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Potential Impacts of Climate Change Related Extreme Weather Events on NSW Healthcare Infrastructure

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Centre for Health Assets Australasia

POTENTIAL IMPACTS OF CLIMATE CHANGE RELATED EXTREME WEATHER EVENTS ON NSW HEALTHCARE INFRASTRUCTURE

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NSW HEALTH ENVIRONMENTAL HEALTH BRANCH
CENTRE FOR HEALTH ASSETS AUSTRALASIA (CHAA)

REPORT

Potential Impacts of Climate Change Related Extreme Weather Events on NSW Healthcare Infrastructure

Due acknowledgement is given for the input provided by Glenis Lloyd, NSW Health Environmental Health Branch

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EXECUTIVE SUMMARY

Recent events in both the Australian and wider context illustrate the potentially serious disruption to health service delivery that may occur as a result of the impact of extreme weather events on health facility infrastructure. Should health facilities fail as a result of these events, the health of a community may be compromised and there are local and international examples demonstrating this connection.

Reviewing recent history provides many examples of extreme weather impacting on the Australian health system. In 1974 Cyclone Tracey destroyed Darwin, killing and injuring many citizens and requiring evacuation of much of the population to other Australian cities so that Darwin could be rebuilt. The local health system was simply unable to cope with the increased burden place on it due to the damage and destruction of infrastructure plus the number of people who required assistance in meeting their most basic needs.

More recently, the Central Coast NSW heatwave in early January 2006 placed a burden on that community and its health infrastructure. Presentations to the local hospital emergency department increased and these threatened to overwhelm available capacity. Anecdotal evidence suggests that many were seeking to escape the heat by availing themselves of the air conditioning in the hospital. In addition, bushfires caused by the heat and prolonged drought cut major access routes and reduced air quality causing further health impacts. Fortunately rain fell, dramatically ending the state of emergency, but if this had not occurred, the situation could have become much more serious with a far worse outcome. Likewise as a result of Hurricane Larry in Queensland in March 2006, Innisfail Hospital was forced to close necessitating the provision of medical support to the community by Townsville and Cairns Base Hospitals. Herberton Hospital was without power for a period of time and leaking roofs forced the need for emergency evacuation. More recently the rainfall and floods in the Newcastle region (mid 2007) that impacted on the Hunter-New England Area Health Service due to flooded access roads, leaking roofs, health staff unable to access their work places, etc, illustrate the threats posed by extreme weather to a region disturbingly close to major population centres.

International examples include the widely documented aftermath of Hurricane Katrina in the US city of New Orleans in 2005 which destroyed most of the health infrastructure together with much of that city. The European heatwave off 2003 that caused many deaths in Europe especially in elderly population groups living alone or in nursing homes is another recent example.

Recent reports by the International Panel on Climate Change (IPCC) and other bodies conclude that climate change is increasingly affecting the variability and intensity of extreme weather events and the impact these will have on human settlement. Although mitigation of climate change continues to be pursued, adaptation initiatives are now receiving greater attention and this study fits with the increasing focus on safeguarding critical community infrastructure being pursued as part of these initiatives.

The study has been undertaken at the request of the NSW Health Environmental Health Branch as part of the *Human Health Impacts of Climate*

Change Adaptation Project funded by the NSW Greenhouse Office. That project was designed to provide research evidence and develop policies and programs that will enable NSW government service providers to adapt to the potential impacts of climate change.

The study is a preliminary investigation of the adaptive capacity of NSW Health infrastructure, in particular health facilities, to increasing incidences of extreme weather events likely to be generated climate change. The IPCC definition has been adopted for the term 'adaptive capacity', which is 'the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences'.

