with affected key stakeholders at all stages of the regulatory cycle. Public consultation is an important part of any regulatory development process. Consultation should occur when the options for regulatory action are being considered and a draft RIS (also known as the 'Consultation RIS') has been produced. This will give interested parties a range of options and also in some cases a firm proposal to consider.

Consultation on regulatory options can improve the quality of the solution adopted by:

- ensuring that both those affected by regulation, and the actioning agencies, have a good understanding of what the problem is;
- providing perspectives and suggestions, on alternative options to address the problem, from those parties that will be affected by the government action;
- helping regulators assess competing interests;
- providing a check on the regulator's assessment of costs (including compliance costs) and benefits and whether/how the proposed option will work in practice, thus reducing the risk of unintended consequences if a particular option is adopted;
- identifying interactions between different types of regulations; and
- possibly enhancing voluntary compliance through greater understanding and acceptance of a proposal, thereby reducing reliance on enforcement and sanctions.

Principle 8: Government action should be effective and proportional to the issue being addressed.

In all responses to identified problems, government action should be effective and proportional to the issue being addressed. Effectiveness should be judged solely in terms of meeting the specified objective. Consideration should be given to the effectiveness of implementation and administration and, as relevant, an assessment of likely compliance rates should be made taking into account matters such as incentive structures and costs to regulated parties.

Proportionality involves ensuring that government action does not 'overreach', or extend beyond addressing a specific problem or achieving the identified objective. The scope or nature of government action should be commensurate with the magnitude of a problem, its impacts, or the level of risk without action. The principle of proportionality applies equally to the implementation of regulation, including the development of frameworks for ensuring compliance.

PROCESS GUIDELINES FOR REGULATORY IMPACT ASSESSMENT

Regulation is an essential part of running a well functioning economy and society, but must be carefully designed so as not to have unintended or distortionary effects, such as imposing unnecessarily onerous costs on those affected by the regulations or restricting competition. Assessing the impact of regulation, including analysing the costs and benefits, is therefore important to ensure that it delivers the intended objective without unduly causing adverse effects.

If regulatory options are being considered (such as self-regulation where governments expect business to comply, quasi-regulation, co-regulation and 'black letter law') then Ministerial Councils must subject these options to a regulatory impact assessment process through the preparation of a draft and final RIS.

The purpose of a draft RIS for consultation is to canvass the regulatory options under consideration, in order to determine the relative costs and benefits of those options. The purpose of a final RIS for decision makers is to draw conclusions on whether regulation is necessary, and if so, on what the most efficient and effective regulatory approach might be, taking into account the outcomes of the consultation process. The basic feature of a RIS is the systematic examination of the advantages and disadvantages of possible methods of achieving the objective. A number of quantitative approaches exist to assist in evaluating options as part of the regulatory impact assessment including:

- risk analysis;
- cost-benefit analysis;
- measuring business compliance costs; and
- assessing effects on competition.

Detailed advice for Ministerial Councils on these quantitative approaches (risk analysis, measurement of business compliance costs and assessment of competition effects) is included in the appendices to this guide . The OBPR can also provide advice and assistance and is responsible for monitoring compliance with the requirements set out in this Guide.

The following steps for preparing RIS are provided to assist Ministerial Councils (including their secretariats or advisory committees) in determining appropriate courses of action and maximising the effectiveness and efficiency of new regulation taking into account the principles outlined above.

As a general rule the level of detail within the assessment should be commensurate with the impact of the proposed regulatory measures.

Steps for Policy Officers undertaking Regulatory Impact Assessment

Step one:

Consult early with the OBPR and seek advice about whether a RIS should be prepared.

Step two:

Send the draft RIS (also known as the 'consultation RIS') to the OBPR for advice as soon as practicable and before the draft RIS is made available for public comment. Where a trans-Tasman (such as Trans Tasman Mutual Recognition Arrangement (TTMRA)) issue is involved, the OBPR will refer it to the Regulation Impact Analysis Unit of the New Zealand Ministry of Economic Development for comment.

A Ministerial Council should continue to consult with the OBPR as the draft RIS is developed further.

It is expected that the level of analysis in a draft RIS would be lower than the level on analysis in the final RIS. This is because the impacts of options are sometimes unclear. The community consultation process is designed to allow interested parties and stakeholders to identify help such impacts. In such cases the OBPR may focus its assessment primarily on the first three parts of the draft RIS, the problem, objectives and options section of the RIS.

Step three:

The Ministerial Council should await the comments of the OBPR prior to public release of the draft RIS for the purpose of consultation. The draft RIS approved by OBPR should be publicly released as part of the mandatory community consultation process.

Step four:

Consult with affected stakeholders by placing advertisements in all jurisdictions to give notice of the intention to adopt regulatory measures, to advise that the RIS is available on request and invite submissions.

Step five:

The RIS should be developed further following its public release, taking into account outcomes from the consultation process and incorporating a list of stakeholders consulted and a summary of their views.

Step six:

The final RIS for decision makers should be forwarded to the OBPR prior to a decision being made by a Ministerial Council. The OBPR will assess the RIS within two weeks of receipt. The assessment will focus on whether the RIS meets the requirements set out in this document, including:

- whether the RIS Guidelines have been followed;
- whether the type and level of analysis are adequate and commensurate with the potential economic and social impacts of the proposal; and
- whether the RIS demonstrates that the preferred option results in a clear net benefit to the community.

Where the preferred option restricts competition, the benefits to the community of the restriction should outweigh the costs and it should be demonstrated that the objectives of the regulation can only be achieved by restricting competition.

The OBPR will advise the Ministerial Council or standard setting body of its assessment, incorporating any comments from New Zealand relating to a trans-Tasman issue.

The Ministerial Council will determine whether or not to adopt the OBPR's advice.

Step seven:

Following a decision by the Ministerial Council to proceed with a regulatory course of action, the decision making body should respond to any issues that have not been dealt with in the way recommended by the OBPR.

Step eight:

Both OBPR comments and any responses made by Ministerial Councils should be available to Commonwealth, State and Territory Cabinets.

Step nine:

The OBPR is to advise Senior Officials through the COAG Secretariat in the Department of the Prime Minister and Cabinet if, in its opinion, decisions of Ministerial Councils are inconsistent with COAG Guidelines.

After a decision is taken, the final RIS, which should be of a standard suitable for publication, will generally be made public.

RIS Guidelines

What needs to be included in a RIS?

This section outlines the process for preparing a RIS and the key questions for consideration at each stage in the process. The basic feature of a RIS is the systematic examination of the advantages and disadvantages of possible methods of achieving an agreed objective.

As a general rule, the level of analysis included in the final RIS provided to the decision maker should be higher than that included in the draft RIS which is prepared for the purpose of consultation.

As outlined below there are seven key elements that should be contained in a RIS. The detail and depth of analysis in a RIS should be commensurate with the magnitude of the problem and with the size of the potential impacts of the proposal. More detailed discussion of the seven elements of a RIS can be found in the OBPR's *Best Practice Regulation Handbook*, which can be downloaded from http://www.obpr.gov.au/bestpractice/index.html

Element 1 Statement of the Problem

The RIS should clearly identify the fundamental problem(s) that need to be addressed. This part of the analysis must:

- present evidence on the magnitude (scale and scope) of the problem;
- document relevant existing regulation at all levels of government, and demonstrate that it is not adequately addressing the problem;
- if the problem involves risk, identify the relevant risks and estimate the probability of an adverse outcome, including where no new or amended regulations are made and where government action would reduce the risk; and
- present a clear case for considering that additional government action may be warranted, taking account of existing regulation and any risk issues.

The statement of the problem should establish a case for action (Best Practice Regulation Principle 1). In particular, officers should consider the following questions:

- what is the problem being addressed?
- how significant is it?
- what are the costs, risks or benefits of maintaining the status quo?

- why is government action needed to correct the problem?
- is there relevant regulation already in place?
- if regulation is in place, why is additional action needed?

Information should be obtained on the nature and magnitude of the problem as well as identifying what government actions (if any) have been taken in the past to address the problem. In some cases government intervention in a market may be justified on the basis of 'market failure', which can arise where there is:

- imperfect competition;
- externalities;
- public goods; or
- imperfect or costly information.

The term market failure is sometimes misunderstood to indicate a failure of markets to deliver a desirable social or equity goal. Any underlying market failure, regulatory failure (for example, unintended consequences or failure of existing regulation) or risks should be clearly identified.

Element 2 Objectives

The RIS should clearly articulate the objectives, intended outcomes, goals or targets of government action. The objectives should not pre-justify a preferred solution. Nor should government regulation be considered to be an objective of government action (that is, regulation is a means to an end, not an end in itself). The objectives should be specified broadly enough to allow consideration of all relevant alternative solutions, but without being so broad that the range of options becomes too large to assess, or the extent to which objectives have been met becomes too hard to establish.

Element 3 Statement of Options

The RIS should identify a range of viable options including, as appropriate, non-regulatory, self-regulatory and co-regulatory options. If only one option (apart from the status quo) is considered feasible, the RIS should provide sound justification for considering only two options.

The Statement of Options of a RIS should address Principle 2 by demonstrating that officers have considered a range of policy options and the benefits and costs of these options.

Regulatory measures and instruments should be the minimum required to achieve the pre-determined and desirable outcomes. Where a decision is made to consider regulatory options additional factors that should be explored include:

- consistency with Australia's international obligations and relevant international accepted standards and practices;
- potential incentive effects and secondary effects;
- minimisation of regulation and administrative burdens as much as possible;
- the potential regulatory burden of alternative measures on the community; and
- compliance and enforcement issues.

Alternatives to regulatory options might include education campaigns.

Element 4 Impact Analysis (Costs and Benefits)

The RIS should provide an adequate analysis of the costs and benefits of the feasible options and should:

- identify the groups in the community likely to be affected by each option and specify significant economic, social and environmental impacts on them;
- assess the costs and benefits of all the options supported by an acceptable level of evidence, where appropriate through a formal cost-benefit analysis (see Appendix C);
- assess the impacts on business, particularly small business, and quantify the effect of each option on business compliance costs (using a tool such as the Business Cost Calculator) (see Appendix D);
- quantify other significant costs and benefits where appropriate, taking into account the significance of the proposal, its impact on stakeholders;
- if an objective of regulation is to reduce risk, analyse the extent to which each option would reduce the relevant risk, and the costs and benefits involved (see Appendix B);
- recognise the effect of the options on individuals and the cumulative burden on business;
- document any relevant international standards, and if the proposed regulation differs from them, identify the implications and justify the variations;
- if the proposed regulation would maintain or establish restrictions on competition, demonstrate that government objectives can be achieved only by restricting competition (see Appendix E); and
- provide evidence in support of key assumptions and clearly identify any gaps in data.

Where a proposed regulation would maintain or establish restrictions on competition, an assessment against the Competition Principles Agreement guiding principle should be undertaken (see Appendix E). The extent of this assessment should be commensurate with an initial assessment of the extent of the anti-competitive impact. It should involve the evaluation of the impact (for primary and relevant related markets) of the regulatory proposal on the following:

- incumbent businesses;
- entry of new businesses;
- prices and production;
- quality and variety of goods and services;
- innovation;
- market growth; and
- related markets.

The results of this assessment should be compared with assessments of feasible alternative policy options that would equally achieve the policy goal but be less anti-competitive. If there are no available alternatives, the proposal should be assessed from the perspective of economic well being or net benefit to the community.

Regulation impact analysis of the feasible policy options, should also include an assessment of whether a regulatory model is already in place in a participating jurisdiction that would efficiently address the issue in question and whether a uniform, harmonised or jurisdiction-specific model would achieve the least burdensome outcome (or generate the greatest net benefit for the community). A regulation impact assessment should also have regard to whether the issue is state-specific or national, and whether there are substantial differences that may require jurisdiction-specific responses.

The impact analysis in a RIS should include an assessment of Principle 3, that is, adopting the option that generates the greatest net benefit to the community.

There are a number of different approaches to quantitative analysis to help establish the most efficient form that any regulation might take. The techniques set out below are to be employed to determine the option with the greatest net benefit for the community (a particular technique may be omitted if circumstances render it irrelevant).

Risk analysis

This methodology is of use in addressing the threshold issue of whether or not to regulate. Risk analysis should be used in conjunction with other quantitative assessment techniques. Detailed guidance for Ministerial Councils on undertaking risk analysis is included at Appendix B.

Cost-benefit analysis

This technique requires that all the major costs and benefits of a proposal be quantified in monetary terms. In this way, the outcomes of a range of options are translated into comparable terms in order to facilitate evaluation and decision-making. Cost-benefit analysis is most effective in instances where there is sound information on which to base the analysis. However, it should also be noted that cost-benefit analysis should involve consideration of the distribution of benefits and costs, as well as taking account of impacts which are unable to be valued quantitatively. Detailed guidance for Ministerial Councils on undertaking cost-benefit analysis is included at Appendix C.

Business compliance costs

Consideration should also be given to the compliance burden imposed on business. These are the additional (incremental) costs incurred by businesses when complying with regulations.

One option for making initial assessments of the likelihood a proposal will involve compliance costs for business is through the use of the Business Cost Calculator's *Quickscan* function. This tool is located on the OBPR website at www.obpr.gov.au/businesscostcalculator/index.html

If this indicates there are compliance costs for business, then the Business Cost Calculator can be used to complete a detailed assessment of these costs.

As part of a regulatory impact assessment, a practical approach for considering the impacts on business compliance costs potentially flowing from regulatory proposals is through a set of threshold questions. A compliance cost checklist is included at Appendix D.

Competition effects

Ministerial Councils will also need to have regard to the competition effects of any policy options. This is discussed in the next section.

Each RIS should outline the results of this analysis and come to a conclusion on which of the options being considered provides the greatest net benefit for the community for the benefit of the ultimate decision making body.

The impact analysis in a RIS should also include an assessment of Principle 4, that legislation should not restrict competition unless it can be demonstrated that the benefits of the restrictions to the community as a whole outweigh the costs; and that the objectives of the regulation can only be achieved by restricting competition adopting the option that generates the greatest net benefit to the community.

A preliminary analysis of whether a proposal may restrict competition can be conducted by working through the questions in the competition checklist included at Appendix E.

Element 5 Consultation

The final RIS should:

- outline the consultation objective;
- describe how consultation was conducted (including the stages of the policy development process at which consultation was undertaken, the timeframes given, and the methods of consultation);
- articulate the views of those consulted, including substantial disagreements;
- outline how those views were taken into consideration; and
- if full consultation was not undertaken, provide a reasonable explanation.

The consultation statement in a RIS should address Principle 7 by setting out the consultation undertaken with affected key stakeholders.

Consultation should occur as widely as possible but, at the least, should include those most likely to be affected by regulatory action (for example, consumer and business organisations) which might provide valuable feedback on the costs and benefits of regulation and on the impact assessment analysis generally. Consultation will also provide feedback on the level of support for the proposed regulation.

A statement of the consultation undertaken is a key component of the RIS process.

The OBPR has developed seven principles for best practice consultation and these are detailed in Appendix F.

Element 6 Evaluation and Conclusion

The RIS should provide a clear statement as to which is the preferred option and why.

The RIS should demonstrate that:

- the benefits of the proposal to the community outweigh the costs; and
- the preferred option has the greatest net benefit for the community, taking into account all the impacts.

Element 7 Implementation and Review

The RIS should provide information on how the preferred option would be implemented, monitored and reviewed. Interactions between the preferred option and existing regulation of the sector should be clearly identified.

The implementation and review section of a RIS should address Principle 6, ensuring that regulation remains relevant and effective over time. Specified outcomes of standards and regulatory measures should be capable of revision to enable them to be adjusted and updated as circumstances change.

However, it is important to ensure that amendments to regulatory measures and instruments do not result in undue uncertainty in business operations and in so doing, impose excessive costs on that sector.

Strategies for reviewing new regulations should be identified in the RIS when considering the policy option.

Frequently Asked Questions

What if there is not time to prepare a RIS?

A Ministerial Council may decide that a situation requiring a regulatory response is an emergency. In these cases, a RIS need not be prepared before the regulation comes into effect. However, the Chair of the Ministerial Council must write to the Prime Minister before making the regulation:

- seeking agreement to waive the need for a RIS; and
- explaining why the situation was an emergency and why no transitional measures were available.

If the situation was an emergency, the Ministerial Council would be expected to prepare a RIS within 12 months of making the regulation. Alternatively, in emergency cases the briefing material prepared for a Ministerial Council can be provided to the OBPR, which will advise whether the key elements of a RIS are addressed in such material. If so, the OBPR can "post assess" the material as complying with the COAG Guidelines.

At what point is a RIS required?

A final RIS is required at the point a decision is taken. For multi-staged decision-making processes, where a RIS is prepared in accordance with these Guidelines, a RIS will not generally be required for follow-up or subsequent regulation which implements the original decision, unless significant additional regulation is contemplated.

What is the role of the OBPR?

The OBPR does not have any power over decisions made by Ministerial Councils and its role is advisory. COAG has directed the OBPR to provide independent advice on the adequacy of RIS prepared for both public consultation and decision by Ministerial Councils. In fulfilling this role the OBPR does not support any particular regulatory approach or jurisdiction. The OBPR can assist and advise as to whether a RIS is consistent with the principles and Guidelines in this document. However, the attention of COAG can be drawn to any regulatory proposals for which the RIS is seriously inadequate through the Productivity Commission's annual regulatory report.

REQUESTING A REVIEW OF A REGULATION IMPACT STATEMENT

If, prior to the introduction of a regulation, there is some dissatisfaction with the process or adequacy of the analysis by which conclusions were reached, two or more jurisdictions may request an independent review of the proposed regulation. The Ministerial Council must then defer its consideration of the regulation and commission a review.

The process of independent review would be triggered if two Heads of Government write to the Chair of the Ministerial Council requesting an independent review of the assessment process. Upon completion, the review body will report back to the relevant Ministerial Council.

The Ministerial Council is to nominate an independent body to conduct the review (the review body). This might include a regulatory review body in any jurisdiction, an appropriate specialist body or a consultant. Jurisdictions that request the review will meet the review's cost and agree to make resources available for the conduct of the review if the Ministerial Council decides to use State or Territory government regulatory review units to conduct the review.

The review body's task is to reassess the RIS and report on whether it can be demonstrated that the assessment process has been carried out according with the Guidelines in this document. It is not intended that the independent review should necessarily repeat the quantitative analysis. The review body may also comment on any aspect of the proposed regulation and will have access to public submissions made in the course of the assessment process.

The report of the review body would become a public document and would be considered by the Ministerial Council in its discussion of the adoption of the proposed regulatory measures. Once the report has been considered, the Ministerial Council's consideration of whether or not the regulation should be adopted by member governments can proceed.

The initial regulatory impact assessment and any review of that assessment are designed to provide the best possible information for decision making by the Ministerial Council. The impact assessment will not bind them or the participating governments since most Ministerial Councils are not formally established and do not have formal and binding voting arrangements. Their purpose is to develop a national consensus in relation to the matters which they consider.

If, upon the advice of the review body, a State or Commonwealth regulatory review body, or other advice, the impact assessment is found to have been faulty, the Ministerial Council retains discretion in its use of the impact assessment to inform its decision making.

If a Ministerial Council fails to act on the recommendations of the review, the matter may be further examined by Heads of Government.

APPENDIX A: FEATURES OF GOOD REGULATION

In formulating national standards and regulatory measures according to the above principles and guidelines, Ministerial Councils should also take into account the following practical features of good regulation.

Accountability

As set out in the protocols for the operation of Ministerial Councils, it is the responsibility of Ministers to ensure that they are in a position to represent appropriately their Government at Council meetings. Therefore, to the greatest extent possible, Ministers should obtain full government agreement on matters which may involve regulatory action before they are considered at Ministerial Council level.

Where a Minister is dissatisfied with the outcome of the impact assessment process, the Minister may seek the agreement of his/her Head of Government to request an independent review of the assessment process.

Compliance strategies and enforcement

Regulatory measures should contain compliance strategies which ensure the greatest degree of compliance at the lowest cost to all parties. Incentive effects should be made explicit in any regulatory proposals. Measures to encourage compliance may include regulatory clarity, brevity, public education and consultation and the choice of alternative regulatory approaches with compliance in mind.

The special characteristics of process regulation need to be considered. For example, the number of licences, certifications, approvals, authorities et cetera. should be kept to the minimum necessary to achieve the regulatory objectives.

The regulatory burden can be reduced if the public is required to undertake a minimum level of interaction with government to, for example, renew permits/ licences or file information. This can be achieved through measures such as ‘one stop shops’; mutual recognition of approval processes within government as well as between governments; better forms and process design.

Having taken these steps to facilitate compliance, regulators also need to consider the feasibility of enforcing regulatory requirements through the detection of non-compliance.

Mandatory regulatory instruments should contain appropriate sanctions to enforce compliance and penalise non-compliance. However, enforcement options should differentiate between the good corporate citizen and the renegade, to ensure that ‘last resort’ penalties are used most effectively (rarely) but model behaviour is encouraged. Enforcement measures should not have the effect of encouraging otherwise good corporate citizens to subvert compliance measures.