The study identified a range of potential adaptation strategies for NSW health facilities in coping with extreme weather events. More specifically it:

1. Explored the impacts that extreme weather events may have on health buildings specifically in the context of the NSW climate (but with reference to the wider Australian context), focussing on the differing requirements by location.
2. Investigated the suitability and applicability of the suggested responses (gleaned from the existing literature) from a health infrastructure perspective
3. Assessed the 'adaptive capacity' of health infrastructure in the light of health, social, financial, technological, and political impacts in Australia resulting from climate change
4. Where possible, it attempted to align potential strategies with existing disaster planning strategies

Finally a draft Action Plan has been developed that summarises the identified key risks and opportunities, and proposes a strategy for dealing with each of these. In doing so, it also assesses where further research and investigation are required in order to develop a cohesive NSW strategy for dealing with the impact of extreme weather events on health infrastructure.

TABLE OF CONTENTS

INTRODUCTION 1
AIMS AND OBJECTIVES 2
METHOD 2
ANALYSIS 3
RESULTS 5
PROJECT OBJECTIVE 1 5
PROJECT OBJECTIVE 2 11
PROJECT OBJECTIVE 3 17
PROJECT OBJECTIVE 4 20
DRAFT ACTION PLAN FOR IMPLEMENTATION OF PROJECT OBJECTIVES IN RESPONSE TO WORKSHOP FINDINGS 23
CONCLUSION 29
APPENDIX A – WORKSHOP PARTICIPANTS 30
APPENDIX B – WORKSHOP REPORT 32
APPENDIX C - REFERENCES 55

INTRODUCTION

The Centre for Health Assets Australasia (CHAA), based in the Faculty of the Built Environment at the University of NSW, was engaged by the NSW Health Environmental Health Branch to undertake a project examining the implications of climate related extreme weather events for NSW health facilities. This project is part of NSW Health's larger *Human Health Impacts of Climate Change Adaptation Project* funded by the NSW Greenhouse Office which is designed to provide research evidence and develop policies and programs that will enable NSW government service providers to adapt to the potential impacts of climate change.

This study is intended to undertake a preliminary investigation of the adaptive capacity of NSW Health infrastructure to climate change. For the purposes of this study, the IPCC[1] definition has been adopted, whereby 'adaptive capacity' is 'the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences'.

The 2006 United Nations Framework Convention on Climate Change (UNFCCC) Adaptation Framework notes that 'Until recently, policy makers concentrated on mitigation, partly because of worries that highlighting adaptation options might reduce the urgency for mitigation…mitigation and adaptation are not alternatives; both need to be pursued actively and in parallel. Mitigation is essential and adaptation is inevitable.'[2] This study has necessarily considered both of these approaches in the background research and in the risk management workshop. However the primary focus is on development of the adaptation strategies required to safeguard essential NSW Health infrastructure i.e. health buildings.

The risk management approach towards adaptation strategies adopted by this study has been developed in accordance with recommendations made by the UNFCCC, the Australian Greenhouse Office[3], the CSIRO[4], UK Climate Impacts Program (UK CIP)[5] and other authorities that adaptation is best considered from a risk management perspective. In addition, a Norwegian study noted that: 'Reducing the potential for defects or damage through the development of technical and organizational preventive measures (a risk management strategy) while at the same time applying the precautionary principle and discursive strategies in the design, construction and geographical localization of buildings, is likely to increase the robustness of the built environment in the light of the unknown risks of future climate change.'[6].

The ROMS (Risk and Opportunity Management System) methodology is a decision-making and problem solving tool that was used to conduct the risk management workshop held for this project. This tool was used to assist the invited participants (health facility managers, clinicians, planners and other stakeholders) in assessing the identifiable risk and opportunities associated with climate change and need for the development of adaptation strategies for NSW Health infrastructure. In accordance with the project objectives, the intent of these strategies was to enable appropriate responses to be

developed to cope with the predicted increases in the variability and severity of climate change generated extreme weather events.

AIMS AND OBJECTIVES

The parameters of the study were deliberately restricted to focus on the health facility-related impacts of extreme weather events increasingly associated with climate change. These include increasing incidences of heatwaves (associated with drought and bushfires), floods, and storm surges. It is anticipated that appropriate planning and design will reduce the potential adverse impacts of extreme weather events on health facilities and consequently on the health of the community. This will ensure that health facilities are able to cope with the increased demands placed on them as a result of natural disasters, including being able to keep operating efficiently and effectively. Facilities may need to support an increased demand for health services (due to illness and injuries) at the same time as withstanding the physical impacts of extreme weather events. For example, at such times, power and water supplies should be reliable, building fabric should not flood, leak, collapse or blow away, and access routes to hospitals should not be compromised by flooding, fallen trees, smoke, or other debris.

In consideration of recently demonstrated impacts of extreme weather events on Australian and overseas community infrastructure, the overall objective of this study became the identification of a range of potential adaptation strategies for NSW health facilities that would enable them to cope with extreme weather events. More specifically it aimed to:

1. Explore the impacts that extreme weather events may have on health buildings specifically in the context of the NSW climate (but with reference to the wider Australian context), focussing on the differing requirements by location.
2. Investigate the suitability and applicability of the suggested responses (gleaned from the existing literature) from a health facility perspective
3. Assess the ‘adaptive capacity’ of health infrastructure in the light of health, social, financial, technological, and political impacts in Australia resulting from climate change
4. Where possible, align potential strategies with existing disaster planning strategies

Finally it aimed at developing an Action Plan that summarises and prioritises key risks and opportunities associated with appropriate adaptation responses to climate change in the NSW context, including an outline strategy for dealing with each of these. In doing so, it also determined where further research and investigation are required in order to develop a cohesive NSW strategy for dealing with the impact of extreme weather events on health facilities.

METHOD

To enable the maximum input of key stakeholders in achieving the above objectives, a two-staged Risk and Opportunity Management Workshop was held on 1 March 2007 and 4 April 2007. The workshop was facilitated by

Professor Martin Loosemore of UNSW, using the ROMS (Risk and Opportunity Management System) methodology to develop an Action Plan for addressing the identified risks and opportunities associated with climate change for NSW Health facilities and determining future research directions. Briefing papers were prepared for the workshop outlining the parameters of the problem to be considered and following opening remarks made by the project sponsor (Glenis Lloyd of the NSW Health Environmental Health Branch) the process followed the format as set out below.

ROMS Methodology

Workshop 1

Step 1: Stakeholder analysis and common objectives

Step 2: Identify risks and opportunities to those objectives

Step 3: Assess their magnitude and prioritise them

Workshop 2

Step 4: Develop an action plan to minimise risks and maximise opportunities

ANALYSIS

The first workshop commenced with a discussion that resulted in the participants endorsing the following common objectives for the study:

1. *Quantifying impacts*

To develop a research program to identify, analyse and assess impacts of extreme weather events on health infrastructure.

2. *Evidence-based practice*

To identify a range of potential facility-related responses to challenges posed by climate change to human health, that may assist in influencing potential funders of climate change research.

To ensure practitioner/researcher engagement to facilitate evidence-based practice by clearly linking research results to the management and operation of facilities, ensuring research is relevant, practical and disseminated in a usable format.

3. *Asset management planning*

To ensure procurement, design, facility management, urban planning and asset management planning strategies enable effective health service responses to climate change and do not exacerbate problems in event of a crisis.

4. *Ensuring behavioural change*

To raise awareness of climate change including changing public expectations and behaviours, securing demonstrable support from industry stakeholders by means of communication and education.

5. *Integrated planning*

To ensure a coordinated cross jurisdictional response to climate change at internal, local and society level involving: disaster planning; emergency services, private health care sector, and other non-health care community services.

Risks and Opportunities associated with achieving these objectives were discussed with workshop participants and the likely probability of each of these occurring was identified ranging from 'rare' to 'almost certain'. The consequence or impact of a risk or opportunity occurring was then considered in terms ranging from 'insignificant' to 'extraordinary' impact. The two scales were combined in a matrix that enabled ranking of all the risks and opportunities from 'low' to 'high'. Finally all risks and opportunities were assessed in terms of 'imminence' – how soon they would occur and 'controllability' – the degree to which they could be managed.