Inclusion of standards in appendices

Standards should be referenced as current editions in appendices to regulatory instruments rather than embodied in such instruments themselves. It may be appropriate in some circumstances for regulations to reference a specific standard (eg AS 1234).

A disadvantage of only referencing the title of a standard (eg AS1234) is that impact assessment is carried out only on the initial instrument and referenced standard. The standard, however, may be subsequently

changed or updated. This may result in significant changes to the costs or benefits of regulation, with no opportunity to review the implications of such a change. This can have the effect of transferring regulatory power from governments to standard setters. To prevent this, it may be appropriate in some circumstances for regulatory instruments to reference a specific version of a standard by referring to its date (for example, AS 1234, 1993). If an amended version of a standard is to be adopted any changes to this standard would then require amendment of the regulatory instrument and hence further impact assessment.

An advantage of only referencing the title is that changes to the standards do not render the regulations null and void.

In determining whether to include a standard, consideration should also be given to the costs of obtaining the standard in order to comply with it.

Performance-based regulations

Regulatory instruments should be performance-based, that is, they should focus on outcomes rather than inputs. 'Deemed to comply' provisions may be used in instances where certainty is needed. In such cases, regulations might reference a standard or a number of standards deemed to comply with the regulation. There should be no restrictions on the use of other standards as long as the objectives of the regulation are met.

Plain language drafting

Where possible, regulatory instruments should be drafted in 'plain language' to improve clarity and simplicity, reduce uncertainty and enable the public to understand better the implications of regulatory measures.

Date of effect

The dates of commencement of proposed standards and regulatory measures should be carefully planned to avoid or mitigate unintended or unnecessary market consequences, such as the necessity to discard non-complying stock and to allow transition to compliance with new regulatory requirements.

Advertising the introduction of standards and regulations

Public consultation usually only involves interested parties. Therefore, once produced, new regulatory measures should be advertised to bring them to the attention of the wider community.

International standards and practices

Wherever possible, regulatory measures or standards should be compatible with relevant international or internationally accepted standards or practices in order to minimise the impediments to trade. Compatibility in this context does not necessarily imply uniformity, however.

National regulations or mandatory standards should be consistent with Australia's international obligations. Australia has obligations under the GATT Technical Barriers to Trade Agreement (Standards Code) and the World Trade Organisation's Sanitary and Phytosanitary Measures (SPS) Code. Regulators may refer to the Standards Code relating to the International Standards Organisation's Code of Good Practice for the Preparation, Adoption and Application of Standards.

APPENDIX B: RISK ANALYSIS

What is risk?

Risk is the probability of an undesirable event occurring. Much regulatory activity, for example in the areas of health and safety, is concerned with the risk of persons being harmed by engaging in a particular activity (for example, by consuming a product or by working in a factory). The notion of harm encompasses fatality, injury or illness.

Risks can be viewed in several ways. It is possible to look at societal risk or individual risk. The former averages out individual risk and measures the risk to society as a whole or to a large group of people. Individual risk, on the other hand, varies from person to person. In addition, voluntary risk can be distinguished from involuntary risk. Voluntary risk occurs where an individual can choose to undertake or avoid the risk-causing activity and is fully aware of the consequences.

Conversely, involuntary risk occurs where there is no choice or inadequate information about the consequences. Incomplete information is one of the main forms of market failure. An analysis should also make a distinction between perceived risks and actual risks. Perceived risks occur where individuals overstate the importance of relatively improbable events or discount the importance of highly probable events.

An important distinction to make when conducting risk analysis is that between risk and uncertainty. Risk involves a situation where the probabilities of the various outcomes are reasonably well known. In statistical terms, a probability distribution can be attached to the cost or benefit in question. Uncertainty involves a situation where, while the values the costs or benefits may take may be known, the probabilities of the outcomes are not known.

What is risk analysis?

Risk assessment is a means of analysing the risk of an undesirable event occurring and the consequences that are liable to arise if does occur. An integral part of the assessment process, following on from these first two steps, is determining what action may be necessary to reduce or eliminate the risk and/or its consequences.

Risk analysis is commonly used by policy analysts as a means of assessing individual and societal risks and proposing possible regulatory and non-regulatory solutions to an identified problem. It is most commonly used to analyse regulatory interventions in the health and safety field. However it can also be applied in other public policy fields.

Risk analysis

Risk analysis can serve a number of functions. By comparing the risk associated with the status quo with that after government intervention, it can be used to determine more accurately whether intervention is appropriate and/or worthwhile. Risk analysis can also be used as an input into other assessment techniques like cost-benefit analysis.

Risk analysis, in its most basic form, involves quantitative assessment of the magnitudes of the risk affected by the proposal. The contents of a risk analysis can easily be extended by the assessment of additional information, such as benefits or associated risks.

Risk analysis is a valuable tool in further addressing the threshold issue of whether or not to regulate. Furthermore, risk analysis is of use in answering two important questions. First, whether the risks that regulation is intended to address are of significant magnitude compared with other risks. Second, the extent to which regulation reduces the initial risk problem.

Content of a risk analysis

The following issues can be addressed in the risk assessment of regulation:

- an appraisal of the current level of risk to the exposed population from an identifiable source;
- the reduction in risk which will result from the introduction of the proposed measures;
- consideration of whether the proposed measures are the most effective available to deal with the risk; and
- whether there is an alternative use of available resources which will result in greater overall benefit to the community.

Limitations of risk analysis

There are a number of ways of assessing risk and the impact it is liable to have. They tend to be relatively arbitrary and non-empirical, so that a set of results can be easily interpreted by different persons in different ways. Risk assessment does not normally involve an assessment of the costs likely to be incurred by the affected parties if the undesirable event does happen. Nor does it take into account the costs and benefits associated with the measures proposed to reduce or eliminate the risk and/or its consequences. Risk analysis should therefore not be used as the sole basis for deciding whether to take action to correct an undesirable situation or for determining the type of action to be taken.

The risk analysis process

Risk analysis involves three distinct but inter-linked steps:

- defining the risk;
- selecting the appropriate response; and
- monitoring the situation and reviewing the effectiveness of the response that was selected and implemented.

Defining the risk

The following questions should be answered to ensure that the risk is defined as accurately as possible:

1. What is the hazard? It is necessary to define exactly what the hazard is;

2. What is the risk? It is important to distinguish between commercial risks and physical risks. Commercial risks can, and probably should, be borne by the company or industry involved and resolved at that level. On the other hand, a physical risk (and this ranges from a direct personal threat to life to environmental pollution) is a problem that is likely to affect individuals and society as a whole and therefore is best addressed at the appropriate government level;

3. How widespread is the risk? Is the risk local only, is it state-wide, national or international ? Obviously, the extent of measures to be considered to combat the risk will depend on this assessment, and may include the need for international co-operation;

4. Is the risk transmittable? In the case of medical risks, for example (such as a contagious disease), the transmitability of the risk is crucial to this assessment, as is the means of transmission and its avoidability. This will also involve identification of the source of the risk and whether transmission occurs across boundaries, for example, from plants to insects to animals to humans, or between different geographical locations;

5. In what circumstances will the risk arise? Is the risk continuous, or will it arise only in particular circumstances (for example, if a product is used only in a specific way; or only if a particular chemical is used);

6. Who or what is most at risk? Identification of the at-risk groups is crucial. It is necessary to determine for instance whether children of certain ages are most at risk, whether it is the population as a whole, whether the risk is confined to a particular group (for example, only plants, or male children below the age of 10, or women over 45); and

7. Is harm or injury liable to occur? Having gone through the above steps, it is important to determine whether any actual harm (for example, to the environment) or injury is liable to occur. This necessarily involves assessing not only the immediate effects but also the longer term effects. If no actual harm or injury is liable to occur, then any question of intervention probably becomes almost superfluous.

Selecting the response

This step is dependent on the accuracy and completeness of having defined the hazard. The first question to be asked is whether there is any realistic, viable action that the government can take to correct or ameliorate the situation. If the answer is no, or if the costs of any action are likely to outweigh the benefits, then serious consideration should be given to not taking any action at all. An explanation must be given as to what actions were considered, why they are impractical and the consequence (if any) of no action being taken.

Monitor the situation and review the effectiveness of the response

Whether the selected response is no action, introduction of a tax or subsidy, or a voluntary code of practice or a mandatory regulation, it is essential that both the situation and the effectiveness of the response be closely monitored. Monitoring will determine whether:

- the risk was under- or over-estimated and the response is adequate in the circumstances;
- the risk has changed and the response no longer applies to new circumstances; and
- those at which the action was directed are responding.

The monitoring and assessment process requires determination of:

- whether the risk has been eliminated. In which case, can the response be removed altogether or should it be retained in place to prevent a recurrence of the risk?
- whether the risk has been reduced but not eliminated. It may be unrealistic to expect complete elimination of the risk to occur. In that case, what level of reduction in the risk leaves a situation which, while not necessarily ideal, is acceptable? and
- how much longer the response should be left in place. If any reduction in the level of risk is not sufficient to justify considering the situation to be acceptable, how much longer should the response stay in place to reach an acceptable level of reduction?

APPENDIX C: COST-BENEFIT ANALYSIS

What is cost-benefit analysis; and how and where can it be used?

Cost-benefit analysis (CBA) is an analytical tool that can be used to measure the economic and social impact of government action by reference to the 'net social benefits' that action might produce. As such, it can be a valuable aid to decision making. Its power as an analytical tool rests in two main features:

- costs and benefits are each as far as possible and appropriate expressed in money terms and hence are directly comparable with one another; and
- costs and benefits are valued in terms of the economy and society as a whole, so the perspective is 'global'. This contrasts with, for example, a financial evaluation, which is conducted from the vantage point of an individual, a firm, an organisation or group.

Cost-benefit analysis can be employed to decide:

- whether a regulatory proposal should be undertaken;
- if an existing regulation should be maintained; or
- between alternative regulatory proposals (usually aimed at similar objectives).

Decisions about the overall effectiveness of regulatory action should not be made on the basis only of its effect on particular groups in society. Public policy makers are expected to make judgments based on what is best for the community as a whole. By measuring 'social', as opposed to only private, market-based costs and benefits, CBA is a valuable tool when developing good policy responses to economic and social problems. When undertaking CBA as part of the evaluation of the regulatory action being considered, TTMRA Principles should be adequately considered.

The term 'net social benefits' refers to the difference between social benefits and social costs. According to the cost-benefit rule, government action is only justified where, subject to budget constraints, there are positive net social benefits expected to be gained from intervention, such as imposing regulations on the community. Benefits and costs are 'social' rather than private or individual, in the sense that they are measured irrespective of the people to whom they accrue and are not confined to formal market transactions. If there are non-market implications from regulatory activities or market prices are distorted, CBA proceeds as if the correct market prices existed. These are referred to as shadow prices.

Inevitably, some costs and benefits resist the assignment of dollar values. Known as 'intangibles', these are separately presented to decision-makers for assessment in conjunction with those that can be quantified.

A major advantage of CBA is that costs and benefits occurring at different points in time can be explicitly compared. The 'factoring down' of benefits and costs that will occur in the future into present values is known as 'discounting'. Since a dollar in the future is usually worth less than a dollar today, future costs and benefits need to be discounted to their equivalent 'present value'. Conversely, in a retrospective analysis, past costs and benefits are compounded forward to their present value.

Under the net present value rule, a regulatory activity should only be undertaken if its net present value (that is, benefits minus costs) is positive. Accordingly, CBA is a valuable tool for decision makers when assessing the issue of whether a particular proposal is appropriate. If comparing a number of options, the alternative with the highest positive net present value would be preferred.

CBA can provide guidance on the implications of regulatory activity, where there are grounds for mistrusting the signals provided by market prices or where no markets exist. CBA is also helpful where regulations impose 'spillover' costs or benefits on third parties. Often these do not receive due recognition because no formal market transactions take place. Through the use of shadow prices, values can be placed on non-market 'spillover' effects (for example, pollution, safety) and compared with market transactions.

Examples where the signals that market prices normally provide are either absent or fail to reflect the true costs of regulatory action arise when valuing:

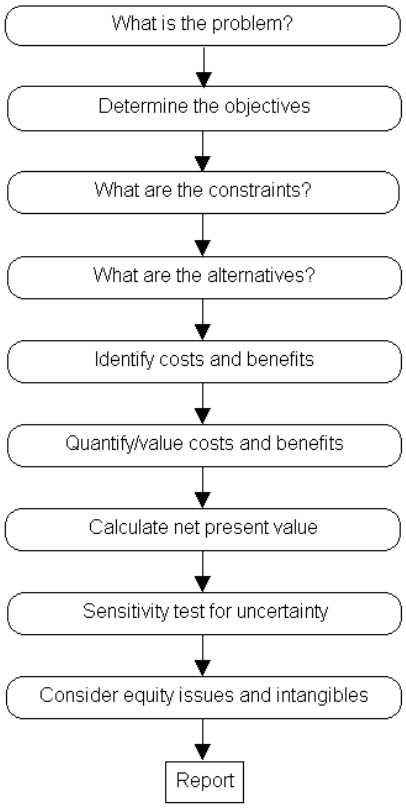
- intermediate goods - such as savings in travel time resulting from transport regulations;
- 'externalities' - or unmarketed positive or negative spillover effects such as arise from pollution, vaccination programs or banning a dangerous product;
- goods affected by taxes and subsidies; and
- labour in the presence of unemployment.

The main practical constraint to using CBA is the feasibility and appropriateness of assigning money values to the costs and benefits generated by government action. In circumstances where these constraints are overwhelming, cost-effectiveness analysis is frequently a viable alternative approach.

The key steps in the CBA process

There is a logical sequence of steps to take when undertaking a cost-benefit analysis prior to deciding on a standard or regulation. A diagram of the steps outlined below is shown in Figure 1.

Figure 1: Key steps in the cost-benefit process



1. *What is the problem?*

The first step entails an investigation and assessment of the problem, its context and its background. A proposal to intervene with regulation or standard will be based on an assessment that the status quo is undesirable. That assessment needs to be described to define the problem. This is an opportunity to place the proposal for intervention in its broader context, before narrowing the focus to its specific details.

2. *What are the objectives?*

This step includes a definition of the objectives to be achieved and who the intended beneficiaries are.

3. *What are the constraints?*

Public policy makers face various constraints on government action. Examples of such constraints are:

- financial - for example, budgetary limitations and price ceilings;
- distributional - for example, a perverse distribution of benefits among individuals or groups (for example, from the less well off to the wealthy);
- managerial - for example, limits on the staff;
- environmental - for example, compliance with environmental protection requirements; and
- policy - for example, is the proposal consistent with broad government policy?

Before options are identified for further consideration, any practical constraints on the feasibility of such alternative options should be examined and documented in the RIS. In some cases the nature and extent of these constraints may be unclear or difficult to measure. In which case, any uncertainties and risks should also be acknowledged and documented in the RIS.

When analysing all alternatives consideration should be given to the principles contained in the Competition Principles Agreement of 11 April 1995, in particular clause 1 (3), which includes reference to consideration of the environmental, social and economic aspects.

4. *What are the alternatives?*

While each alternative to the proposal for intervention that is identified will require a considerable amount of subsequent analysis if it is to be fully incorporated into a CBA, the number of alternatives generated should be sufficient to provide the decision-makers with real scope for exercising choice. To facilitate this, alternatives should be clearly distinguished.

Furthermore, a 'do nothing' alternative should always be identified, implicitly if not explicitly. This will be the base case against which alternatives can be compared. Then costs and benefits would be incremental to what would have happened in the absence of regulatory action.

5. *What are the benefits?*

A list of the benefits that are expected to flow from the proposals should be drawn up. To identify benefits (and costs), a clear account of the chain of causation from the proposal is needed. This should be available from the policy analysis undertaken in formulating the proposal. The list of benefits might include such items as:

- an increase in the value of economic output as a result of a particular action;
- avoided costs - costs which would have been incurred in the 'do nothing' situation;

- productivity savings – that is, producing more with less; and
- health, environmental and other social benefits, which are often not marketed or are characterised by prices which reflect less than the full value of the benefits.

6. *What are the costs?*

Similarly, for each alternative a list of costs should be drawn up. Examples of costs are:

- increases in expenditure by governments to establish and/or maintain regulation and enforcement regimes;
- increased costs on business and the broader community from higher input costs and regulatory compliance costs. A RIS should provide quantitative data on regulatory compliance costs, including information about the number and type of businesses or individuals affected, and the likely financial (and other) impacts on those affected. Compliance costs can include additional paper burden costs, additional staffing, licence fees or charges, external advice, transport and/or restrictions on competition. RIS should also give full consideration to ways of minimising such costs. Where quantitative data about such costs are unavailable, a qualitative assessment should be provided;
- increased costs on consumers from higher prices for goods and services; and
- externalities or spillover effects on other parties, both positive and negative. For example, environmental costs such as air, water and noise pollution.

Particular attention should be given to the likely impacts on small business, especially where regulatory compliance costs could have a disproportionate impact on small business.

7. *How can costs and benefits be quantified?*

Cost-benefit analysis compares costs and benefits using a common measure, usually dollars. Therefore, dollar values must be assigned to as many of the costs and benefits as possible. Market prices, where they exist, provide a great deal of information concerning the magnitude of costs and benefits. However, actual prices sometimes have to be adjusted to convert private costs and benefits into social ones, that is, costs and benefits which reflect gains and losses to the economy as a whole, rather than to individuals or groups.

8. *How should net present value be assessed?*

The values assigned to costs and benefits should be based on an explicit assumption about price inflation; normally, costs and benefits will be valued in real terms with the base being that of the current year. Total costs in each year of the project's life are subtracted from total benefits in that year to yield net benefits in each year. Annual net benefits are then discounted back to today's dollars. The stream of discounted net benefits is then summed to yield the net present value.

Subject to a consideration of budget constraints, intangibles and distributional issues, a CBA will support a proposal if the net present value is equal to or greater than zero. Similarly, if there are a number of ways of achieving the desired outcome, a CBA will support the alternative with the highest net present value, where that is equal to or greater than zero.

9. *How should uncertainty be dealt with?*

The values included in a CBA are the 'most likely' or 'best' estimates. Sensitivity analysis is a simple procedure for providing the decision-maker with information about the impact of estimation errors on the viability of the proposal. The first step in a sensitivity analysis is to substitute the most pessimistic estimates for each variable simultaneously, and see how much the net present value is affected. If the result is still greater or equal to zero, then we are able to say that even under worst case assumptions, the CBA supports the proposal.

The second step is to try to assess how risky the proposal is, that is, which variables significantly affect the net present value and which do not. This can be established by varying each variable one at a time, holding all other variables unchanged.

10. *How should the report be structured?*

The final step in the cost-benefit process is the writing-up of the analysis, which includes the recommendation to the decision-maker. The report should include:

- a summary of the results of the analysis;
- an introduction describing the considerations which led to the decision to undertake a CBA;
- a statement of the 'problem' the proposal is designed to redress;
- the objectives of the regulatory proposal;
- a description of the alternatives considered;
- the constraints considered in conducting the analysis and the alternatives selected;
- the time profiles of costs, benefits and net benefits, together with information on the sensitivity of those profiles to alternative assumptions;
- information on intangible costs and benefits;
- a list of assumptions made in performing the analysis, and information on how benefits and costs were estimated;
- a description of distributional effects;
- a conclusion discussing the results of the analysis; and
- an outline of an evaluation mechanism.

To what level or depth should the analysis be conducted?

The steps outlined are recommended for every CBA. However, obtaining and analysing information also incurs costs. Hence, there are important choices to make regarding the level or depth to which the analysis is conducted. The more significant a proposal and the greater the likely economic and social implications, the more expenditure on a CBA can be justified. The viability of smaller proposals can be threatened by investing too much in analysis. This possibility should set obvious limits on the level and depth of the analysis required.

The likely benefits of obtaining and analysing additional information should always exceed the costs of so doing. Better information often reduces the uncertainty surrounding estimates, however, if a proposal is already known to be clearly viable or unviable, the pay-off from obtaining extra information may be negligible. Detail and complexity are not the same as rigour - which is ultimately more important. An elaborate and detailed analysis of a problem that has been wrongly conceptualised may well be worthless.

But a 'back of the envelope' analysis of a problem that has been thought through correctly will, at the very least, be a helpful first step.

Letting decision-makers decide

Distributional implications can be obscured by the aggregating character of the cost-benefit process. Analyses should include all the information available to ensure that decision-makers are aware both of the identity of the groups likely to gain and to lose as a result of government action, and of the nature and size of the gains and losses. This information should be carefully presented, most usefully in the form of a distributional incidence chart or matrix.

Distributional judgements are properly made at the political level. In the interests of avoiding subjective bias, analysts should, by and large, refrain from attaching distributional weights to cost and benefit streams. Exceptions might be where there are unambiguous government policy objectives to assist specific groups in the community, and where the justification for special assistance to these groups relative to other groups is clearly established. However, for reasons of transparency, decision-makers and the public should be made fully aware of the costs of government action aimed at benefiting particular individuals or groups in the community.

APPENDIX D: BUSINESS COMPLIANCE COSTS

Consideration should be given to the compliance burden imposed on business. These are the additional (incremental) costs incurred by businesses when complying with the regulations.

One option for making initial assessments of the likelihood a proposal will involve compliance costs for business is through the use of the Business Cost Calculator's *Quickscan* function. This tool is located on the OBPR website at www.obpr.gov.au/businesscostcalculator/index.html

As part of a regulatory impact assessment, a practical approach for considering the impacts on business compliance costs potentially flowing from regulatory proposals is through consideration of the set of threshold questions in the checklist below.

Business Compliance Cost Checklist

As part of a regulatory impact assessment, a practical approach for considering the impacts on business compliance costs potentially flowing from regulatory proposals is through a set of threshold questions (a compliance cost checklist).

Would the regulatory proposal involve one of the following compliance tasks?

Notification

Will businesses incur costs when they are required to report certain events?

- For example, businesses may be required to notify a public authority before they are permitted to sell food.

Education

Will costs be incurred by business in keeping abreast of regulatory requirements?

- For example, businesses may be required to obtain the details of new legislation and communicate the new requirements to staff.

Permission

Are costs incurred in seeking permission to conduct an activity?

- For example, businesses may be required to conduct a police check before legally being able to employ staff.

Purchase cost

Are businesses required to purchase materials or equipment?

- For example, businesses may be required to have a fire extinguisher on site.

Record keeping

Are businesses required to keep records up-to-date?

- For example, businesses may be required to keep records of accidents that occur at the workplace.

Business Compliance Cost Checklist

Enforcement

Will businesses incur costs when cooperating with audits or inspections?

- For example, businesses may have to bear the costs of supervising government inspectors on site during checks of compliance with non-smoking laws.

Publication and documentation

Will businesses incur costs when producing documents for third parties?

- For example, businesses may be required to display warning signs around dangerous equipment or to display a sign at the entrance to home-based business premises.

Procedural

Will businesses incur costs that are of a non-administrative nature?

- For example, businesses may be required to conduct a fire safety drill several times a year.

Other

Are there any other business compliance costs associated with the regulatory proposal?

APPENDIX E: COMPETITION EFFECTS

When considering regulatory options Ministerial Councils will need to consider what the impact is of the proposed regulatory measure on competition, including the introduction of new processes and techniques.

A preliminary analysis of where a proposal may restrict competition can be conducted by working through the questions in the competition checklist below. Where this preliminary analysis indicates there will be an impact on competition, then a competition assessment should be undertaken as part of the RIS.

Competition Assessment Checklist

As part of a regulatory impact assessment, a practical approach for considering the impacts on business and individuals and on competition potentially flowing from regulatory proposals is through a set of threshold questions (a competition checklist) followed by, where appropriate, a competition assessment.

The competition assessment checklist is made up of the following threshold questions. (Some examples are provided.)

Would the regulatory proposal affect the number and range of suppliers?

- Grant exclusive rights for a supplier to provide a good or service?
- Establish a licence, permit or authorisation process as a requirement of operation?
- Affect the ability of some types of firms to participate in public procurement?
- Significantly alter costs of entry or exit to a supplier?
- Create a geographic barrier to the ability of businesses to supply goods or services, invest capital or supply labour?

Would the regulatory proposal change the ability of suppliers to compete?

- Control or substantially influence the price at which a good or service is sold?
- Alter the ability of suppliers to advertise or market their products?
- Set standards for product/service quality that are significantly different from current practice?
- Significantly alter costs of some suppliers relative to others?

Would the regulatory proposal alter suppliers' incentives to compete vigorously?

- Create a self-regulatory or co-regulatory regime?
- Impact on the mobility of customers between suppliers?
- Require/encourage the publishing of information on company outputs/price, sales/cost?
- Exempt an activity from general competition law?

If the answer to any of these questions is 'yes', then further analysis may be required and you should contact the OBPR. (There may be other impacts on business and individuals which are not covered in the checklist. In such cases you should consult with the OBPR.)

APPENDIX F: CONSULTATION GUIDELINES

Consistent with the principle for good regulatory process that effective consultation with affected key stakeholders should occur at all stages of the regulatory cycle, In February 2006, COAG committed to improving mechanisms for consultation with business and supporting appropriate consultation with all relevant stakeholders.

Consultation ensures that both the regulator and the regulated have a good understanding of the problem, alternative options to address it, possible administrative and compliance mechanisms and associated benefits, costs and risks.

Lack of consultation can lead to regulation that is inappropriate to the circumstances, costly to comply with and poorly adhered to.

Seven principles for best practice consultation are outlined below:

Continuity — Consultation should be a continuous process that starts early in the policy development process.

Targeting — Consultation should be widely based to ensure it captures the diversity of stakeholders affected by the proposed changes. This includes Commonwealth, State, Territory and local governments, as appropriate.

Appropriate timeliness — Consultation should start when policy objectives and options are being identified. Throughout the consultation process stakeholders should be given sufficient time to provide considered responses.

Accessibility — Stakeholder groups should be informed of proposed consultation, and be provided with information about proposals, via a range of means appropriate to those groups.

Transparency — Ministerial Councils need to explain clearly the objectives of the consultation process, the regulation policy framework within which consultations will take place and provide feedback on how they have taken consultation responses into consideration.

Consistency and flexibility — Consistent consultation procedures can make it easier for stakeholders to participate. However, this must be balanced with the need for consultation arrangements to be designed to suit the circumstances of the particular proposal under consideration.

Evaluation and review — Policy agencies should evaluate consultation processes and continue to examine ways of making them more effective.

Various consultation mechanisms can be used that are consistent with these principles such as annual regulatory plans, business consultation portals and the use of policy ‘green papers’ and exposure drafts for matters of major significance.

These consultation Guidelines are to be applied to all major initiatives and cover all aspects of developing regulation: from the policy proposals/‘ideas’ stage through to post-implementation reviews. The nature and extent of consultation should be commensurate with the potential magnitude of the problem and impact of proposed regulatory and non-regulatory solutions.

DRAFT STANDARD FOR CONSTRUCTION OF BUILDINGS IN FLOOD HAZARD AREAS

VERSION 7

OCTOBER 2011

ABCB Important Disclaimer

While the Australian Building Codes Board (ABCB)[1] , the participating Governments and other groups or individuals who have endorsed or been involved in the development of the Standard, have made every effort to ensure the information contained in this Standard is accurate and up to date, such information does in no way constitute the provision of professional advice.

The ABCB gives no warranty or guarantee and accepts no legal liability whatsoever arising from or connected to, the accuracy, reliability, currency or completeness of any material contained in this Standard.

Users should seek appropriate independent professional advice prior to relying on, or entering into any commitment based on material in this Standard in relation to building or related activities. Its interpretation in no way overrides the approvals processes in any jurisdiction.

[1] The Australian Building Codes Board (ABCB) is a joint initiative of all three levels of government in Australia and includes representatives from the building and construction industry, and the plumbing industry. The mission of the ABCB is to address issues relating to safety and health, and amenity and sustainability in the design and performance of buildings through the National Construction Code (NCC) Series, and the development of effective regulatory systems and appropriate non-regulatory solutions. This is set out in an inter-government agreement between the Commonwealth, States and Territories.

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Preface

Currently, the National Construction Code (NCC) does not contain detailed construction practice for buildings *in flood hazard areas*. However, although not targeted at technical solutions for building *in flood hazard areas*, the NCC does contain performance provisions requiring all buildings to perform adequately under all reasonably expected design actions, withstand extreme or frequently repeated design actions, and specifically, to resist the action of liquids, ground water and rainwater ponding. The performance requirements with respect to surface water are designed to ensure that if the ponding of surface water occurs then drainage and disposal of surface water must be conveyed to an appropriate outfall and avoid water damaging or entering a building.

In recognition of the absence of technical standards relating to flooding within the NCC, the Australian Government and State and Territory Government Building Ministers responsible for building regulatory matters decided the ABCB should develop a standard for the design and construction of certain new buildings *in flood hazard areas* (the Standard). The Standard aims to reduce the risk of death or injury of building occupants as a result of buildings subjected to certain flood events. It is anticipated that subject to regulation impact in accordance with the Council of Australian Governments (COAG) Best Practice Regulation Guide and ABCB Board approval, the Standard would be referenced in the NCC Volumes One and Two in 2013.

It must also be emphasised that the Standard is not a stand-alone solution to mitigating life safety risk due to flooding. Reducing life safety risk due to flooding requires a comprehensive set of measures that consider flood hazard and function and aim to reduce risk to a manageable level. This may be achieved by limiting development within both hazardous areas and areas (such as floodways) where it may impact on flood behaviour for other developments. Within areas allowable for development, development controls or protection works may be used to reduce risk. This requires a suite of measures which generally involve a combination of effective land use planning considering flood hazard, flood mitigation measures, flood warning and emergency response strategies for flooding, and building standards. The balance of these measures will vary from new development areas to infill or redevelopment areas. Sufficient awareness of the flood risk and the safety measures required by the occupants and those assisting them during a flood emergency are essential pre-requisites.

Therefore, with the application of this Standard within *flood hazard areas*, in the absence of supporting measures, it is not possible to guarantee that a building constructed in accordance with the Standard will eliminate the risk of serious injury or fatality even in the *defined flood event.*

In addition, larger floods than the *defined flood event* (*DFE*) can occur and even floods of the scale of the *DFE* can vary in behaviour and could exceed the design parameters and limitations of this Standard. Availability of assistance from emergency services or other avenues are important considerations not treated in this Standard.

Acknowledgements

The ABCB acknowledges the contribution of members of an expert Reference Group that assisted the development of the Standard.

The following organisations were represented on the Reference Group –

- Australian Government Attorney-General's Department
- Brisbane City Council
- Bureau of Meteorology
- Geoscience Australia
- Gold Coast City Council
- Hawkesbury City Council
- Housing Industry Association
- Insurance Australia Group
- Master Builders Australia
- NSW Department of Planning and Infrastructure
- NSW Office of Environment and Heritage
- Queensland Department of Local Government and Planning
- Risk Frontiers
- Tasmania Department of Justice

Table of Contents

1 Scope and General

1.1 General

The National Construction Code (NCC) is an initiative of the Council of Australian Governments (COAG) developed to incorporate all on-site construction requirements into a single code. The NCC comprises the Building Code of Australia (BCA), Volume One and Two; and the Plumbing Code of Australia (PCA), as Volume Three.

The BCA is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government and each State and Territory Government.

The BCA is a uniform set of technical provisions for the design and construction of buildings and other structures throughout Australia whilst allowing for variations in climate and geological or geographic conditions.

The BCA contains requirements to ensure new buildings and structures, and subject to State and Territory legislation alterations and additions to existing buildings, located in *flood hazard areas* do not collapse during a flood when subjected to flood actions resulting from the *defined flood event*.

The Standard provides additional requirements for buildings *in flood hazard areas* consistent with the objectives of the BCA which primarily aim to protect the lives of occupants of those buildings in events up to and including the *defined flood event*. *Flood hazard areas* are identified by the relevant State/Territory or Local Government *authority having jurisdiction*.

Section 2 of the Standard contains basic design requirements including a fundamental Performance Requirement that describes the level of performance required for the construction of buildings *in flood hazard areas*.

Section 2 also contains Deemed-to-Satisfy design criteria for the design of buildings *in flood hazard areas*. These provisions only apply if certain limits such as maximum flow velocity and depth of submersion, are not exceeded. This does not mean that buildings cannot be constructed if they fall outside these limits if if it is permissible under a planning scheme or planning instrument to do so. It means that such a proposal would need to be considered as an Alternative Solution under the relevant Performance Requirements and must be assessed accordingly.

The Standard also does not contain provisions that specify particular materials or design solutions which comply with the Performance Requirement. Therefore, in all instances, designers are required to use professional judgment in order to develop designs intended to comply with the Performance Requirement.

It must also be emphasised that the Standard is not a stand-alone solution to mitigating life safety risk due to flooding. Mitigating risk to life in flooding requires a comprehensive set of measures that consider flood hazard and aim to reduce residual flood risk to a manageable level. This set of measures generally involves a combination of effective land use planning considering flood hazard, flood mitigation measures, emergency response strategies for flooding, and building standards.

Therefore, with application of this standard within *flood hazard areas*, in the absence of supporting measures, it is not possible to guarantee that a building constructed in accordance with the Standard will eliminate the risk of serious injury or fatality even in the *defined flood event*.

In addition, larger floods than the *defined flood event* can occur and even floods of the scale of the *defined flood event* can be unpredictable and could exceed the design parameters and limitations in this Standard. Also, assistance from emergency services or other avenues may not be available to individual properties.

It is important to understand that flood is a local hazard whose parameters, including depth and velocity, vary significantly within the flood hazard area. Modelling of flood hazard generally provides information on average velocities across an area for an event rather than velocities at all points across a location. It is possible to have strong local flow velocities not being shown by such modelling.

In addition, there are significant variations in the information available on flooding between areas within a local authority and between local authorities within Australia. This may result from the age of studies, the type of modelling undertaken, the information available to understand flood behaviour, or the reliance of historical flood information or estimates used to provide an understanding of flood risk. This will mean that the information available is not uniform.

Flood investigations may have also resulted in mitigation works which may alter flood behaviour. These are local by nature and their benefits would generally be considered in studies on flooding for the area and considered by the local authority in determining the flood hazard area.

Existing development in more active flow areas, including floodways, is more likely to be subjected to higher velocities of flow than provided for in the Standard and is also more likely to impact upon flood behaviour elsewhere. Any additional development or redevelopment in these areas is also likely to be exposed to more hazardous conditions and therefore would require careful consideration and assessment. Also note that the flow velocities could also be expected to exceed those specified in this Standard in many areas subject to local overland flooding.

The local authority may need to rely upon its own judgement upon where the Standard applies or request specific information from the proponent. This may limit the application of the Standard by the local authority to *backwater and inactive flow areas* in the *DFE* where it is less likely the velocity nominated in the Standard would be exceeded.

In many cases detailed information on the depth of inundation at the development in question will rely upon the provision of survey advice from the proponent relative to flood level information determined in the *DFE*.

In some cases the local authority may require the proponent to engage a suitably qualified professional to determine the *DFE* and/or to gain a more detailed understanding of flood behaviour at the location. This may include ascertaining the specific design criteria necessary to enable consideration of the development in relation to the Standard and meeting other requirements established by the local authority.

1.2 Scope

The Standard specifies requirements for flood-resistant design and construction of buildings that are subject to the BCA requirements and that are located, in whole or in part, in *flood hazard areas*.

The ABCB has also prepared an Information Handbook which provides additional information relating to the construction of buildings in *flood hazard areas*. The Handbook is available on the ABCB website www.abcb.gov.au.

1.3 Application

1.3.1 Identification of applicable *flood hazard areas*

A *flood hazard area* is an area subject to flooding during the *defined flood event* (*DFE*) as determined by the *authority having jurisdiction*, or where this information is not available, by the proponent in accordance with standards set, or referred to, by the *authority having jurisdiction*.

This Standard does not apply to parts of *flood hazard areas* with the following characteristics:

(a) The part of the *flood hazard areas* is subject to mudslide or landslide during periods of rainfall and runoff.

(b) The part of the *flood hazard areas* is subject to storm surge or coastal wave action.

1.3.2 Identification of applicable buildings

This Standard only applies to new Class 1, 2, 3, 9a health care and 9c buildings and Class 4 parts of buildings and, subject to State and Territory legislation, alterations and additions to existing buildings of these classifications.

1.4 Limitations

The Standard is not intended to –

(a) override or replace any legal rights, responsibilities or requirements; or

(b) override any land use planning controls imposed by the *authority having jurisdiction*; or

(c) address administrative requirements for construction of buildings *in flood hazard areas*.

1.5 Normative References

The following documents are referred to in this Standard:

(a) AS/NZS 1170.0.

(b) AS/NZS 1170.1.

(c) AS/NZS 1170.2.

1.6 Units

Except where specifically noted, this Standard uses the SI units of kilograms, metres, seconds, Pascals and Newtons (kg, m, s, Pa, N).

1.7 Definitions

Defined terms used within the text of the Standard are printed in italics. For the purposes of the Standard the following definitions apply:

Authority having jurisdiction: The relevant State, Territory, or Local Government agency with the statutory responsibility to determine the particular matter.

Defined flood level (DFL): the flood level associated with a *defined flood event (DFE)* relative to a specified datum. The *DFL* plus the *freeboard* determines the extent of the *flood hazard area*.

Defined flood event (DFE): the flood event selected for the management of flood hazard for the location of specific development as determined by the *authority having jurisdiction*.

Finished floor level**:** the uppermost surface of the finished floor, not including any floor covering such as carpet, tiles and the like.

Flood hazard area: the area (whether or not mapped) encompassing land lower than the *flood hazard level* which has been determined by the *authority having jurisdiction.* The area relates to that part of the allotment on which a building stands or is to be erected.

Flood hazard level (FHL)*:* the flood level used to determine the height of floors in a building and represents the *defined flood level* (*DFL)* plus the *freeboard*.

Freeboard: the height above the *defined flood level* (*DFL)* as determined by the *authority having jurisdiction*, typically used to compensate for effects such as wave action and localised hydraulic behaviour.

Habitable room: a room used for normal domestic activities, and-

(a) includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom; but

(b) excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes-drying room, vehicle parking area, storage area and other spaces of a specialised nature occupied neither frequently nor for extended periods.

Hydrodynamic action: the action caused by a fluid in motion.

Hydrostatic action: the pressure exerted by a fluid at equilibrium due to the force of gravity.

Inactive flow or backwater area: the part of the *flood hazard area* where the maximum flow velocity is not greater than 1.5m/s. The area does not include areas within or directly adjacent to a river, stream or floodway, where the maximum flow velocity is likely to exceed 1.5m/s.

Wet flood proofing: includes permanent or contingent measures applied to a building that prevent or provide resistance to damage from flooding while allowing floodwaters to enter and leave the building.

1.8 Notation

The following letters and symbols have the following meanings:

G permanent action (dead load) (AS/NZS1170.1

Q imposed action (live load) (AS/NZS 1170.1)

F_l flood action, resulting from the *DFE*

W_u ultimate wind action (AS/NZS 1170.2)

Ψ_c combination factor for imposed action (AS/NZS 1170.0)

D_e equivalent surcharge depth in metres

C shape factor

V velocity of moving water in m/s

g gravitational acceleration in m/s^2

Pa Pascal

N Newton

m metre

s second

kg kilogram

1.9 Performance-Based Standards

The Standard is presented as a performance-based document. Buildings to be constructed in *flood hazard areas* must be designed to comply with the Performance Requirement in Clause 2.3. The Performance Requirement lists various provisions that must be met during the design process.

The Performance Requirement enables the design of a building to be constructed in *flood hazard areas* to be developed from first principles to maximise its potential to meet specific client needs for a specific site.

1.10 Design Pathways

The Standard provides two pathways for compliance as follows:

(a) Formulating an Alternative Solution which complies with the Performance Requirement. This involves the application of engineering practice from first principles in combination with appropriate design considerations as an alternative to the requirements of Clauses 2.4 to 2.13. An alternative solution requires designers to apply professional judgment on all design issues.

(b) Compliance with the Deemed-to-Satisfy Provisions.

2 Basic Design Requirements

2.1 Objective

The objective of the Standard is, in the event of a flood, to -

(a) safeguard people from injury caused by structural failure; and

(b) safeguard people from loss of amenity caused by structural behaviour; and

(c) safeguard people from illness or injury caused by utility failure; and

(d) protect other property from physical damage caused by structural failure.

2.2 Functional Statement

A building is to withstand the combination of loads and other actions to which it may be reasonably subjected during a flood event.

2.3 Performance Requirement

(a) A building in a *flood hazard area*, to the degree necessary, must be designed, constructed, connected and anchored to resist flotation, collapse or significant permanent movement resulting from the action of hydrostatic, hydrodynamic, erosion and scour, wind and other actions during the *DFE* or lesser event in accordance with the requirements of this Standard.

(b) The actions and requirements to be considered to satisfy (a) include but are not limited to-

(A) flood actions; and
(B) elevation requirements; and
(C) foundation requirements; and
(D) requirements for enclosures below the *flood hazard level*; and
(E) requirements for structural connections; and
(F) material requirements; and
(G) flood proofing; and
(H) requirements for utilities; and
(I) requirements for egress; and
(J) impacts to other structures and properties.

Limitations:

Clause 2.3 only applies to-

(a) Class 1, 2, 3, 9a health care and 9c buildings, and Class 4 parts of buildings; and

(b) areas that are not subject to landslip, mudslide, storm surge or coastal wave action.

2.4 Deemed-to-Satisfy Provisions

Where a building solution is proposed to comply with the Deemed-to-Satisfy Provisions, Performance Requirement 2.3 is satisfied by complying with Clauses 2.5 to 2.13.