The risks and opportunities that could affect the achievement of the common objectives as identified by the workshop participants and that were assessed to be of high impact, imminence and controllability were ranked and addressed in development of the action plan during and after the second workshop. They are also discussed in terms of the previously identified NSW Health objectives for the study in the following report of the results.

More detailed results for each step of ROMS Methodology are included in the appendices to this report. These include details of all the risks and opportunities identified and information regarding the ranking of these using the ROMS methodology.

RESULTS

PROJECT OBJECTIVE 1

Explore the impacts that extreme weather events may have on health buildings specifically in the context of the NSW climate (but with reference to the wider Australian context), focussing on the differing requirements by location.

Effects of Climate Change on Human Health and Health Infrastructure

The following table sets out examples of climate change related health and facility impacts that have already been seen in Australia and overseas.

Events	Health impacts	Facility impacts
Heatwaves (and Bushfires)	In Australia and other countries, heatwaves are responsible for more deaths than any other natural hazard but are mostly underrated because they are viewed as a 'passive' hazard in contrast to the more catastrophic hazards such as tropical cyclones or bushfires (Emergency Management Australia, 1998, Bureau of Meteorology, 2006). Heatwaves are likely to affect the elderly and other vulnerable populations (very young, dependent on alcohol or other drugs, chronically ill, etc) causing them to seek admission to health facilities due to increased incidence of CVD and other ailments.	During the Sydney heatwaves in 2005 "one hospital has been swamped by people not needing medical treatment - simply looking to take advantage of its spacious air conditioned reception area" (Mercer, 2001). A 7-day heatwave in Adelaide in February 1997 caused hospital computers to overheat and fail (Emergency Management Australia, 1998). Water shortages and water supply failures may also become a problem during prolonged heatwaves as demand for water may increase dramatically. Transport systems may also suffer from problems and interruption due to possible heat-related expansion of railway lines and steel bridges, and other associated damage to roadways (Emergency Management Australia, 1998).
Floods	The flooding of the river Elbe in 2002 in Saxony/Germany required immediate public health action in order to ensure a proper public hygiene response (Meusel et al., 2004). Floods are significantly likely to result in degradation of human health and loss of life, high financial cost, trauma and	Where health facilities are flooded, electrical power outages may be unavoidable. In the UK in June 2005, Warwick Hospital evacuated emergency patients by ambulance and helicopters to other facilities (BBC News, 2005). Flooding may also create an access problems for physicians and other staff

	associated human misery (Schreider et al., 2000, Meusel et al., 2004, Kundzewicz, 2002)	travelling to and from the hospital (Cocanour et al., 2002) The floods in the Hunter New England Area Health Service region in July 2007 similarly created access problems for staff who in many cases were also trying to protect their own families and property from rising water and other damage at the same time. (Newsletter for HNEH staff from CEO, 12 June, 2007)
Storm surges	93 hospitals were adversely impacted Hurricane Katrina in the Southern USA in 2005, with 19 hospitals being evacuated and another 18 being closed (Planning 2.0, 2005). Numerous deaths were attributed to transportation shortages, although evacuation measures were aided by helicopters, buses, and ambulances. In March 2006, Tropical Cyclone Larry crossed the tropical north Queensland coast near Innisfail, giving pressure to medical services (Emergency Management Australia, 1998, Queensland Government, 2006), although at a much smaller scale than Hurricane Katrina.	Water pushing several kilometres inland where land is low lying may potentially knock down health facilities and wash away roads (Commonwealth of Australia, 2006, Meusel et al., 2004, Joint Commission on Accreditation of Healthcare Organizations, 2006). In March 2006, Cyclone Larry in north Queensland, the Innisfail Hospital was forced to close, thus requiring medical support from Townsville and Cairns Base Hospitals. Herberton hospital was without power until a generator was provided and leaking roofs resulted in emergency evacuation (Emergency Management Australia, 1998, Queensland Government, 2006).