2.5 Application

(a) The Deemed-to-Satisfy Provisions only apply to *flood hazard areas* where the maximum flow velocity is not greater than 1.5 m/s.

(b) Where the *authority having jurisdiction* is not able to determine whether the maximum flow velocity is not greater than 1.5 m/s, the Deemed-to-Satisfy Provisions of this Standard can only apply to *inactive flow or backwater areas*.

2.6 Flood Actions

2.6.1 General

(a) Values of flood actions for use in design must be established that are appropriate for the type of structure or structural element, its intended use and exposure to flood action.

(b) The flood actions must include, but not limited to, the followings as appropriate: *hydrostatic actions*, *hydrodynamic actions*, debris actions, wave actions, erosion and scour.

(c) The flood actions must be based on the *DFE*.

2.6.2 Hydrostatic Actions

(a) *Hydrostatic actions* caused by a depth of water to the level of the *DFL* must be applied to all surfaces, both above and below ground level.

(b) Reduced uplift and lateral actions on surfaces of enclosed spaces below the *DFL* must apply only if provisions are made for entry and exit of flood water.

2.6.3 Hydrodynamic Actions

(a) Dynamic effects of moving water must be determined by a detailed analysis based on the principles of fluid mechanics.

(b) Where water velocities do not exceed 1.5 m/s, the hydrodynamic actions can be approximated into equivalent hydrostatic actions by increasing the *DFL* by an equivalent surcharge depth D_e, equal to

$$D_e = (C\ V^2)/2g$$

Where

V = velocity of moving water in m/s

g = gravitational acceleration (9.8 m/s^2)

C = shape factor (1.25)

(c) This surcharge depth must be added to the *DFL* and applied to the vertical projected area of the building or structure that is perpendicular and upflow to the flow. Surfaces parallel to the flow or downflow will be subjected to the *DFL* hydrostatic pressures only.

2.6.4 Debris Actions

Where required, impact actions caused by objects transported by flood waters striking against buildings and structures must be determined using a rational approach as concentrated loads acting horizontally at the most critical location at or below the *DFL*.

2.6.5 Wave Actions

Where required, wave actions caused by water waves propagating over the water and striking a building or other structure must be determined using a rational approach. Wave actions include wash and wind generated waves but the Standard does not cover coastal waves.

2.6.6 Erosion and Scour

The effects of erosion and scour must be included in the calculation of actions on building foundations and other structures *in flood hazard areas*. The Standard does not cover coastal erosion.

2.6.7 Combinations of Actions

In addition to the combinations specified in AS/NZS 1170.0, the following combinations must be considered for structures located in a *flood hazard area*-

(a) $[1.2G, \psi_c Q, Y_F F_l]$; and

(b) [0.9G, 0.5W_u, $Y_F F_l$].

Where F_l represents the flood related actions for the *DFE*, including hydrostatic (including buoyancy), hydrodynamic, wave and debris actions as appropriate; and

Y_F is the flood load factor as given in Table 2.6.7.

Table 2.6.7

Defined Flood Event (DFE)	**Flood load factor Y_F**
DFE based on annual probability of exceedance of not more than-	
1:100	1.0
1:50	1.2
1:25	1.4
DFE based on maximum recorded flood with record length of not less than-	
100 years	1.1
50 years	1.3
25 years	1.5

2.7 Floor Height Requirements

Unless otherwise specified by the *authority having jurisdiction*-

(a) the *finished floor level* of *habitable rooms* must be above the *FHL;* and .

(b) the *finished floor level* of enclosed non-*habitable rooms* must be no more than 1.0 m below the *DFL*.

2.8 Footing System Requirements

2.8.1 General

The footing system of a structure must provide the required support to prevent flotation, collapse or significant permanent movement resulting from the flood actions specified in Section 2.6.

2.8.2 Geotechnical Considerations

The footing system design must account for instability and decrease in structural capacity associated with soil properties when wet, erosion and scour, liquefaction, and subsidence resulting from the flood actions specified in Section 2.6, depending on the geotechnical characteristics of the site.

2.8.3 Footing System Depth

The footing system depth must be adequate to provide the support required in 2.8.1 taking into account the geotechnical considerations of 2.8.2.

2.8.4 Piers, Posts, Columns or Piles

Piers, posts, columns and piles used to elevate buildings to the required elevation must take account of-

(a) the potential erosion action due to flood; and

(b) the potential debris actions.

2.8.5 Use of Fill

Fill providing support to the footing system must be designed to maintain that support under conditions of flooding, including rapid rise and draw-down of flood waters, prolonged inundation, erosion and scour, without exceeding the maximum design differential movement of the footing system as specified in AS 2870 as appropriate.

2.8.6 Use of Slabs

Slabs must comply with the following-

(a) the slab must be installed on fill in accordance with 2.8.5, or on undisturbed soil of adequate bearing capacity; and

(b) the slab must have adequate strength to resist the design actions even if the supporting soil under the slab is undermined by erosion; and

(c) the bottom of the slab edge (usually the edge beam or edge footing) must be at or below the depth of expected scour.

2.9 Requirements for Enclosures below the *Flood Hazard Level (FHL)*

Any enclosure below the *FHL* must have openings to allow for automatic entry and exit of floodwater for all floods up to the *FHL*.

2.10 Requirements for Structural Attachments

(a) Erosion control structures that are attached to the foundation or superstructure of the building must be structurally adequate and not reduce the structural capacity of the building during the *DFE*.

(b) Decks, patios, stairways, ramps and the like below the *FHL* that are attached to the building must be structurally adequate and not reduce the structural capacity of the building during the *DFE*.

2.11 Material Requirements

(a) Materials used for structural purposes and located below the *FHL* must be capable of resisting damage, deterioration, corrosion or decay taking into account the likely time the material would be in contact with flood water and the likely time it would take for the material to subsequently dry out.

(b) Materials used for structural purposes include loadbearing columns, bracing members, structural connections, fasteners, wall framing members and the like.

2.12 Requirements for Utilities

2.12.1 General

(a) Utilities and related equipments must not be placed below the *FHL* unless they have been designed specifically to cope with flood water inundation.

(b) Buried systems must be placed at a depth sufficient to prevent damage due to scour and erosion during the *DFE*.

(c) Exposed systems must be designed to withstand the flood related actions (buoyancy, flow, debris and wave) as appropriate.

2.12.2 Electrical

Unless the electrical supply authority determines otherwise-

(a) Electrical meters and switches must be placed above the *FHL* and made accessible during the *DFE*.

(b) Electrical conduits and cables installed below the *FHL* must be waterproofed or placed in waterproofed enclosures.

2.12.3 Plumbing and drainage

Plumbing and drainage openings below the *FHL* must be protected from backflow.

2.12.4 Mechanical and HVAC systems, tanks and the like

Ductwork, tanks, gas storage cylinders and the like shall be placed above the *FHL* or designed, constructed, installed and anchored to resist all flood-related actions and other actions during the *DFE* with appropriate load factors as given in 2.6.7. Potential buoyancy and other flood related actions on the empty tank during the *DFE* condition shall be considered.

2.13 Requirements for Egress

Egress from a balcony, verandah, deck, door, window or the like must be available to allow a person in the building to be rescued by emergency services personnel, if rescue during a flood event up to the *DFE* may be required.

2.14 Additional State or Territory requirements

State or Territory agencies may have a range of requirements for the location, construction and use of buildings to be constructed *in flood hazard areas*. It is also necessary to determine whether legislation requires –

(a) approval for construction; or

(b) conditions of approval: or

(c) limitations on use.

The ABCB Information Handbook presents an outline of requirements in each State and Territory.

3 References

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CONSTRUCTION OF BUILDINGS IN FLOOD HAZARD AREAS

INFORMATION HANDBOOK

VERSION 5

OCTOBER 2011

Australian Building Codes Board

Committee-in-Confidence

Important Notice and Disclaimer

The Australian Building Codes Board (ABCB) and the participating Governments are committed to enhancing the availability and dissemination of information relating to the built environment. Where appropriate, the ABCB seeks to develop non-regulatory solutions to building-related issues.

This Handbook on Construction of Buildings in Flood Hazard Areas (the Handbook) is provided for general information only and should not be taken as providing specific advice on any issue. In particular, this Handbook is not mandatory or regulatory in nature. Rather, it is designed to accompany the ABCB Standard for Construction of Buildings in Flood Hazard Areas and to assist in making information on this topic readily available.

However, neither the ABCB, the participating Governments, nor the groups which have endorsed or been involved in the development of the Handbook, accept any responsibility for the use of the information contained in the Handbook and make no guarantee or representation whatsoever that the information is an exhaustive treatment of the subject matters contained therein or is complete, accurate, up-to-date or reliable for any particular purpose.

The ABCB, the participating Governments and groups which have endorsed or been involved in the development of the Handbook expressly disclaim all liability for any loss, damage, injury or other consequence, howsoever caused (including without limitation by way of negligence) which may arise directly or indirectly from use of, or reliance on, this Handbook.

Users should exercise their own skill and care with respect to their use of this Handbook and should obtain appropriate independent professional advice on any specific issues concerning them.

In particular, and to avoid doubt, the use of this Handbook does not–

- guarantee acceptance or accreditation of a design, material or building solution by any entity authorised to do so under any law;
- mean that a design, material or building solution complies with the National Construction Code (NCC); or
- absolve the user from complying with any Local, State, Territory or Australian Government legal requirements.

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Preface

The Inter-Government Agreement (IGA) that governs the ABCB places a strong emphasis on reducing reliance on regulation, including consideration of non-regulatory alternatives such as non-mandatory guidelines, information handbooks and protocols.

This Information Handbook is one of a series produced by the ABCB. The series of Information Handbooks is being developed in response to comments and concerns expressed by government, industry and the community that relate to the built environment. The topics of Information Handbooks expand on areas of existing regulation or relate to topics which have, for a variety of reasons, been deemed inappropriate for regulation. The aim of the Information Handbooks is to provide construction industry participants with best practice, non-mandatory advice and guidance on specific topics.

Construction of Buildings in Flood Hazard Areas has been identified as an issue that requires consistent uniform guidance. The Construction of Buildings in Flood Hazard Areas Information Handbook has been developed to foster a greater understanding of provisions in the ABCB Standard for Construction of Buildings in Flood Hazard Areas and to provide additional advisory information outside the scope of the Standard. This Information Handbook addresses the issues in generic terms. It is expected that this Information Handbook will be used to develop solutions relevant to specific situations in accordance with the generic principles and criteria contained herein.

This Information Handbook should be read in conjunction with the ABCB Standard for Construction of Buildings in Flood Hazard Areas.

It must also be emphasised that the Handbook either independently or in combination with the Standard, does not provide a stand-alone solution to mitigating life safety risk due to flooding. Reducing life safety risk due to flooding requires a comprehensive set of measures that consider flood hazard and function and aim to reduce risk to a manageable level. This may be achieved by limiting development within both hazardous areas and areas (such as floodways) where it may impact on flood behaviour for other developments. Within areas allowable for development, development controls or protection works may be used to reduce risk. This requires a suite of measures which generally involve a combination of effective land use planning considering flood hazard, flood mitigation measures, flood warning and emergency response strategies for flooding, and building standards. The balance of these measures will vary from new development areas to infill or redevelopment areas.

Therefore, with application of this Handbook, whether independent from or in combination with the Standard within flood hazard areas, in the absence of supporting measures, it is not possible to guarantee that a building constructed in accordance with these requirements will eliminate the risk of serious injury or fatality even in the defined flood event (DFE).

In addition, larger floods than the DFE can and will occur and even floods of the scale of the DFE can be variable and could exceed the design parameters and limitations of the Standard. Availability of assistance from emergency services or other avenues are important considerations that are not treated in the Standard.

Acknowledgements

The ABCB acknowledges the valuable contributions of members of an expert Reference Group that assisted the development of the Information Handbook.

The following organisations were represented on the Reference Group –

- Australian Government Attorney-General's Department
- Brisbane City Council
- Bureau of Meteorology
- Geoscience Australia
- Gold Coast City Council
- Hawkesbury City Council
- Housing Industry Association
- Insurance Australia Group
- Master Builders Australia
- NSW Department of Planning and Infrastructure
- NSW Office of Environment and Heritage
- Queensland Department of Local Government and Planning
- Risk Frontiers
- Tasmania Department of Justice

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Introduction

Reminder:

This Handbook is not mandatory or regulatory in nature and compliance with it will not necessarily discharge a user's legal obligations. The Handbook should only be read and used subject to, and in conjunction with, the general disclaimer at page ii.

The Handbook also needs to be read in conjunction with the building legislation of the relevant State or Territory, and the ABCB Standard for Construction of Buildings in Flood Hazard Areas. It is written in generic terms and it is not intended that the content of the Handbook counteract or conflict with the legislative requirements, any references in legal documents, any handbooks issued by the Administration or any directives by the Building Control Authority.

Background

In Australia, floods cause more damage on an average annual basis than any other natural disaster. From 1967 to 1999, the total cost of floods has been estimated at $10.4 billion or 29% of the average proportional annual cost of natural disasters. In addition, during the same period, floods were responsible for 18% of fatalities caused by natural hazards[1].

Historically our towns developed on riverbanks to facilitate the shipping of goods to and from the settlements, and where fertile soil existed, but this also left them vulnerable to flooding.

Mitigating risk to life in flooding requires a comprehensive set of measures that consider flood hazard and aim to reduce residual flood risk to a manageable level. This set of measures generally involves a combination of effective land use planning considering flood hazard, flood mitigation measures, flood warning and emergency response strategies for flooding, and building standards.

At present, requirements for flood resistant design and construction in the National Construction Code (NCC) are limited to ensuring the building or structure does not collapse when subjected to flood actions. Flood risk is generally regulated by the authority having jurisdiction. This could be an individual local government which uses planning controls to restrict the location of buildings in flood hazard areas and in areas where development is permissible, have flood related development controls to limit the residual risk of flooding. Restrictions on location keep buildings away from areas where development may affect flood behaviour (including floodways), and away from the most hazardous areas (characterised by high velocities and/or

[1] Middelmann, M. H. (Editor) 2007, *Natural Hazards in Australia. Identifying Risk Analysis Requirements*, Geoscience Australia, Canberra, 2007.

depths). In the remaining areas where development is permissible building/development controls may include the requirement for the building or certain floors to be located above an established minimum flood level, such as the flood hazard level. The flood hazard level considers both the design flood level (DFL) from the DFE plus a freeboard to provide above floor areas with protection from the DFE considering uncertainty in the DFL and other phenomenon such as wind and wake waves and local hydraulic affects.

This Handbook has been prepared to accompany the ABCB Standard for Construction of Buildings in Flood Hazard Areas (the Standard). The Handbook provides commentary on the provisions in the Standard together with additional advisory information.

Therefore, with application of this Handbook to flood hazard areas whether independent from, or in combination with, the Standard and in the absence of supporting measures, it is not possible to guarantee that a building constructed in accordance with these requirements will eliminate the risk of serious injury or fatality even in the defined flood event (DFE).

In addition, larger floods than the DFE can and will occur and even floods of the scale of the DFE can be variable and could exceed the design parameters and limitations in the Standard. Availability of assistance from emergency services or other avenues are important considerations not treated in this Standard.

It is important to understand that flood is a local hazard whose parameters, including depth and velocity, vary significantly within the flood hazard area. Modelling of the DFE generally provides information on average velocities within an area at the peak of the flood for the DFE rather than velocities at a specific location. Velocities and depths will generally increase in larger floods.

In addition, there are significant variations in the information available on flooding between areas within a local authority and between local authorities within Australia. This may result from the age of studies, the type of modelling undertaken, the information available to understand flood behaviour, or the reliance on historical flood information or estimates to provide an understanding of flood risk.

Flood investigations may have also resulted in mitigation works which may alter flood behaviour. These are local by nature and their benefits would generally be considered in studies on flooding for the area and considered by the local authority in determining its flood hazard area.

In some cases the local authority may require the proponent to engage a suitably qualified professional to determine the defined flood event and/or to gain a more detailed understanding of flood behaviour at the location. This may include ascertaining the specific design criteria necessary for this standard and meeting other requirements established by the local authority.

In addition, flood behaviour can change with climate change, either due to sea level rise or due to potential increases in the intensity and frequency of flood producing rainfall events. In some cases this change will be significant, whilst in other cases it will be relatively minor. Sea level rise and increases in the intensity and frequency of flood producing rainfall events can alter flood flow velocities, water depths and levels in the design flood event (DFE). This could impact upon the flood hazard level (FHL) and therefore the flood hazard area and the minimum floor levels set for buildings and the locations within this area where development is allowable given the flood hazard and potential impacts upon other properties.

Managing changing flood risks due to climate change relies upon the same mechanisms currently used to manage flood risk. That is, it requires a combination of: effective land use planning considering changing flood hazard; flood mitigation measures that consider climate change impacts on flooding; emergency response strategies for flooding that are robust and can adapt for changes in flood behaviour; and building standards (such as minimum floor levels for new buildings) that can be adapted to allow for climate change over time.

The degree of these changes will vary with the location and the timeframe over which changes are managed and different jurisdictions and authorities may have different requirements. The relevant authority having jurisdiction can advise on how climate change impacts on flooding should be dealt with for the project in question.

Work has been undertaken both in Australia and overseas aimed at reducing the impacts of flooding on buildings through structural design and using compatible structural and non-structural building materials. However, as most of Australian works are local in character, most Australian building professionals are not familiar with the issue and there is no other national guidance on the subject.

Since the discussion of this issue may touch on planning, building and non-building topics, the development of a Handbook is seen as the most appropriate vehicle for approaching the subject. This approach also satisfies the Council of Australian Governments principles for best practice regulation.

Other Handbooks by the ABCB

The ABCB has produced a range of Information Handbooks and other educational material including:

- Information Handbook – Energy Efficiency Provisions for BCA 2010 Volume One.
- Information Handbook – Energy Efficiency Provisions for BCA 2010 Volume Two.
- Information Handbook – Applying Energy Efficiency Provisions To New Building Work Associated With Existing Class 2 To 9 Buildings.

- BCA Awareness Resource Kit – Module 3: Understanding Energy Efficiency Provisions for Class 1 and 10 Buildings.

- BCA Awareness Resource Kit – Module 4: Understanding Energy Efficiency Provisions for Class 2 to 9 Buildings.

COMMENTARY ON THE STANDARD 'CONSTRUCTION OF BUILDINGS IN FLOOD HAZARD AREAS'

1 SCOPE AND GENERAL

C1.1 General

The scope of the ABCB Standard on Construction of Buildings in Flood Hazard Areas (the Standard) is restricted to the current NCC objectives of health, safety, amenity and sustainability. Therefore the Standard primarily focuses on structural safety and life safety, rather than protection of property or building contents.

The current NCC does not contain detailed construction practice for buildings in flood hazard areas. However, although not targeted at flooding, the NCC does require buildings to have structural resistance to the action of liquids, ground water, and rainwater ponding by requiring compliance with Australian Standards for structural design. The aim of the Standard is to provide more specific requirements for construction in flood hazard areas

The construction measures contained in the Standard are not the only measures that should be considered to address issues arising for buildings in flood hazard areas. There are other measures that are outside the scope of the Standard. The scope of this Handbook extends further than the scope of the ABCB Standard and provides additional information on these issues.

The ABCB develops minimum technical standards relating to the structural and fire safety, health, amenity and sustainability for inclusion in the NCC. The NCC applies to all new building design and construction work and subject to State and Territory legislation alternations and additions to existing buildings. The NCC does not apply to existing buildings not undergoing work, and is adopted by every State and Territory.

The issue of whether new buildings can be constructed within part or any of the flood hazard area is a land use planning issue (in consideration of the flood risk) for the responsible authority, primarily local, State/Territory government. Current building and planning regulations in a number of States and Territories enable local governments to define flood hazard areas and determine the height, above ground or defined flood level, to which the floor levels of habitable rooms must be built.

It is important to note that flood events are likely to arise or there will be locations in which the limitations stated in the Standard will be exceeded. Therefore, communities and households must be aware that all houses may not be protected during a major flooding event because of a number of factors. These factors may include-

(a) the flood event exceeds the defined flood event; or

(b) the flood water velocity exceeds 1.5m/s; or

(c) the depth of submersion of the lowest non-habitable floor exceeds 1m; or

(d) the flood level is higher than habitable floor level; or

(e) loss of foundation material due to excessive scour, mudslide or landslip; or

(f) excessive debris impact loading.

C1.2 Scope

The requirements of the NCC are applicable to all buildings. The Standard only specifies additional requirements and is not a comprehensive list of requirements for buildings in flood areas.

The Standard is a performance-based document. Buildings to be constructed in flood hazard areas are required to comply with the Performance Requirement in clause 2.3. The Performance Requirement lists various 'heads of consideration' that must be considered during the design process.

The Performance Requirement enables the design of a building to be constructed in flood hazard areas to be developed from first principles to maximise its potential to meet specific client needs for a specific site.

The Standard provides two pathways for compliance. One pathway involves formulating an Alternative Solution which complies with the Performance Requirement. This involves the application of engineering practice from first principles and requires designers to apply professional judgment on all design issues.

The other pathway involves compliance with the Deemed-to-Satisfy Provisions. These provisions only apply if certain limits such as maximum flow velocity and depth of submersion are not exceeded. This does not mean that buildings cannot be constructed if they fall outside these limits. It means that such a proposal would need to be considered as an Alternative Solution under the relevant Performance Requirements and must be assessed accordingly.

The Alternative Solution pathway involves the application of engineering practice in combination with appropriate design consideration as an alternative to the requirements in Clauses 2.4 to 2.13.

C1.3 Application

C1.3.1 Identification of applicable flood-prone land

The term flood is used to describe the temporary condition of partial or complete inundation of normally dry land. The source of the flood could be the overflow of inland or tidal waters or the rapid accumulation of runoff or surface water from any source.

The identification of applicable flood hazard areas is a planning issue and State/Territory and/or local authorities should be consulted in this determination.

The DFE and DFL used by the authority having jurisdiction (usually the local authority) to manage flood risk to property is generally determined through land use planning in consideration of flood risk management. It is often associated with a 1% chance of a flood of that size being exceeded in any given year or an annual exceedance probability of 1 in 100. However, other flood events or information may be used by the local authority to manage flood risk to buildings or the particular flood situation at the location in question and in setting both the DFE and DFL.

There are significant variations in the information available on flooding between areas within a local authority and between local authorities within Australia. This may result from the age of studies, the type of modelling undertaken, the information available to understand flood behaviour, or the reliance of historical flood information or estimates to provide an understanding of flood risk.

Flood investigations may have also resulted in mitigation works which may alter flood behaviour. These are local by nature and their benefits would generally be considered in studies on flooding for the area and considered by the local authority in determining is flood hazard area.

In many cases information about flow velocities may not be known or may be limited. Modelling of the DFE may provide average velocities at the peak of flow within an area rather than peak velocities at a specific location. Therefore it is unlikely that the local authority will have specific information on flow velocities at a particular site in all cases.

Existing development in more active flow areas, including floodways, is more likely to be subjected to higher velocities of flow than permitted by the Deemed to Satisfy Provisions and is also more likely to impact upon flood behaviour elsewhere. Any additional development or redevelopment in these areas is also likely to be exposed to more hazardous conditions it requires careful consideration and assessment. Also note that the flow velocities could be expected to exceed the limits set in this Standard in many areas subject to local overland flooding.

The local authority may need to rely upon judgement as to where the Standard or its Deemed-to-Satisfy Provisions apply or request specific information from the proponent to determine whether the standard applies and provide key criteria for design. This may limit the application of the Deemed to Satisfy Provisions by the local authority to backwater and inactive flow areas in the DFE where it is less likely the velocity nominated in the Deemed to Satisfy Provision in the Standard would be exceeded.

In many cases detailed information on the depth of inundation at the development in question will rely upon the provision of survey advice from the proponent relative to flood level information determined in the DFE.

In some cases the local authority may require the proponent to engage a suitably qualified professional to determine the DFE and/or to gain a more detailed understanding of flood behaviour at the location. This may include ascertaining the specific design criteria necessary to enable consideration of the development in relation to the Standard and meeting other requirements established by the local authority.

The National Flood Information Database (NFID) shows there are at least 230,000 allotments below the 100-year ARI flood level. Of this figure, approximately 2/3 have a flood depth of less than 1m and approximately 3/4 have a flood depth of less than 1.5m.

Where a part of a flood hazard area is subject to mudslide, landslide, storm surge or coastal wave action while other parts are not affected, the standard would only apply to those parts not affected. For example if part of an allotment of land is affected by landslip, but the part of the allotment where it is proposed to construct a building is not, the standard could still apply to the building.

C1.3.2 Identification of applicable buildings

The Standard only applies to new Class 1, 2, 3, 4, 9a health care and 9c buildings and, subject to State and Territory legislation, alterations and additions to existing buildings of these classifications. Note also that the Performance Requirement in 2.3 is limited to Class 1, 2, 3, 4, 9a health care and 9c buildings. That means buildings of other classes are not subject to any requirements of the Standard, including the Performance Requirement.

Note that a basement carpark under a Class 2 building for instance is usually classified as a Class 7 part of the building. Also, a garage associated with a house can be classified as a Class 10 part of the building. Class 7 and Class 10 parts of the building are not covered by the Standard. However, the standard would apply to the Class 1 or 2 part of the building above the Class 7 or 10 part. This would mean that structurally, the Class 7 or 10 part would need adequately support the Class 1 or 2 part above in a defined flood event.

Class 1, 2, 3, 4, 9a health care and 9c buildings under the NCC are defined as-

Class 1: one or more buildings which in association constitute—

(a) Class 1a — a single dwelling being—

(i) a detached house; or

(ii) one of a group of two or more attached dwellings, each being a building, separated by a fire-resisting wall, including a row house, terrace house, town house or villa unit; or

(b) Class 1b —

(i) a boarding house, guest house, hostel or the like—

(A) with a total area of all floors not exceeding 300 m^2 measured over the enclosing walls of the Class 1b; and

(B) in which not more than 12 persons would ordinarily be resident; or

(ii) 4 or more single dwellings located on one allotment and used for short-term holiday accommodation,

which are not located above or below another dwelling or another Class of building other than a private garage.

Class 2: a building containing 2 or more sole-occupancy units each being a separate dwelling.

Class 3: a residential building, other than a building of Class 1 or 2, which is a common place of long term or transient living for a number of unrelated persons, including—

(a) a boarding house, guest house, hostel, lodging house or backpackers accommodation; or

(b) a residential part of a hotel or motel; or

(c) a residential part of a school; or

(d) accommodation for the aged, children or people with disabilities; or

(e) a residential part of a health-care building which accommodates members of staff; or

(f) a residential part of a detention centre.

Class 4: a dwelling in a building that is Class 5, 6, 7, 8 or 9 if it is the only dwelling in the building.

Class 9: a building of a public nature—

(a) Class 9a — a health-care building, including those parts of the building set aside as a laboratory; or

(b) Class 9c — an aged care building.

Aged care building means a Class 9c building for residential accommodation of aged persons who, due to varying degrees of incapacity associated with the ageing process, are provided with personal care services and 24 hour staff assistance to evacuate the building during an emergency.

Health-care building means a building whose occupants or patients undergoing medical treatment generally need physical assistance to evacuate the building during an emergency and includes—

(a) a public or private hospital; or

(b) a nursing home or similar facility for sick or disabled persons needing full-time care; or

(c) a clinic, day surgery or procedure unit where the effects of the predominant treatment administered involve patients becoming non-ambulatory and requiring supervised medical care on the premises for some time after the treatment.

There is also an elevation requirement in Clause 2.7 which affects the usage of particular floor areas.

C1.4 Limitations

This Handbook is not intended to:

- override or replace any legal rights, responsibilities or requirements; or
- provide users with the specifics of the NCC.

This Handbook is intended to make users aware of provisions that may affect them, not exactly what is required by those provisions. If users determine that a provision may apply to them, the NCC should be read to determine the specifics of the provision.

C1.5 Normative References

These are the normative references referred to in this Standard. The use of other NCC referenced documents are also necessary in the design of buildings in flood hazard areas.

C1.6 Units

The Standard uses the SI units of kilogram (kg), metres (m), seconds (s), Pascals (Pa) and Newtons (N).

C1.7 Definitions

The terms used in this Standard primarily come from the Glossary of Floodplain Management in Australia – Best Practice Principles and Guidelines.

The level of freeboard above the DFL is to be determined by the authority having jurisdiction (usually the local government) Freeboard is typically used to compensate for effects such as wave action and localised hydraulic behaviour. Depending upon the circumstances of the individual event, freeboard may provide protection from floods marginally above the DFL. However, freeboard should not be relied upon to provide protection for flood events larger than the DFE.

C1.8 Notation

The Standard uses letters and symbols in the calculation of flood actions. These letters and symbols are defined in the Standard.

C1.9 Performance-based standards

Consistent with the NCC, the Standard is performance-based. The Standard contains performance requirements together with solutions which are deemed-to-satisfy the performance requirements.

C1.10 Design pathways

Because the Standard is performance-based, it allows a person to develop a solution which meets the performance requirements as an alternative to the prescriptive or deemed-to-satisfy provisions in the Standard.

2 BASIC DESIGN REQUIREMENTS

C2.1 Objective

This is the NCC structural provision objective restated to cover flood actions, with the inclusion of an objective relating to utility (eg electrical) failure.

C2.2 Functional Statement

This is the same as the NCC structural provision functional statement restated to cover flood actions.

C2.3 Performance Requirement

This is similar to the NCC structural performance requirement restated in terms of flood action.

C2.4 Deemed-to-Satisfy Provisions

Clauses 2.5 to 2.13 are the Deemed-to-Satisfy Provisions.

C2.5 Application

This establishes the application of the Deemed-to-Satisfy Provisions. For situations outside these limits, an Alternative Solution in accordance with the Performance Requirements would be necessary.

C2.6 Flood Actions

C2.6.1 General

Within the limiting applications of the Standard, a single process for determining flood actions is used for all types of floods. It is useful however to be aware that there are differences between flood characteristics, flood loads and flood effects in riverine and coastal areas in terms of wave effects, depth, duration, direction of flow and debris.

C2.6.2 Hydrostatic Actions

Hydrostatic actions are those caused by stagnant water either above or below ground surface and are equal to the water pressure multiplied by the surface area on which the pressure acts. They can be divided into vertical downward loads, lateral loads and upward loads (buoyancy).

C2.6.3 Hydrodynamic Actions

Hydrodynamic actions are those induced by the flow of water above ground level. They are usually lateral loads. Accurate estimates of flow velocities during flood are difficult to make. Designers should consult the relevant local government and specialists in this area.

Since the Deemed-to-Satisfy Provisions of the Standard are only applicable to flood hazard areas with maximum velocity of floodwater of 1.5 m/s, and a maximum depth of submersion of non-habitable floors of 1m in the DFE, a general drag coefficient of 1.25 has been nominated for simplicity rather than a table of drag coefficients for different shapes.

Clause 2.6.3 of the Standard provides a simple equivalent hydrostatic formula for the computation of the hydrodynamic forces. This formula is only valid for slow moving water (flow velocity less than 3 m/s) and building aspect ratio (width to height) less than 12. For situations outside these limits, a full engineering analysis should be carried out.

C2.6.4 Debris Actions

Design for debris impact actions is difficult because the nature and size of the potential debris is uncertain. However, there is guidance in specialist literature on this issue. Nevertheless, within the limited application of the Standard, reliance is placed on the general robustness of the building to cope with debris actions.

C2.6.5 Wave Actions from Wind and Wakes (excluding coastal waves)

Design for wave actions is possible and there is guidance in specialist literature on this issue. Within the limited application of the Standard, reliance is placed on the general robustness of the building to cope with wave actions. However, designers should investigate historical damages near a site to determine whether wave force can be significant and ought to be taken into account.

Sections 2.5.4 and 2.5.5 are adequate only if the application is limited to buildings within the currently proposed restrictions (1 metre inundation in slow moving water) but become more complex for buildings and general civil engineering structures subject to more severe conditions.

C2.6.6 Erosion and Scour due to Flood Actions (excluding coastal erosion)

Erosion and scour can affect the stability of the foundation and can increase the flood actions on buildings. The usual methods to mitigate the effects of erosion and scour are to increase the depth of the foundation embedment or to setback buildings from potential danger zones. Erosion protection measures should be undertaken if potential for erosion due to flood actions is serious.

C2.6.7 Combinations of Actions

It is expected that estimates of the flood depth and the flow velocity are made conservatively (95 percentile value estimate with 75% confidence) for the Defined Flood Event (DFE) which is the ultimate design condition. A load factor of 1.0 has therefore been adopted in the Standard.

In the absence of more accurate hydrological analysis, the maximum recorded flood level is a reasonable approximation of the statistically defined DFE provided that the record is at least for 30 years.

The US practice is slightly different from that proposed in the Standard. A load factor of 0.75 is used when combining with wind and other loads (for zone of similar hazard) and a load factor of 1.5 is used when dealing with buoyancy of storage tanks.

The flood load factor is a function of the uncertainties in determining the flood actions. The uncertainties are dependent on the Defined Flood Event (DFE). The benchmark DFE is the flood with annual probability of exceedance of 1:100 which is the design event associated with the ultimate limit state. It is assumed that the outcomes are determined by modelling and analysis with appropriate level of confidence (say 75%).

If the DFE is defined using another level of probability, then this can be compensated by adjusting the flood load factor accordingly.

If the DFE is based on the maximum recorded flood, then there will be more uncertainties involved. The length of the record is another useful indicator of the reliability of the figure. The flood load factors have therefore been adjusted to reflect the associated uncertainties.

The [0.9G, 0.5W_u, $Y_F F_l$] combination primarily addresses the risk of uplift or buoyancy effects. The buoyancy effects for 1 m inundation for enclosed areas should be assumed to be on the conservative side by assuming water entries are blocked. There have been instances of houses floating away in a flood event.

C2.7 Floor Height Requirements

Land use planning instruments or planning schemes will generally establish minimum flood risk management related requirements. This may involve the restriction of the location of development and, where development is permissible, the establishment of minimum conditions that the development must satisfy. These minimum requirements often relate to both floor levels and fill levels.

The Standard requires habitable floors to be above the Flood Hazard Level (i.e. the DFL plus the freeboard) and non-habitable floors to no more than 1m below the DFL (see figure C2.6).

Freeboard allows for wave action, local hydraulic factors, and some level of uncertainty in regard to the flood modelling and identification of the DFE. Freeboard for residential buildings would typically be a maximum of 0.5m unless the specific exposure factors at the location require a higher value. In shallow depths of local overland flow, often resulting from urban piped drainage system bypass, a smaller minimum freeboard of 0.3m is typically used.

The 1m maximum inundation of non-habitable floors only applies to an enclosed room with walls and does not apply where there are no walls (i.e. consists only of columns or posts). The flood action on an open structure is much less compared to a solid wall.

The reference to the floor level is a reference to the uppermost surface of the floor, not including any floor covering such as carpet or tiles. Where the floor has more than one level (ie a step down) the reference is to the lowest part of the floor.

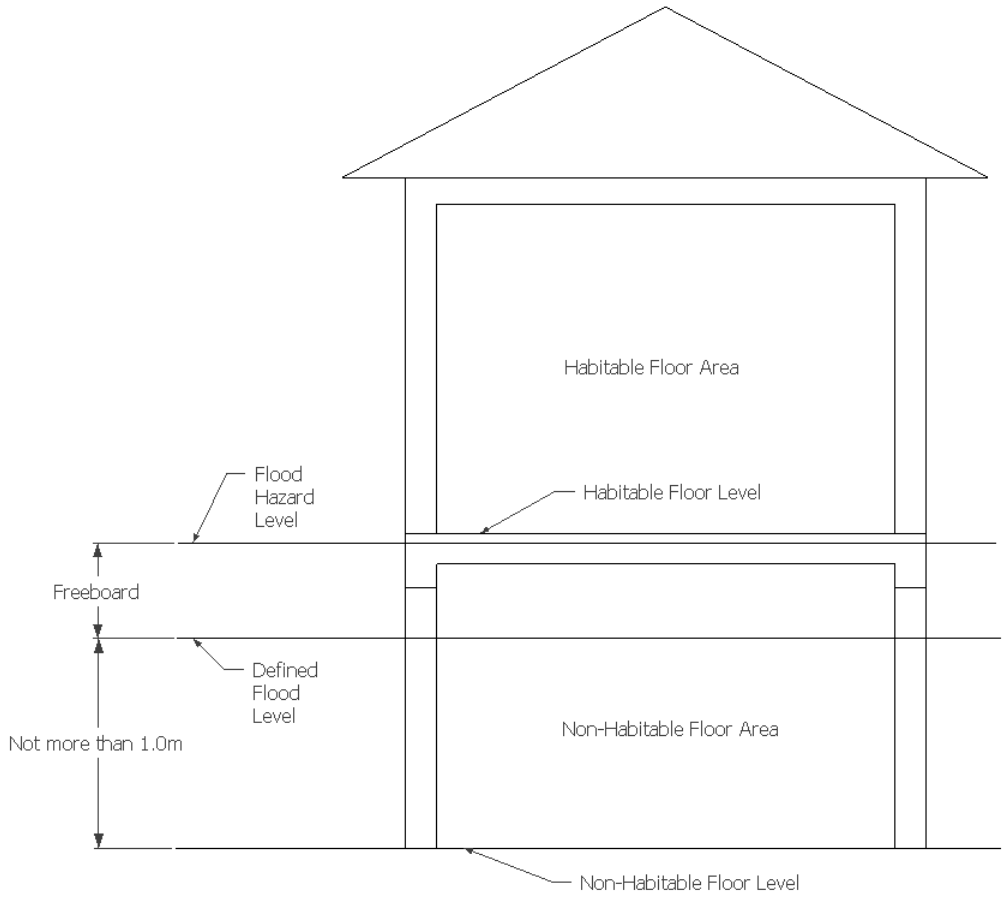

Figure C2.6 Elevation showing DFL

C2.8 Footing System Requirements

C2.8.1 General

The footing system of a structure must be designed to maintain the necessary support for the structure during a flood situation and in particular must be designed to prevent flotation, collapse or movement. The deemed-to-satisfy provisions of the Standard are limited to a maximum flow of 1.5m/s. At higher velocities, more engineering input needs to be taken to ensure the footing system remains structurally adequate.

C2.8.2 Geotechnical Considerations

As the flood flow velocity increases, the risk of collapse and undermining of the footing system by scour increases.

C2.8.3 Footing System Depth

The footing system depth is dependant on a number of factors including foundation material, flood flow velocity, whether the footing system sits on fill or undisturbed soil, slope of land, and potential for landslip.

C2.8.4 Piers, Posts, Columns or Piles

Use of piles is most appropriate if erosion is an issue. Use of piers, posts, columns and piles lessen the interference with the flow of flood water compared with the use of fill to achieve the required elevation.

C2.8.5 Use of Fill

Whether the use of fill is permitted in flood hazard areas needs to be checked with the authority having jurisdiction. Fill can reduce the capacity of the floodplain, exacerbate the flood risk or cause a nuisance for neighbouring property. Where the use of fill is permitted to elevate the house above the DFL or reduce potential inundation, care needs to taken to ensure the fill remains stable and is not adversely affected by erosion and scour.

C2.8.6 Use of Slabs

Flood hazard areas may restrict the construction option of a single storey house with a concrete slab-on-ground. Particularly where the use of fill is restricted, the elevation requirement means that the slab must be above the FHL. Where this is not possible, an alternative construction method, such as an elevated house would need to be considered. Again, care needs to be taken to ensure the flood does not erode or scour the material supporting the slab.

C2.9 Requirements for Enclosures below the FHL

Some planning schemes and planning instruments will not permit enclosures below the flood hazard level and may require minimum fill levels to be at the DFL. However, where enclosures are permitted below the FHL the Standard only contains deemed-to-satisfy provisions for wet flood-proofing and not dry flood proofing. This means the flood water must be allowed to enter and leave the enclosure below the FHL to equalise the hydrostatic pressure on both sides of the external walls. The holes in the walls must be large enough so as not to become easily blocked by debris.

The openings should meet the following criteria-

(a) doors and windows should not be counted as openings but openings can be installed in doors and windows; and

(b) there should be a minimum of two openings on different sides of each enclosed area; and

(c) the total net area of all openings should be at least 1% of the enclosed area; and

(d) openings should permit a 75 mm sphere to pass through; and

(e) any opening covers should not impede the flow of water; and

(f) consideration should be given to prevent the openings from becoming blocked.

C2.10 Requirements for Structural Attachments

Items such as decks and patios must be structurally adequate so as not to cause failure of the main building they are attached to. Any structure either designed to fail or not structurally adequate must be designed to not impact upon the structural adequacy of the building.

C2.11 Material Requirements

All materials used in the construction of the building must conform to the appropriate requirements of the NCC, including its referenced documents. In addition, materials that are exposed to water inundation should be given further consideration of their properties when wet in deciding whether they are suitable for use. These include-

(a) likely duration of exposure to wetness

(b) changes to dimensions and strength when wet

(c) water absorption rate and required drying time

(d) cost and feasibility of replacement of components.

The Deemed-to Satisfy provisions of the Standard are only applicable for wet flood proofing. If dry flood proofing method is used, the proposed solution should be assessed as an Alternative Solution under the NCC requirements

With wet flood proofing, the water is allowed to enter the building to reduce the built-up of hydrostatic pressure between the flood water and the inside of the building. The structural materials used below the DFL must therefore be water resistant to minimise the resulting damage.