Table 1: Health and Facility Impacts associated with Extreme Weather Events

This study did not seek to precisely quantify the predicted effects of climate change on human health (or predict quantifiable increases in demands for specific health services) as such predictions require the professional expertise of epidemiologists or public health experts. However, the background briefing for the workshop and introductory remarks by NSW Health noted outline findings documented by other parties from journals and government reports. Many of these are included in the table above.

The change in weather patterns, including increased variability and extremes, suggest that patterns of disease will alter both within NSW and Australia generally. Health infrastructure may come under pressure as a result of those seeking refuge from extreme events (heat, storms, etc) and it may also be subject to increased demands by those suffering injury or ill health as a result of such events (e.g. elderly or vulnerable populations suffering from heat stress related to extended periods of higher than normal temperatures).

Public health expects such as McMichael, Woodruff and others[7] [8 9]have written on the likely impact of climate change on human health needs in the worldwide and Australian context. The UNFCCC[10] report noted that 'the

IPCC has concluded that climate change is likely to undermine health mainly within tropical and subtropical countries and predominantly in lower-income populations'. In discussing developed countries, it acknowledges that these will be in a stronger position and likely to be able to use existing public health strategies, augmenting or improving these as necessary to cope with increased risks. However, the report does note that even developed countries have pockets of at-risk populations who will require protection during incidences of extreme weather events such as heatwaves – as demonstrated by events in Europe in 2003.

Heatwaves in particular will cause an increase in illness and death rates, with the demand on health facilities manifesting as increased hospital admission rates and emergency department presentations. Recent work undertaken by the NSW Health Environmental Health Branch looking at the Central Coast Heatwave in 2006 suggest that presentations will begin to increase after two to three days of intense heat peaking up to one week after the rise in extreme temperature. (Glenis – can you expand on this please? And give a reference here?)

Our Current understanding of Climate Projections and Impact on Weather Patterns in the NSW and Australian Context

NSW CLIMATE PROJECTIONS

The current literature on climate projections for NSW suggests an increase of 0.4-2.0°C on average temperatures by 2070, with the following climatic impacts[11 12 13]:

- Warmer average annual temperature
- 50-100% more hot days 35°C and fewer cold nights. Sydney may average 4 days over 40°C per year and Canberra 10 days. It is also projected that there will be 100-200% more hot days over 40°C at Cobar, Walgett, and Wilcannia
- More frequent heatwaves
- 70% increase in droughts
- 10-20% increase in the intensity of extreme daily rainfall

AUSTRALIAN CONTEXT

The following predictions have been made in regard to the effects of climate change on the Australian climate[1]:

- Increased annual average temperature of 0.4-2.0°C by the year 2030
- More heatwaves and fewer frosts
- Prolonged drought and heavy rains
- More severe wind speed in cyclones and storm surges
- More frequent storms and bushfires
- Changing ocean currents which affect coastal waters

OTHER STATES CLIMATE PROJECTIONS

With an increase of 0.4-2.0°C, the projected impacts on other States include[14]:

- Reduction in rainfall hence reduction in runoffs in Southern and Eastern Australia
- South Australia : 18% increase in the annual days above 35°C
- Northern Territory : 25% increase in annual days above 35°C
- Victoria : 6% decrease in extreme daily rainfall with 25% increase in 100-year storm tides along eastern coast
  Victoria
- Queensland : 100 year storm surge height around Cairns increases by 22% and area flooded doubles.

SUMMARY: CLIMATE PROJECTIONS

Most research has focussed on developing predictions based on an expected increasing average number of events, rather than the increasing unpredictability of not only the number, but the severity and impact of the events. This type of analysis provides little insight into the nature, severity and location of climate-related extreme weather events. Until recently, the finest level of detail for predicted events was available at a geographic scale consistent with assessment at whole of State level and as a result there was insufficient data for this study to analyse in terms of predicting how different regions and health facilities within NSW will be impacted with any degree of accuracy.