Designers and building owners may choose to select water resistant non-structural materials for wall linings etc. However, there is an argument that it may be more cost effective to use non-water resistant non-structural materials (eg ordinary plasterboard), as such material can readily be removed to allow any cavities to drain and the structural members to fully dry out after inundation, and then later replaced with new material.

The deemed-to-satisfy provisions in the Standard do not include provisions relating to dry flood proofing. For dry flood proofing, the building or relevant parts of the building envelope are made substantially impermeable to flood water. If this method is proposed, it would need to be considered on a case by case basis under the performance requirements. If this method is used, care must be taken to ensure the structural adequacy of the envelope of the dry food proofing part of the building to carry the differential hydrostatic pressure (in addition to the hydrodynamic action) created by the flood water. This pressure is quite severe and could cause major structural damage if not properly accounted for.

For further information on suitability of materials subject to flood inundation refer to Appendix C.

C2.12 Requirements for Utilities

C2.12.1 General

Utilities and associated equipment, if exposed to flood water (i.e. located below the DFL) should be designed, constructed and installed to prevent floodwater from entering and accumulating within the system.

Utilities and associated equipment should also be anchored to resist the forces generated by the flood (such as buoyancy) and should not be mounted on items or structures that could break away during the flood.

Utilities include electrical, plumbing, telecommunication, HVAC and similar services.

C2.12.2 Electrical systems including photovoltaic systems

This provision is subject to the requirements of the electrical supply authority. So unless the electrical supply authority determines otherwise-

(a) Electrical service conduits and cables below the DFL should be waterproofed.

(b) Underground service conduits and cables should be buried at a depth sufficient to prevent damage caused by erosion and scour.

(c) Meters and switches should be mounted above the DFL and made accessible during the flood.

C2.12.3 Plumbing and drainage

Plumbing systems include sewage and waste water disposal facilities, and hot/cold water supply.

C2.13 Requirements for Egress

During a *defined flood event*, it may be necessary for emergency services or other person to rescue people trapped in a house by flood waters. Rescue could be by boat. Therefore, a means of exiting the house must be available to allow rescue. The exit route could be from a balcony, verandah, deck, door or openable window of sufficient size.

For further information on egress and evacuation before or during a flood, refer to the AEM series documents on Flood Safety.

C2.14 Additional State or Territory requirements

Refer Appendix B.

3 ADVISORY INFORMATION

C3.1 General

This Section provides supplementary, non-mandatory information to the Standard with the aim of improving resilience (or reducing vulnerability) of buildings when subject to flooding. The Standard was designed mainly to cope with infrequent flooding of the order of 1 in 100 annual probability.

This Section provides:

(a) Background information to the Standard requirements.

(b) Information on performance of types of construction and of materials under flooding conditions.

(c) Guidance on rehabilitation of buildings after a flood event.

(d) Sources for further information.

All references made in this Section are listed in Section 4.

C3.1.1 Flooding in Australia

In Australia, floods cause more damage on an average annual basis than any other natural disaster. From 1967 to 1999, the total cost of floods has been estimated at $10.4 billion or 29% of the average proportional annual cost of natural disasters. In addition, during the same period, floods were responsible for 18% of fatalities caused by natural hazards[2].

Historically our towns developed on riverbanks to facilitate the shipping of goods to and from the settlements, and where fertile soil existed, but this also left them vulnerable to flooding. Many towns have some mitigation works to reduce this risk, but flood risk remains for floods larger that the design floods used for these mitigation works.

C3.1.2 Floodplain management

Floodplain management is outside the scope of this section and interested readers are referred to ‘Flood plain management in Australia: Best practice principles and guidelines’ SCARM

[2] Middelmann, M. H. (Editor) 2007, *Natural Hazards in Australia. Identifying Risk Analysis Requirements*, Geoscience Australia, Canberra, 2007.

Report 73, AEM Series Documents including 'Managing the Floodplain' or relevant State Manuals, such as the NSW Floodplain Development Manual[3].

Floodplain management is a partnership between government and the community using a range of measures to reduce the risks to people, property and infrastructure and therefore goes well beyond the scope of the standard.

It requires a different mix of measures to manage flood risk to existing developed areas and future developed areas. This mix of measures will vary with location as there is no one size fits all solution to managing flooding.

Best floodplain management practice as outlined in SCARM and the AEM series document Managing the Floodplain recommends the preparation of floodplain management plans to outline how the full range of flood risk faced by a community and its people, property and infrastructure, can be managed at a particular location. In new development areas it provides guidance to inform strategic decisions on where, what and how to develop the floodplain whilst aiming to manage residual flood risk to an acceptable level. Local authorities can use land use planning controls to influence the long term development of an area in consideration of flooding, by restricting the location of development (zonings) and placing conditions (controls) on it.

New development areas can be located away from: floodways, through which the main floodwaters flow; areas where the velocity and depth of floodwaters can be particularly hazardous; and where it is not possible for people to easily self evacuate to flood free areas and there is no practical alternative. Within the remaining developable land, additional conditions can reduce the exposure of the new development to flooding. These controls can include: minimum fill levels for land; minimum floor levels for buildings and other structural requirements (such as identified in the Standard); and the ability to evacuate people to flood free areas (with the latter considering the full range of flood risk).

For existing development areas flood risk is harder to manage due to the scale of development and the practicality, effectiveness and affordability of large scale mitigation measures. Redevelopment or extensions (and there occupants) to existing development in these areas may be exposed to a higher degree of hazard (velocity and depth) in the defined flood event or events up to the probable maximum flood (PMF) than those in new development areas, where planning controls can more effectively be used to reduce risk.

This Handbook and the Standard are only concerned with the construction of buildings in flood hazard areas. The DFE and DFL used by the authority having jurisdiction to manage flood risk to property is generally determined in land use planning in consideration of flood risk

[3] Agriculture and Resource Management Council of Australia and New Zealand, SCARM Report 73, *Flood plain Management in Australia: best practice principles and guidelines*, CSIRO, 2000

management and is often associated with a 1% chance of a flood of that size being exceeded in any given year or an annual exceedance probability of 1 in 100. However, other flood events or information may be used by the local authority for managing flood risk to buildings or the particular flood situation at the location in question and in setting both the DFE and DFL.

A recent survey by National Flood Information Database (NFID) shows at least 230,000 allotments below the 1% AEP flood level. Approximately 2/3 of these have a flood depth of less than 1m and approximately 3/4 have a flood depth of less than 1.5 m.

It is important to note that for the purposes of the Standard and this Handbook, the DFE does not define the extent of flood-prone land which is defined by the Probable Maximum Flood (PMF). The PMF is the largest flood that could conceivably occur at a particular location, resulting from the probable maximum precipitation. Generally it is not physically or financially possible to provide general protection against this event. The AEP for the PMF event is commonly assumed to be in the order of 10^{-4} to 10^{-7}. Therefore buildings built to the Standard may face higher velocities and depths than the DFE may generate.

The Standard specifies that the deemed-to-satisfy provisions apply to buildings constructed with a maximum depth of inundation of the lowest non-habitable floor of 1 m below the DFL. Habitable floor levels are to be above the FHL.

C3.1.3 Wet flood proofing principle

The Standard is based on the 'wet flood proofing' principle i.e. the flood water is intentionally allowed to enter and leave the building. The alternative approach is called 'dry flood proofing' i.e. the flood water is prevented from entering the building by either permanent or temporary barriers. 'Dry flood proofing' is considered not suitable for the majority of buildings in Australia because the hydrostatic forces are not equalised on both sides of the external wall, as is the case for wet flood proofing. Also, most houses would allow rising water to enter via gaps around door openings, weep holes, ventilation grilles and the like. Therefore, traditional house construction practice may not be suitable for dry flood proofing. If such a solution is proposed, it will be necessary to assess it under the 'Alternative Solution' provisions of the NCC.

'Wet flood proofing' will reduce the hydrostatic forces on the building elements, but it will require consideration of the effect of water immersion on building materials and assemblies.

The objective of the Standard is to minimise the damage to the structural components of a buildings which is expensive to repair and could lead to structural collapse. The rehabilitation of a flooded building should involve only cleaning, content replacement and minor repairs. However, if flood water can for example enter a wall cavity, wall linings may need to be removed to clean the cavity and allow structural members to dry out.

C3.1.4 Velocity of flood water

The Standard places a limit on its applicability on a maximum average velocity of flood water of 1.5 m/s. This is consistent with the FEMA standard[4]. However, other studies[5] show that wading by adults becomes difficult and dangerous when the depth of still water exceeds 1.2 metres or when the velocity of shallow water exceeds 0.8 metres per second. Safety is further compromised if the occupant is a child, elderly, infirm or fearful.

This means that where high set houses with non-habitable rooms underneath which have floor levels below the FHL are constructed, that if occupants try to evacuate once the DFL has been reached that they will be more exposed to hazardous conditions when evacuating. This highlights the importance of effective evacuation strategies that facilitate the evacuation of all affected residential buildings (including for aged care and health care facilities) before effective evacuation access is lost. Residents and emergency response planning would need to be made aware of such limitations.

The flow of water around a building in a flood event is a complex problem. A building in an open field is subject to a flow velocity similar to the 'Greenfield' velocity of the site (predevelopment). However as the density of buildings increases, the local flow velocity also increases and could be up to four times the 'Greenfield' velocity. Appendix B of the Guideline on Reducing Vulnerability of Buildings to Flood Damage[6] gives some guidance on the determination of velocity of flood water.

Since the forces on the building increase with the square of the velocity, building in areas subject to fast moving flood water should be avoided because of increasing risk to people and properties. A doubling in velocity means a quadrupling of the magnitudes of the hydrodynamic forces on the building.

C3.2 Structural Design

C3.2.1 Flood actions

Section 3.1, 3.2 and Appendix A of the Guideline on Reducing Vulnerability of Buildings to Flood Damage[6] contains some explanations of the flood actions that may cause building

[4] FEMA 348 Protecting Building Utilities from Flood Damage: Principles and Practices for the Design and Construction of Food Resistant Building Utility Systems

[5] Summarised in Cox, R. 2011 *People and vehicle safety in flooding waters.* Presentation to NSW Floodplain Management Association Conference, Tamworth 24 February 2011.

[6] Hawkesbury-Nepean Floodplain Management Steering Committee, 2006, *Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas*, Parramatta, June 2006

damage. ASCE Standard ASCE/SEI 7-05 also contains useful information on the calculation of flood actions.

There are important differences in flood actions for different kinds of floods in riverine and coastal areas. For example, potential effects of wave actions are greater in coastal areas while flood duration can be much longer in riverine areas etc. The flood actions referred to in the Deemed-to-Satisfy provisions of the Standard are mainly directed at riverine areas with slow moving or stagnant water.

Hydrostatic actions are actions arising from pressure exerted by still water. The hydrostatic pressure at any point is always equal in all directions and acts perpendicular to the surface on which it is applied. The hydrostatic pressure induce horizontal forces which act on vertical and inclined surfaces of buildings such as walls and vertical forces (up and down) which act on horizontal and inclined surfaces of buildings such as floors. Vertical forces include buoyancy which generates an uplift force equal to the weight of the water being displaced. These forces make it difficult to dry proof buildings structurally. A water differential level of 100 mm can cause the plasterboard to break and a differential level of 1000 mm can cause damage to a brick wall. For wet proofed buildings, both of these forces from outside of the building are largely counteracted by those from the inside of the building and only the water differential level between inside and outside needs to be considered. Buoyancy effects however can be important for lightweight buildings and empty storage tanks and these items need to be structurally secured.

Hydrodynamic actions are actions arising from moving water. These induce forces which are proportional to the square of the flow velocity. These forces can be quite large. The SCARM Report[7] identifies that wading by able bodies adults becomes difficult and dangerous when the depth of still water exceeds 1.2m, when the velocity exceeds 0.8m/s, and for various combinations of depth and velocity between these limits. The SCARM Report also states that at velocities in excess of 2m/s, the stability of foundations and poles can be affected by scour. Also, at depths in excess of 2m, lightly framed buildings can be damaged by water pressure, flotation and debris impact, even at low velocities. The SCARM Report also identifies the degree of flood hazard depending on a variety of factors including flood depths and velocities. It identifies high hazard (ie fit adults have difficulty in wading to safety) when the maximum flood depth is up to 1m and maximum velocity is up to 1.5m/s. The Hawkesbury-Nepean Guidelines[6] find that a house subjected to flood water flowing at a velocity exceeding 1.5 m/s, half way up the wall (or approximately 1.2 m deep) could suffer damage to the cladding and/or frame.

[7] Agriculture and Resource Management Council of Australia and New Zealand, SCARM Report 73, *Flood plain Management in Australia: best practice principles and guidelines*, CSIRO, 2000.

The calculation of the forces generated by moving water is complex and dependent on the shape and size of the building. The Standard provides a simple equivalent hydrostatic formula which is only valid if the flow velocity is less than 3 m/s and the aspect ratio (width to height ratio) is less than 12. For situations outside these limits, a proper engineering analysis should be carried out.

Debris actions are actions arising from impacts of debris floating in moving flood water. There is wide variation in impact loads depending on the nature of the debris and the velocity of the flood water. ASCE Standard 7-05 Section C5.4.5 provides a detailed discussion on the treatment of debris actions. It is generally considered that most of the currently used cladding systems in Australia are sufficiently robust to resist the impacts of objects 'normally encountered' for design conditions envisaged in the Standard.

Wave actions are actions arising from water wave propagating over surface water striking the building. Forces are generated by wave breaking on the surface of the building, uplift caused by shoaling wave beneath the building, wave run up and wave induced drag and inertia forces. Wave load calculation procedure is available in ASCE Standard 7-05. Wave action should be considered for flooding in the coastal zones. However, for the design conditions where this Standard is applicable, wave action is not considered to be a major factor in design.

Erosion and scour: These terms are used to indicate a general (erosion) or local (scour) lowering of the ground surface because of the flood actions. Erosion and scour can affect the stability of the foundation and lead to footing failures and therefore should be considered in design.

C3.2.2 Foundation design

Earthwork should be carried out in accordance with AS3798 -1996[8] .

Footings should be constructed in accordance with AS2870 – 1996[9]. It should be noted that for expansive soil, AS2870 only considers moisture movement under normal seasonal conditions. More damage therefore could be expected when the foundation is subjected more extreme conditions during and after a flooding event.

Issues concerning foundation design include:

(a) Erosion and scouring caused by flowing water.

(b) Collapse of soil caused by saturation.

[8] AS3798 -1996 'Guidelines on Earthworks for Commercial and Residential Developments'

[9] AS2870 -1996 'Residential Slabs and Footings'

(c) Soil piping.

(d) Batter slumping.

(e) Swelling and shrinking of soils following the movement of water.

Designers should have some knowledge of the site soil properties and site characteristics to assess whether any or all of the above issues are relevant. Section 3.4 and 4.1 of the Guideline on Reducing Vulnerability of Buildings to Flood Damage[6] provides more discussion on these issues.

C3.2.3 Building types

The Standard requires habitable floors to be placed at least 0.5 m above the DFL. This will put single storey slab-on-ground dwellings at a disadvantage if built on flood-prone land. The two-storey dwelling provides a better option in term of reducing flood damage to both the structure and its content. The elevated (high set) dwelling is another option worth considering. Section 4.2 of Reference [1] provides further discussion on building types.

C3.2.4 Construction materials

Distinction between structural and non-structural components should be made in the selection of construction materials used in parts of the building subject to inundation. The Standard only requires structural components to be water resistant for the duration of the flood.

There are different levels of material water resistance:

(a) Materials that are weakened when wet.

(b) Materials that are stable but porous that will need drying out after the flood.

(c) Materials that are not porous and not weakened when wet.

Material properties are also affected by the duration of the immersion (that could be as long as a week) and the quality of the flood water. Long term problems may also arise if inadequate attention is given to the cleaning up or in not allowing the structural members to dry out sufficiently (such as corrosion in steel and decay in timber). The selection of appropriate materials is also influenced by the ease and cost of repair and/or replacement. Section 4.3 of the Guideline on Reducing Vulnerability of Buildings to Flood Damage[6] provides further discussion of the suitability of various materials for construction on flood-prone land. Further

information can also be obtained from the FEMA Bulletin on Flood Damage-Resistant Materials[10].

C3.2.5 Construction elements

Construction elements that are affected by water immersion under the terms of the Standard are the foundation, ground floor and walls.

(i) Foundation

The foundation may fail due to erosion of the supporting soil or excessive settlement. Section 5.1 of the Guideline on Reducing Vulnerability of Buildings to Flood Damage[6] provides information on the advantages and disadvantages of different types of footing design.

(ii) Ground floor

Concrete floors are relatively unaffected by water immersion. Wood-based flooring materials are affected by immersion at varying degrees. Insulation of floors is also affected by flood water. Section 5.2 of the Guideline on Reducing Vulnerability of Buildings to Flood Damage[6] provides further discussion on these issues.

(iii) Walls

Walls should be able to resist the additional hydrostatic and dynamic pressures from flood water. The wall should also be robust to resist any debris loading. Issues may also arise from the support settlement while drying out.

Brickwork normally performs satisfactorily but minor cracking could occur if situated on expansive soil. External claddings such as timber, fibre cement, plastic or aluminium are not likely to be affected by flood water.

Silt may be deposited in wall cavities in framed construction and water trapped in the cavities may cause longer term problems. Internal wall lining such as plaster board may need to be removed to clean the cavity and allow the structural members to dry out.

Section 5.3, 5.4, 5.5 and 5.6 of the Guideline on Reducing Vulnerability of Buildings to Flood Damage[6]] provide further information on these issues.

[10] FEMA Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program Technical Bulletin 2 / August 2008

C3.3 Non-Structural Design

C3.3.1 General

Non-structural issues are mainly concerned with the protection of utilities such as electrical, plumbing, and heating, ventilation, and air-conditioning (HVAC) and other mechanical services in the event of flooding.

The protection of utilities is necessary since damage to equipment and disruption of utility services can cause a building to be uninhabitable even if the structure itself is not damaged.

The general rule is to place all these systems, including the control devices, above the DFL if at all possible. The placement of these systems is usually controlled by authorities having jurisdiction in regard to these systems and the authorities should be consulted and/or advised about potential flood problems. Reference [7] provides general advice on the protection of utilities.

C3.3.2 Electrical

Where possible, wiring should be placed above the DFL. A practical option could be to place wiring in the roof space or the floor above and extend down the wall. The meter box, switch board, power points and switches in particular should be elevated above the DFL to gain extra protection. Conduits should be installed to ensure that water will be drained freely if subject to immersion.

Fixed electrical equipments such as air conditioners and hot water systems should be mounted above the DFL to reduce the chance of inundation.

C3.3.3 Sewerage

The main issue with sewerage systems during flooding is to prevent the backflow of sewage into the building. Backflow protection devices should be fitted for this purpose.

C3.3.4 Storage tanks

The main issue with storage tanks is the possibility that they may float or pop out of the ground due to buoyancy and therefore they should be designed to resist the uplift forces. Above ground tanks should be placed above the DFL if possible.

C3.4 Assessment and Repair of Flood Damage Buildings

The assessment and repair of flood damage buildings is an important issue for health and safety reasons as well as to prevent longer term structural problems. The BRANZ Bulletin 455[11] and the Timber Queensland Guide to Assessment and Repair of Flood Damaged Timber and Timber Framed Houses[12] should be consulted for further information.

Additional matters to check after inundation by flood waters include whether the termite management system has been compromised, particularly chemical systems, integrity of flashings, and monitoring of residue moisture and the presence of mould.

C3.5 Identification of flood hazard areas

The DFE and DFL used by a local authority to manage flood risk to property is generally determined in land use planning in consideration of flood risk management. It is often associated with a 1% chance of a flood of that size being exceeded in any given year or an annual exceedance probability of 1 in 100. However, other flood events or information may be used by the local authority for managing flood risk to buildings or the particular flood situation at the location in question and in setting both the DFE and DFL.

There are significant variations in the information available on flooding between areas within a local authority and between local authorities within Australia. This may result from the age of studies, the type of modelling undertaken, the information available to understand flood behaviour, or the reliance of historical flood information or estimates to provide an understanding of flood risk. This will mean different levels of information availability.

Flood investigations may have also resulted in mitigation works which may alter flood behaviour. These are local by nature and their benefits would generally be assessed in studies for the area and considered by the local authority in determining the flood hazard area.

In many cases information about flow velocities will not be known or will be limited. Modelling of the DFE may provide velocities at the peak of flow within an area rather than peak velocities at a specific location. Therefore it is unlikely that the local authority will have specific information on flow velocities at a particular site in all cases.

Existing development in more active flow areas, including floodways, is more likely to be subjected to higher velocities of flow than permitted by the Deemed to Satisfy Provisions and is also more likely to impact upon flood behaviour elsewhere. Any additional development or

[11] BRANZ BULLETIN 455 Restoring A House After Flood Damage, December 2004

[12] Timber Queensland, Guide to Assessment and Repair of Flood Damaged Timber and Timber Framed Houses Technical Guide (Revised 19th Jan 2011)

redevelopment in these areas is also likely to be exposed to more hazardous conditions it requires careful consideration and assessment. Also note that the flow velocities could also be expected to exceed the limits set in this Standard in many areas subject to local overland flooding.

The local authority may need to rely upon judgement upon where the Standard applies or request specific information from the proponent to determine whether the standard applies and provide key criteria for design. This may limit the application of the Deemed to Satisfy Provisions by the local authority to backwater and inactive flow areas in the DFE where it is less likely the velocity nominated in the Deemed to Satisfy Provision in the Standard would be exceeded.

In many cases detailed information on the depth of inundation at the development in question will rely upon the provision of survey advice from the proponent relative to flood level information determined in the DFE.

In some cases the local authority may require the proponent to engage a suitably qualified professional to determine the DFE and/or to gain a more detailed understanding of flood behaviour at the location. This may include ascertaining the specific design criteria necessary to enable consideration of the development in relation to the Standard and meeting other requirements established by the local authority.

C3.6 Appropriate location of and control of development in flood hazard areas through land use planning

Best floodplain management practices, as outlined in SCARM and the AEM Series document Managing the Floodplain recommends the preparation of floodplain management plans to gain an understanding of flood behaviour and outline how the full range of flood risk faced by a community and its people, property and infrastructure, can be managed at a particular location.

In new development areas floodplain management plans provide information to guide strategic decisions on where, what and how to develop the floodplain whilst reducing residual flood risk to people, property and infrastructure to an acceptable level. Local authorities can use planning controls to influence the long term development of an area in consideration of flooding, by restricting the location of development (zonings) and placing conditions (controls) on it.

New development areas can be located away from: floodways, through which the main floodwaters flow; areas the velocity and depth of floodwaters can be hazardous; and where it is not possible for people to readily self evacuate to flood free areas and there is no practical alternative. Within the remaining developable land, additional conditions can reduce the exposure of new development to flooding. These controls can include: minimum fill levels for land; minimum floor levels for buildings and other structural requirements (such as identified in

the Standard); and the ability to evacuate people to flood free areas (with the latter considering the full range of flood risk).

In existing development areas flood risk is harder to manage due to the scale of development and the practicality, effectiveness and affordability of large scale mitigation measures. Redevelopment or extensions to existing development and its occupants in these areas may be exposed to a higher degree of hazard (velocity and depth) in the defined flood event or events up to the probable maximum flood (PMF) than those in new development areas, where planning controls can more effectively be used to reduce risk.

This Handbook and the Standard are only concerned with the construction of buildings in flood hazard areas. The DFE and DFL used by a local authority to manage flood risk to property is generally determined in land use planning in consideration of flood risk management. It is often associated with a 1% chance of a flood of that size being exceeded in any given year or an annual exceedance probability of 1 in 100. However, other flood events or information may be used by the local authority for managing flood risk to buildings or the particular flood situation at the location in question and in setting both the DFE and DFL.

Various references and publications containing information that may be assistance to designers or relevant authorities are listed in Sections 4 and 5.

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Appendix A NCC Extracts

BCA Volume Two (similar provisions in BCA Volume One)

P2.1 Structural stability and resistance to actions

(a) A building or structure, during construction and use, with appropriate degrees of reliability, must—

(i) perform adequately under all reasonably expected design actions; and

(ii) withstand extreme or frequently repeated design actions; and

(iii) be designed to sustain local damage, with the structural system as a whole remaining stable and not being damaged to an extent disproportionate to the original local damage; and

(iv) avoid causing damage to other properties,

by resisting the actions to which it may reasonably be expected to be subjected.

(b) The actions to be considered to satisfy (a) include but are not limited to—

……

(vi) liquid pressure action; and

(vii) ground water action; and

(viii) rainwater action (including ponding action).

P2.2.1 Surface water

(a) Surface water, resulting from a storm having an average recurrence interval of 20 years and which is collected or concentrated by a building or sitework, must be disposed of in a way that avoids the likelihood of damage or nuisance to any other property.

(b) Surface water, resulting from a storm having an average recurrence interval of 100 years must not enter the building.

Limitation:

P2.2.1(b) does not apply to a Class 10 building where in the particular case there is no necessity for compliance.

Appendix B Additional State and Territory requirements

The following provides a summary of relevant State/Territory flood related building and planning provisions. The information was provided by the State/Territory administrations in October/November 2010.

B.1 Northern Territory (NT)

Part 10 (Areas liable to flooding) of the NT Building Regulations under the Building Act regulates buildings in flood prone areas.

Reg 37 (Flood prone areas) specifies that the parts of the Territory included in Schedule 4 are prescribed as flood prone areas.

Reg 38 (Flood levels) specifies that the flood level for a flood prone area is the 1 in 100 year flood level. However, the Director may also determine the flood level.

Reg 39 (Requirements in flood prone areas) specifies that in relation to a building constructed in a flood prone area:

(a) the height of the lowest floor level, or lowest part of the floor level, of a habitable room shall be not less than 300 mm above the flood level;

(b) the structural design of the building shall be adequate to withstand flooding giving consideration to:

(i) the site, size and shape of the building;

(ii) the effect of buoyancy on the sub-structure of the building; and

(iii) the stresses that the depth and velocity of water and the impact of water borne debris may have on the structure.

NT Planning Scheme Clause 6.14 (Land subject to flooding and storm surge) specifies that in a Defined Flood Area (ie the area that is inundated by the 1% Annual Exceedence Probability flood event):

(a) the minimum floor level of habitable rooms should be 300mm above the flood level for the site; and

(b) the use of fill to achieve required floor levels should be avoided.

Local Governments have no powers to develop their own building, planning or other requirements to control the construction of buildings in flood prone areas

B.2 Australian Capital Territory (ACT)

The ACT's main urbanised area is greater Canberra, and as Canberra is comparatively new, and "intensively designed", there are notionally no relevant "flood prone areas" available for construction. Isolated settlements and pre-ACT villages incorporated into the ACT have no flood prone areas available for construction either, (Hall village, Tharwa village, Uriarra settlement, Oaks Estate, etc).

Government controls release of new land for urbanisation and ensures land is not released for construction in flood prone areas.

B.3 Western Australian (WA)

Planning and Development Act 2005

Town Planning (Buildings) Uniform General By-laws 1989

Section 23. Land liable to flooding - A building shall not be constructed on land defined by the council as being liable to flooding or inundation.

Many of the 'at risk' local governments incorporate provisions into their individual Town Planning Schemes (TPS). Each TPS is different but a general overview is that developments require planning approval, council has power to not issue approval in areas at risk flooding, ability for council to liaise with other government departments (such as Department of Water) minimum FFLs may be determined by council.

Examples of WA Local Government Flood Prone Planning Policies

B.3..1 Shire of Beverley TPS No. 2

Clause 4.5 Flood Prone Areas provides the process and conditions for how developments on land identified within the extent of a 1 in 100 year flood for Avon River will be dealt with. Including—

1. Developments will require planning approval

2. Council will consult with the Water Authority of Western Australia

3. Council may determine the FFL for any buildings in the planning application.

B.3..2 Shire of York TPS TPS 2

Clause 5.4 Avon River Flood Fringe provides 8 provisions that deal with the development of land within flood plan areas identified in the Avon River Flood Study. Including no development in these areas if the council or water agency thinks that is appropriate, requirement for planning approval, minimum FFL heights, fencing, and rehabilitation of land.

B.3..3 Shire of Moora TPS 4

4.10 LAND LIABLE TO FLOODING

Notwithstanding anything elsewhere appearing in the Scheme development of land identified in the Moore River Flood Study adopted by the Water and Rivers Commission as within the extent of 100 year flood shall be subject to the following:

a) in addition to a building licence, the Council's planning approval is required for all development including a single house and such application shall be made in accordance with the provisions of the Scheme.

b) in determining an application for planning approval the Council shall consult with the Water and Rivers Commission.

c) development which includes a building or structure shall not be permitted unless in accordance with recommendations of the Water and Rivers Commission.

d) the Council may accept that an applicant consults with the Water and Rivers Commission and demonstrates compliance with the recommendations of the Water and Rivers Commission to the satisfaction of the Council in which case the Council is not required to act in accordance with paragraph (b) of this sub-clause.

B.3..4 Shire of Carnavon TPS 10

Clauses 6.8 and 6.9 deal with flooding and storm surge.

Cyclonic Storm Surge Affected Areas

Areas subject to the potential threat of inundation by cyclonic storm surge are given consideration in respect to floor heights and structural adequacy.

Flood Prone Areas

Where any development is proposed which is in area or location subject to the influence of - flooding (river overflow); flood (localised drainage problems); or storm surge, it is to be assessed for construction systems and floor heights to enable the development to be adequately above the estimated flood level for that location.

B.3..5 City of Mandurah TPS No. 3

5.5.5 Land Subject to Flood Risk, Damage, Hazard or Erosion by Water

Council shall not approve development on land that is subject to flood risk, damage, hazard or erosion by water unless the owner is prepared to indemnify Council against any claim for damages and to charge the land with the indemnity. Development shall not be permitted even

with such indemnification where the development would cause problems relating to flood management, environmental degradation or erosion, or the land is flood prone.

B.4 Victoria (VIC)

Building Regulations 2006, Regulation 802(2) sets out the purposes of Regulation 802, what is considered to be land that is in an area liable to flooding.

Land can be identified in a planning scheme under the *Planning and Environment Act 1987* as being in an area liable to flooding.

Land may be designated by the relevant council as being in an area liable to flooding if it is likely to be flooded by waters from a waterway or any land upon which water concentrate (see para (d)(i) and (ii).

Building Regulations 2006 - Regulation 802

Flood areas

(1) This regulation does not apply to-

(a) a Class 10 building; or

(b) an unenclosed floor area of a building; or

(c) an alteration to an existing building if the area of the existing building is not increased by more than 20m2.

(2) For the purposes of this regulation, land is in an area liable to flooding if-

(a) by or under the *Water Act 1989* it is determined as being liable to flooding (however expressed); or

(b) it is identified in a planning scheme under the *Planning and Environment Act 1987* as being in an area liable to flooding; or

(c) it is described on a certified or sealed plan of subdivision or plan of strata subdivision or plan of cluster subdivision (as the case requires) as being liable to flooding (however expressed); or

(d) it is designated by the relevant council as likely to be flooded by waters from-

(i) a waterway, as defined in section 3 of the *Water Act 1989*; or

(ii) any land upon which water concentrates or upon or over which surface water usually or occasionally flows (whether in a defined channel or otherwise) including land affected by flow from a drainage system.

(3) The report and consent of the relevant council must be obtained to an application for a building permit if the site is on an allotment that is in an area liable to flooding.

(4) The report and consent of the relevant council under subregulation (3) need not be obtained to an application for a building permit if-

(a) a planning permit is required for the construction of the building; and

b) the relevant planning scheme regulates the level of the lowest floor of the building in relation to any flood level declared under the Water Act 1989 or otherwise determined by the floodplain management authority or the relevant council.

(5) The relevant council must not give its consent under subregulation (3) if it is of the opinion that there is likely to be a danger to the life, health or safety of the occupants of the building due to flooding of the site.

(6) In its report under subregulation (3) the relevant council may specify a level for the surface of the lowest floor of a building on the site.

(7) Before specifying a floor level under subregulation (6) the relevant council must-

(a) consult with the floodplain management authority for that site; and

(b) specify a level at least 300mm above any flood levels declared under the Water Act 1989 or otherwise determined by the floodplain management authority, unless the authority consents to a lower floor level.

(8) The relevant council must without delay advise the floodplain management authority and the sewerage authority for that site of the floor level (if any) specified under subregulation (6).

B.5 Queensland (QLD)

The *Sustainable Planning Act 2009* provides that a planning scheme must not include provisions about building work, to the extent the building work is regulated under the *Building Act 1975* (BA).

Section 31 of the BA provides a head-of-power for local governments to include building provisions in a planning scheme if permitted by a regulation.

Section 13 of the *Building Regulation 2006* (BR) states:

(1) a local government may, in a planning scheme or by a temporary local planning instrument under the Planning Act or a resolution –

(a) designate part of its area as a natural hazard management area (flood); and

(b) declare the level to which the floor levels of habitable rooms as defined under the NCC of buildings on the land must be built.

(2) The local government must, in designating a natural hazard management area (flood), comply with 'State Planning Policy1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide', adopted by the Minister on 19 May 2003.

(3) The local government must keep a register of the natural hazard management areas (flood) it designates and when each designation was made.

Natural hazard areas (flood) can be designated through a provision of a local law, planning scheme or local government resolution.

The State Planning Policy 1/03 (SPP) sets out the State's interest in ensuring the natural hazards of flood, bushfire and landslide are adequately considered when making decisions about development. The SPP informs the way in which local planning instruments address natural hazards.

The SPP states that, generally, the appropriate flood event for determining a natural hazard management area (flood) is the 1% Annual Exceedance Probability (AEP) flood. The SPP is currently under review and will consider the outcomes recommended from both the Victorian Bushfires Royal Commission and the Queensland Floods Commission of Inquiry.

The policy can be accessed at: http://www.dlgp.qld.gov

Provisions in the SPP which are of particular relevance to floods include A1.1, A3.1, A3.2, A4.2, and A5.2.

B.6 New South Wales (NSW)

In NSW local government councils are responsible for managing their flood risk. They are encouraged to define a range of flood affected areas including floodway (where water flow is a key function), flood storage areas (where water storage is an important flood function), the flood planning area (area where the majority of controls apply for flooding) and flood prone land (the extent of the probable maximum flood for emergency response and recovery purposes). Flood prone areas in NSW, unlike other states, include both riverine and local overland flooding areas. Councils are at different stages in defining these areas with very few councils currently able to map all flood prone land. Local government, with technical support from the State Government and financial support from State and in some cases Commonwealth Government have

undertaken a wide range of studies and developed a range of management plans which provide essential information for the management of flood risk. The NSW Government's Flood Prone Land Policy and Floodplain Development Manual outline government policy and direction on policy implementation. The Manual is consistent with the National Best Practice Manual.

NSW flood related planning requirements for local councils are set out in Ministerial Direction No. 4.3 Flood Prone Land, issued under section 117 of the *Environmental Planning and Assessment Act 1979*. It requires councils to ensure that development of flood prone land is consistent with the NSW Government's Flood Prone Land Policy as set out in the *NSW Floodplain Development Manual 2005*. It requires provisions in a Local Environmental Plan on flood prone land to be commensurate with the flood hazard of that land. In particular, a planning proposal must not contain provisions that:

- permit development in floodway areas,
- permit development that will result in significant flood impacts to other properties,
- permit a significant increase in the development of that land,
- are likely to result in a substantially increased requirement for government spending on flood mitigation measures, infrastructure or services, or
- permit development to be carried out without development consent except for the purposes of some agriculture, roads or exempt development.

The direction requires that a planning proposal must not impose flood related development controls above the residential flood planning level (typically the 1% flood plus 0.5m freeboard) unless adequately justified to the satisfaction of the Department of Planning and Infrastructure.

The full direction No. 4.3 Flood Prone land can be obtained on line at: http://www.planning.nsw.gov.au/LinkClick.aspx?fileticket=dOkLhSFp9eo%3d&tabid=248&language=en-AU

When preparing comprehensive Local Environmental Plans councils use a Standard Instrument template which includes the following model provision (clause 7.3) for flooding in areas where flooding matters cannot be fully addressed by limiting land uses, such as where an existing zone and existing land uses include residential accommodation.

(1) The objectives of this clause are as follows:

(a) to minimise the flood risk to life and property associated with the use of land,

(b) to allow development on land that is compatible with the land's flood hazard, taking into account projected changes as a result of climate change,

(c) to avoid significant adverse impacts on flood behaviour and the environment.

(2) This clause applies to:

(a) land that is shown as “Flood planning area” on the Flood Planning Map, and

(b) other land at or below the flood planning level.

(3) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development:

(a) is compatible with the flood hazard of the land; and

(b) will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and

(c) incorporates appropriate measures to manage risk to life from flood, and

(d) will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and

(e) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

(4) Subclause (5) applies to:

(a) land shown as “projected 2100 flood planning area” and “projected 2050 flood planning area” on the Flood Planning Map; and to

(b) other land below the projected 2100 flood planning level and the projected 2050 flood planning level as a consequence of projected sea level rise.

(5) When determining development to which this subclause applies, council must take into consideration any relevant matters outlined in subclause 3(a) – (e), depending on the context of the following:

(a) the proximity of the development to the current flood planning area; and

(b) the intended design life of the development; and

(c) the scale of the development; and

(d) the sensitivity of the development in relation to managing the risk to life from any flood, and

(e) the potential to relocate, modify or remove the development.

Subclauses (4) & (5) can only be used once a council has identified the 'projected 2100 flood planning area' and 'projected 2050 flood planning area' as outlined in the Flood Risk Management Guide 2009, which updates the sea level rise information in the NSW Floodplain Development Manual 2005.

The flood clause accommodates climate change induced sea level rise as set out in the NSW Sea Level Rise Policy Statement, which sets sea level rise planning benchmarks of 40cm by 2050 and 90cm by 2100 relative to 1990 levels. The clause is also consistent with the NSW Coastal Planning Guideline: Adapting to Sea Level Rise that shows councils how they can incorporate the sea level rise planning benchmarks into their strategic and statutory land use planning and development assessment processes. This guideline is supported by the

In addition to the above strategic processes and provisions for development requiring consent, the NSW State Environmental Planning Policy (Exempt and Complying Development Codes) 2008, known as the Codes SEPP, aims to provide streamlined assessment processes for development that complies with specified development standards.

The Codes SEPP includes specific requirements for buildings proposed to be constructed on a 'flood control lot'. Clause 3.36C of the Codes SEPP is particularly relevant to the proposed ABCB Standard as follows.

3.36C Development standards for flood control lots

(1) This clause applies:

(a) to all development specified for this code that is to be carried out on a flood control lot, &

(b) in addition to all other development standards specified for this code.

(2) The development must not be on any part of a flood control lot unless that part of the lot has been certified, for the purposes of the issue of the relevant complying development certificate, by the council or a professional engineer who specialises in hydraulic engineering as not being any of the following:

(a) a flood storage area,

(b) a floodway area,

(c) a flow path,

(d) a high hazard area,

(e) a high risk area.

(3) The development must, to the extent it is within a flood planning area:

(a) have all habitable rooms no lower than the floor levels set by the council for that lot, and

(b) have the part of the development at or below the flood planning level constructed of flood compatible material, and

(c) be able to withstand the forces of floodwater, debris and buoyancy up to the flood planning level (or if on-site refuge is proposed, the probable maximum flood level), and

(d) not increase flood affectation elsewhere in the floodplain, and

(e) have reliable access for pedestrians and vehicles from the development, at a minimum level equal to the lowest habitable floor level of the development, to a safe refuge, and

(f) have open car parking spaces or carports that are no lower than the 20-year flood level, and

(g) have driveways between car parking spaces and the connecting public roadway that will not be inundated by a depth of water greater than 0.3m during a 1:100 ARI (average recurrent interval) flood event.

(4) A standard specified in subclause (3) (c) or (d) is satisfied if a joint report by a professional engineer who specialises in hydraulic engineering and a professional engineer who specialises in civil engineering confirms that the development:

(a) can withstand the forces of floodwater, debris and buoyancy up to the flood planning level (or if on-site refuge is proposed, the probable maximum flood level), or

(b) will not increase flood affectation elsewhere in the floodplain.

Because of the above strategic and statutory planning provisions that endeavour to keep residential buildings *away* from hazard areas, additional specific provisions have not been included in the NSW building regulations for buildings constructed in flood prone areas.

NSW defines 'flood prone land' as 'land subject to inundation by the probable maximum flood (PMF)'. This is consistent with definitions in SCARM (2000).[13]

[13] SCARM (2000) *Floodplain Management in Australia: Best Practice Principles and Guidelines*. Agriculture and Resource Management Council of Australia and New Zealand, Standing Committee on Agriculture and Resource Management (SCARM). Report No 73. CSIRO Publishing, 2000

B.7 South Australia (SA)

South Australia's initiative, 'Better Development Plans' (BDP) provides generalised policies for use in council development plans throughout the State. The intent behind the BDP is to promote best practice planning policy across all councils. Each council can then add to this base policy, more specific planning policy which relates to their circumstances.

It should be noted that all councils in South Australia are in the process of converting to the BDP policy system.

BDP provides general policy on flooding under the heading 'Hazards' – Principles of Development Control:-

Flooding

4 Development should not occur on land where the risk of flooding is likely to be harmful to safety or damage property.

5 Development should not be undertaken in areas liable to inundation by tidal, drainage or flood waters unless the development can achieve all of the following:

(a) it is developed with a public stormwater system capable of catering for a 1 in 100 average return interval flood event

(b) buildings are designed and constructed to prevent the entry of floodwaters in a 1 in 100 year average return interval flood event.

6 Development, including earthworks associated with development, should not do any of the following:

(a) impede the flow of floodwaters through the land or other surrounding land

(b) increase the potential hazard risk to public safety of persons during a flood event

(c) aggravate the potential for erosion or siltation or lead to the destruction of vegetation during a flood

(d) cause any adverse effect on the floodway function

(e) increase the risk of flooding of other land

(f) obstruct a watercourse.

Typically in South Australia, planning policy dictates design for the prevention of entry of floodwaters of a 1 in 100 year average flood event. Some examples of local government

development plan policy follows. The requirements are not prescriptive in building design but instead place the onus on the applicant to show that their building design will mitigate flooding.

B.7..1 Tea Tree Gully Council Example

Example of Tea Tree Gully Council Development Plan, following the BDP model for policy on development located in floodwater areas (excerpt below) and overlay maps (attachment 1 and 2). The overlay maps identify 'development constraints' which include mapping of river/creek floodwater areas.

Hazards

Flooding

4 Development should not occur on land where the risk of flooding is likely to be harmful to safety or damage property.

5 Development should not be undertaken in areas liable to inundation by tidal, drainage or flood waters unless the development can achieve all of the following:

(a) it is developed with a public stormwater system capable of catering for a 1 in 100 year average return interval flood event

(b) buildings are designed and constructed to prevent the entry of floodwaters in a 1 in 100 year average return interval flood event.

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(a) impede the flow of floodwaters through the land or other surrounding land

(b) increase the potential hazard risk to public safety of persons during a flood event

(c) aggravate the potential for erosion or siltation or lead to the destruction of vegetation during a flood

(d) cause any adverse effect on the floodway function

(e) increase the risk of flooding of other land

(f) obstruct a watercourse.

7 Development located in the River/Creek floodwater areas shown on Overlay Maps – Development Constraints should be able to demonstrate that it will not impact unduly on the free flow of floodwaters either upstream or downstream from the proposed development.

B.7..2 Adelaide Hills Council Example

The Adelaide Hills Council has the most detailed information on flood hazard, having two categories of hazard, being low to high category and extreme flood hazard category. The relevant parts are included below:-

Principles of Development Control

10 Development should not be undertaken on land subject to flooding as shown on Figures AdHiFPA/1 (attachment 3) to 19, or within other areas subject to flooding or inundation by a 100 year return period flood event, unless buildings are designed and constructed to prevent the entry of floodwaters from a 1 in 100 year average return interval flood event.

11 Development located on land subject to flooding as shown on Figures AdHiFPA/1 to 19, or within other areas subject to flooding or inundation by a 1 in 100 year average return interval flood event, should not:

(a) impede the flow of floodwaters through the land or other surrounding land;

(b) occur where the risk of flooding is unacceptable having regard to personal and public safety and to property damage;

(c) increase the potential hazard risk to public safety of persons during a flood event;

(d) aggravate the potential for erosion or siltation or lead to the destruction of vegetation during a flood;

(e) cause any adverse effect on the floodway function.

B.7..3 Gawler Council Example

Gawler Council has detailed policies surrounding the Gawler Rivers flood plains. Map GRFP/1 (attached) shows the extent of the policy area.

Gawler Rivers Flood Plain Policy Area

Introduction

In addition to the applicable zone policies, the Gawler River Flood Plain Policy Area policies apply to the area shown in: Maps Ga/13 to 20 and Figure GRFP/1 (attachment 4).

Applicable zones: Deferred Urban, Rural, Special Uses, Residential, Residential Historic (Conservation), Residential Park, Light Industry and General Industry Zones.

Desired Character

The Policy Area is defined by the Australian Height Datum (AHD) for the 1:100 year Average Recurrence Interval (ARI) flood level, taking into account also subsequent modification as a consequence of mitigation works to protect specific locations. The floodplain supports a range of rural and urban activities.

Rural Areas:

Agricultural production should continue in the rural areas of the Policy Area whilst the natural environment of the floodplain is maintained and protected with no new residential or other forms of built form in close proximity of the riverbank. Land uses or activities that are suitable in the Policy Area, subject to design considerations include:

(a) river structures for irrigation management (channels, pumping stands);

(b) recreation uses;

(c) continuation of existing primary production including horticulture, but with improvements to existing management practice and subject to conditions regarding protection from floodwaters;

(d) Upgrading or replacement of existing dwellings and ancillary buildings subject to conditions

regarding protection from flood waters, dwellings, providing there is 100 metre set-back from the top of the riverbank and the finished floor level is 300 millimetres above the Australian Height Datum (AHD) for the 1:100 year Average Recurrence Interval (ARI) flood level.

Urban Areas:

Infill residential development is provided for in residential zones, but in broadacre residential areas it is not appropriate for these to be developed until local or regional mitigation measures are installed. The following uses will be considered:

(a) dwellings in areas characterised by existing residential development providing the finished floor level is 300 millimetres above the Australian Height Datum (AHD) for the 1:100 year Average Recurrence Interval (ARI) flood level, but no dwellings in broadacre residential areas;

(b) elevated buildings in locations identified for recreation or business use;

(c) recreation uses.

B.7..4 West Torrens Council Example

Stormwater Management

Major system

74 The design of the land division should enable the major storm drainage system to have the capacity to safely convey major stormwater flows.

Design Techniques (Design Techniques illustrate ONE WAY of satisfying the above principle)

74.1 The major storm drainage system has the capacity to safely convey stormwater flows for Average Return Interval (ARI) = 100 years, assuming 50 percent minor system blockage; and

74.2 The major storm drainage system design outflow is matched to the capacity of any

existing downstream system.

74.3 The design of the stormwater drainage system shall be based upon the onsite detention of all stormwater (roof and surface water) exceeding a maximum permitted discharge of 20litres per second for a rainfall 1 in 20 years recurrence interval.

75 The arrangement of roads, allotments, reserves and open space should enable where possible as is required for water quality and use for non potable purposes the provision of a major storm drainage system that:

(a) contains and retains creeks and vegetation;

(b) incorporates, where practical, sports grounds and other less flood sensitive land uses;

(c) incorporates, where required, detention and retention basins;

(d) enhances residential amenity; and

(e) integrates with the open space system and provides recreational opportunities.

Minor system

76 The design of the land division should facilitate a minor storm drainage system which has the capacity for minor stormwater flows and should:

(a) not overload adjoining downstream systems; and

(b) where practicable, provide for stormwater to be detained and retained close to its source.

Design Techniques (Design Techniques illustrate ONE WAY of satisfying the above principle)

76.1 The minor storm drainage system has the capacity to convey stormwater flows for ARI = 5 years for suburban residential lots with neighbourhood densities(1) not greater than 20

dwellings per ha, and ARI = 10 years for neighbourhood densities greater than 20 dwellings per ha.

(1) Neighbourhood density means the ratio of the number of dwellings to the area of the land (including

associated neighbourhood or local facilities) they occupy. The area includes internal public streets, all areas of public open space, local community services, local employment areas, and half the width of adjoining arterial roads.

76.2 The minor system design outflow is matched to the capacity of any existing downstream system.

76.3 The design of the stormwater drainage system shall be based upon the onsite detention of all stormwater (roof and surface water) exceeding a maximum permitted discharge of 20litres per second for a rainfall 1 in 20 years recurrence interval.

B.8 Tasmania (TAS)

The TAS Building Act 2000 and the Building Regulations 2004 require that the floor level of habitable rooms must be 300mm above the prescribed designated flood level.

Ten mapped floodplains and other areas subject to flooding including tidal.

A new Statewide (Planning) Code is under consideration as part of a Planning Directive.

Local Government cannot have its own building related controls. Individual planning schemes may address flood prone land at this stage. Uniformity will occur under the Planning Directive

The Building Act 2000

159. Land subject to flooding

A person must not erect or place a building containing habitable rooms on land subject to flooding unless the floor level of each habitable room in the building is 300 millimetres or more above the prescribed designated flood level for that land.

The Building Regulations 2004

12. Land subject to flooding

For the purposes of section 159 of the Act, the following is the designated flood level:

(a) 600 millimetres above ground level or the highest known flood level, whichever is the highest, for land known to be subject to flooding other than as provided in paragraph (b) or (c);

(b) the level which has a 1% probability of being exceeded in any year for the following watercourse floodplains:

(i) the Derwent River through New Norfolk;

(ii) the upper reaches of the Tamar River and the lower reaches of the North Esk River;

(iii) the Huon River at Huonville and Mountain River;

(iv) the South Esk River through Perth and Longford to the Tamar River;

(v) the Jordan River below Pontville;

(vi) the Mersey River through Latrobe;

(vii) the Bagdad Rivulet;

(viii) the Elizabeth River through Campbell Town;

(ix) the Meander River through Deloraine;

(x) the Macquarie River through Ross;

(c) 600 millimetres above the ordinary high-water mark of the spring tide for land on which flooding is affected by the rise and fall of the tide.

Appendix C Extracts from the Guideline on Reducing Vulnerability of Buildings to Flood Damage

Extracts from the Guideline on Reducing Vulnerability of Buildings to Flood Damage.[6]

Table 4.3.1.2 Material Absorbency

Table 4.3.1.3 Materials for 96-Hour Immersion

For infrequent flooding (i.e. above the 1 in 100 AEP flood planning level) the degree of corrosion in heavier gauge mild steel nails and bolts used in timber framing and structural steel connections is unlikely to be critical to require avoiding mild steel. However, for all nails used for framing anchor and straps, AS 1684.2 requires corrosion protected flat head connector nails irrespective of their exposure to moisture.

4.3.1.2 Fastenings and Adhesives

The level of corrosion protection required for fixing hardware (nails, screws, hinges, etc.) depends on a number of factors. Better quality hardware should be used where:

• subject to frequent and/or prolonged wetting,

• it is structurally critical and at risk of severe corrosion,

• the hardware is difficult to examine periodically after a flood,

• the hardware is difficult to replace if severe corrosion does occur,

• inundation by seawater can be expected, and/or

• there is little cost difference involved.

Given that flooding is a relatively low probability in the life of a building placed above a flood planning level such as a 1 in 100 AEP event, most of the heavier mild steel gauge bolts, nails and screws used in structural applications such as timber framing or connecting steel beams do not warrant corrosion-free alternatives. Unless there is constant or prolonged wetting, corrosion should be limited and restricted to the surface. In a more corrosive environment or in critical areas, consideration could be given to using galvanised or stainless steel hardware. The definition of critical areas is somewhat subjective but they could be those satisfying one or more of points above.

Adhesives and sealants that are available for construction are made from a wide range of materials and their performance, when immersed in water, will not generally be obvious. Most perform poorly in this regard and great care should be taken in their application. Of the more

common materials solvent-based neoprene adhesives are the best, followed by rubber-based adhesives.

Of the less common materials two-part epoxies and polysulphide epoxy resins perform well. Among the common wood glues resorcinol based glues perform better than melamine urea formaldehyde. PVA glues are the most common wood glues; however, they absorb water and lose their strength. Sealants are also used for their bonding properties. Common sealants in order of greatest water resistance are:

• polysulphide sealants,

• silicone sealants,

• rubber-based sealants,

• epoxy putty,

• polyurethane joint filler (bitumen

impregnated), and

• water-based acrylic.

4.3.2 Types of House Construction

4.3.2.1 Traditional House Construction

The vast majority of houses are constructed from:

• brick veneer (a brick wall outside a frame structure),

• light-clad frame (a frame structure directly covered with materials such as timber, aluminium, vinyl, or fibre cement sheet or boards), or

• full brick (two brick walls separated by a cavity). Also referred to as double or cavity brick. Brick veneer and light-clad frame houses normally use a timber or light gauge steel frame which commonly has internal plasterboard lining. They are readily constructed by the building trades, such as carpenters and bricklayers, and are often the most cost-effective forms of construction especially for detached houses because the industry and market are geared to this product. Brick ties and other components that are embedded in mortar are a special case. It is well established that components in mortar corrode at a significantly higher rate than those in the air spaces within the building envelope. This is particularly the case if the mortar beds have been immersed in saline or brackish water. Thus it is a wise precaution to ensure that stainless steel or other high durability materials are used for brick ties.

All these forms of construction use a wall cavity, Figure 57 Concrete panel houses which have problems following a flood, such as trapping silt and retaining moisture in any wall insulation. These issues and possible solutions are discussed in Section 5.4.

4.3.2.2 Concrete Panel Housing

Construction techniques normally associated with commercial and industrial developments are now being used for unit, townhouse and other medium/high density residential developments, (Figure 57). The panels are durable, but depend on the connections to stay in place. If the connections are not appropriately designed and protected they may fail under load or may corrode over time.

Concrete Panel Housing (CPH) comprises external walls and often internal walls made of vertically positioned concrete panels. These can be either precast on site (tilt up construction) or made in a factory and transported to site for placement (precast construction), (Figure 58). The flood performance of CPH is excellent, due to its inherent strength and imperviousness. When used as an isolated concrete wall, i.e. without external cladding or internal lining, this form of construction will suffer no damage and will only need a hose and scrub down or, at the worst, repainting.

Many of the recommendations in these guidelines are applicable to CPH construction. As CPH is engineered for a specific design and constructed by specialists, these guidelines do not include detailed advice on CPH specific flood-effective designs. The principles of these guidelines can be easily applied in their design to suit floodplain conditions. Some important applications to be considered are:

• CPH is usually built with slab-on-ground floors, so in flood prone areas consideration should be given to raising the slab above the surrounding ground level with compacted fill (see Section 5.1.2). It is also practical to have CPH built with raised, suspended floors, using timber or steel framed flooring or suspended in situ or precast concrete slab floors.

- As the panels are reinforced concrete, the simplest approach is to design the walls to resist hydrostatic forces. If this is uneconomic, then it is vital to have near-floor level openings for the entry of rising floodwaters to prevent unbalanced hydrostatic forces forming (see Section 3.2.1). Section 3.2.1.3 gives advice on the provision of sufficient water inlets which can also allow outflow of receding floods. Construction details of openings are best left to the designer, but consideration should be given providing efficient floodwater entry and exit while also providing a thermal, vermin and intruder barrier.

• Minimum repairs are needed when the concrete panels are not lined or clad but rather have appropriate external and internal finishes applied. Acrylic painting of the wall is the simplest internal finish. CPH walls can also be lined internally with plasterboard placed either directly on

the wall or on battens (or furring channels) attached to the wall. Battened lining can be used in conjunction with insulation in locations requiring additional thermal insulation, (Figure 59).

While battened linings result in the formation of a cavity and a moisture trap, it does not reduce the flood advantage that CPH offers because the structural performance of the concrete wall will not deteriorate. Additional insulation should be incorporated in the wall itself in the form of sandwich construction, (Figure 60).

For the best flood performance, it is recommended that internal walls also be constructed from solid concrete rather than lined frames. Where internal linings are used over concrete panel walls, allowance should be made for water entry and exit near the skirting. Also where battens support the wall lining, they should be placed vertically wherever practical, to provide better drainage of floodwaters and an improved drying environment. The skirting should be removable or have perforations in water resistant material.

The use of metal door frames should enhance resistance to water damage.

Currently, CPH is economic in unit type developments where repetition and mass production of the panels reduces costs. However, CPH can be used for larger two-storey houses where CPH can be cost competitive with double brick construction.

More information on Concrete Panel Housing is available in the Cement and Concrete Association of Australia's publication "The Concrete Panel Homes Handbook", which can be downloaded from the website: www.concrete.net.au.

4.3.2.3 Blockwork Construction

The two most common forms of residential blockwork construction are:

• autoclaved aerated concrete (AAC) blocks, and

• concrete blocks.

Lightweight AAC blocks commonly used in residential buildings are very porous. If immersed, they can absorb a high volume of water and this can lead to damage of other components. The waterproof coatings usually applied on the exposed wall surfaces are to protect against light wetting, e.g. rainwater, rather than protecting against water immersion over several days. Wherever they are laid below ground, the usual recommendation is that they should be imperviously sealed e.g. with bitumous sealant. Thus without special treatment, they may not be suitable in flood prone areas, (Figure 61). In contrast, concrete blocks will not be damaged by floodwaters and can be easily cleaned after a flood. A house constructed of single-leaf concrete masonry and concrete floors, metal door frames with no skirting boards has very low vulnerability to water damage. In some climates the presence of empty cores in the blocks may

not provide sufficient thermal insulation and they may need to be lined or clad thereby increasing flood repairs (see Section 5.4.1 for problems with wall cavities).

Concrete block walls also have the benefit that they can be reinforced to increase their strength in bending, which brick constructed walls are unable to resist. Reinforced concrete or concrete block walls can also be used to provide extra strength to walls at risk from debris and flow velocity.

4.3.2.4 Other House Construction Types

There are a number of alternative construction methods and materials, including:

• mud brick,

• rammed earth,

• reverse masonry veneer, and

• straw bale.

As these types of construction are relatively uncommon area, they are not considered in these guidelines. Key considerations about their flood performance include:

• structural integrity of the material upon immersion,

• how the product and installation will affect drying time,

• the potential for deposition of floodwater contaminants in cavities, and

• the behaviour of the material in relation to other components.

The most important consideration is the effect of immersion for extended periods on the material. It is vital to realise that waterproof coatings may be sufficient to stop rain water from entering and/or damaging the integrity of the material, but quite often will not prevent damage when immersed in water.

4.3.3 Minimising Water Retention and Absorbency

The main factors influencing water damage are the duration of a flood, the length of time components stay wet, the materials used and the detailing. Water can be retained in all sorts of traps and hollows that are a problem in flood prone areas. These include:

• hollows around foundation piers and against sub-floor brick walls

• the space between the underside of kitchen cupboards and the floor

• the base of built-in wardrobes and similar areas

• undrained brick cavities in full-brick construction

• the base of brick chimneys

• under bathtubs and prefabricated shower trays

• sealed cavities in double-sided plasterboard walls and hollow core doors

• the spaces immediately above any ceiling, including the void between a ceiling and the floor immediately above in multi-storey construction.

Water that is retained in these places can delay drying out and promote corrosion in metal items and fungal decay in timber or other organic materials. A long duration flood allows water to soak into materials and sealed cavities, saturating them and maximising the potential for damage. For example, timber will become fully saturated and swell, the pore structure in concrete will become saturated, while the voids in hollow core doors and sealed stud and plasterboard cavities will fill up with water.

The drying time for a building that has been immersed for a prolonged period is measured in months. The damage caused can vary, from mechanical damage caused by timber swelling through to the disintegration of some materials and the onset of fungal decay and corrosion. This will be worsened by the presence of trapped silt and/or absorbent wall and ceiling insulation.

The following four steps will minimise the potential for water absorption and water damage:

1. Choose materials and construction details that are critical to the minimisation of these effects.

2. Choose materials that are not affected by water.

3. Avoid moisture traps in house designs and during building by ensuring clean and tidy construction e.g. wall cavities kept free of building debris and waste.

4. Seal porous materials against water entry. For example, sealing the end grain of timber can significantly decrease water absorption as the open end grain can absorb water at a rate up to 10 times that of the side grain. Some tests have shown that perhaps the best end grain sealer is two-part polyurethane filler or two coats of oil-based primer. The latter is likely to be slightly less effective but easier to apply. Other products may be satisfactory but, because of the problems with reapplying the sealer once constructed, a check should be made with the manufacturer that the product has been proven to provide long-term protection against water absorption without cracking or peeling. Section 5 addresses in more detail what can be done for the individual components within a house.

4.3.4 Maximising Drying Rates

Ensuring rapid drying of house components after flooding is very important to minimise:

• the chance of structural damage to timbers used for framing, flooring systems, etc. and

• the risk of damage to finishes and finishing.

Houses cannot be reinstated until any permanent loss of strength to structural components is addressed and everything in the house is completely dry. Replacement of plasterboard, carpets etc. should only occur after the adequacy of the post flood structure is certified.

Typical Drying Times

The times required for building components to dry out can be substantial and thus the time required before repairs can be made will also be substantial. In Table 4.3.4, estimates of the drying times required for components and the waiting times prior to repair are given for solid brick, brick veneer and timber clad structures.

These drying times are for Sydney during winter and Figure 62 contains a diagram with correction factors. These factors are presented as a function of maximum daily temperature and 3 pm relative humidity. Thus, the average 3 pm relative humidity and the average maximum daily temperature in Sydney during winter are 52% and 17ºC respectively, and the correction factor is 1.

In contrast, the conditions for Richmond (NSW) during summer are significantly drier and hotter, with the average maximum daily temperature being 30ºC and average 3 pm relative humidity 47%, and thus the correction factor is 0.5 so that all the suggested drying times could be halved. These drying times are provided only as a guide and such factors as post-flood weather conditions, house aspect, ventilation details, etc will influence the times. For example, following a flood, extreme weather patterns may persist. Under these circumstances, it would be advisable to adopt a slightly more conservative correction factor to cover this variability. Instances where components have not dried after the suggested drying time has elapsed, may simply reflect differences in house type, microclimate variability etc. Where components remain wet after the elapse of twice the proposed drying time, suggests that there may be factors, such as trapped moisture or restricted ventilation, which can delay drying.