However recent developments including the use of LIDAR to map terrain and further targeted CSIRO research in the near future will enable more precise future assessment of the impact of climate change generated weather events on smaller geographic regions or localities within the State. It should then become possible to map the location of key facilities and assess the likely impact from extreme weather events more accurately.

We do know already however that there is an increased likelihood of more frequent rainstorms and strong winds (and greater fire risks) are also noted. The variability of the incidence, severity and impact of these events will also increase.

While much of NSW will be drier, heavy rainstorms may be more frequent in central and south-east NSW, and in the far north-east, particularly in summer. In autumn and winter, heavy rainstorms are likely to increase in the centre and north-west of the State, and decrease on the coast. Increased average wind speed and extreme winds are expected in spring (greatest across central NSW). Along with these climate projections, it is also noted that the “loss of life, and the impact on hospital and emergency services, through extreme weather events is likely although not predictable”[15]. Consequently, “a major challenge in Australia is how to protect and improve public health systems…”[16]

This may require changes in the adaptive capacity of health facilities in NSW, as a direct result of changes to the climate of NSW, but also possibly resulting from changes in other States (or indeed countries), that may trigger changes in the pattern of migration that will impact on the use of NSW health services. The aftermath of Cyclone Tracey, in Darwin in 1973, and of the Bali Bombings in 2002, demonstrates the impact that events in other locations can have on NSW health facilities.

Health facilities must be able to respond to such events, and in doing so possess sufficient capacity to be able to moderate the influences of extreme weather (and other catastrophic events) on human health[17].

Barriers to understanding

While calls for responses to extreme weather events are evident within the literature, the workshop identified that a key barrier to moving forward with adapting to extreme weather events was the lack of understanding of the likely quantum and nature of the impacts of such events on health facilities. In particular, prior to any attempts at adaptation, the quantification of the impacts of climate change and the resulting extreme weather events was considered key to reinforcing understanding of the immediacy and severity of problem.

It was pointed out that although awareness of climate change has permeated through the government system and other funding bodies, many were still uncertain about its impact on Australia, the health of its community, and hence its health services and infrastructure. It was also noted by workshop participants that there appeared to be uncertainty (and confusion) surrounding the government's commitment to pursuing the adaptation route for health infrastructure as opposed to mitigation strategies. To date, the lack of research in this area and other competing priorities in funding allocation further discouraged any attempts to explore health infrastructure adaptation to extreme weather events.

However it was also noted that this project demonstrates a commitment to exploration of the issue by the NSW government including highlighting the areas of knowledge that do exist and that could be further pursued. Ideally this would occur with national leadership and incorporate similar information and strategies that would also be applicable in other areas of Australia.

In addition, although some research has been undertaken in the NSW context, it remains difficult to specifically determine quantifiable demands for health services as a result of the likely impact of climate change on human health. This makes it difficult to understand exactly how increasing incidences of extreme weather events will affect the utilisation of health facilities e.g. whether it will double or triple attendances at emergency departments after several days of above average temperatures. Clearly, detrimental effects on human health will occur due to floods, storm surges and similar events. These will manifest as incidences of acute trauma, water borne diseases and mental health episodes requiring care. A larger scale adaptation project has already clearly identified those who may be at risk in a heatwave situation in NSW. (Glenis – further information or reference please?)

Actions to enhance understanding

Research has already focussed on climate change related impacts on human health on a regional basis, although current information regarding Oceania and the specific Australian context is considered neither relevant nor up to date. Despite this, Campbell-Lendrum and Woodruff[18] highlight the need for a risk assessment framework approach to be applied to this issue that would use both traditional epidemiological methods in conjunction with consideration of the specific characteristics of climate change on a region by region basis. However, this study also notes that 'The attempt to carry out a full accounting of the health impacts of climate change rapidly clarifies significant knowledge gaps', which require further research to obtain more useful predictions of these impacts.

The use of GIS and LIDAR mapping to examine the impact on real locations of the predicted increasing incidence and variability of extreme weather events are feasible techniques already being used. These mapping techniques could be used to model the impact of the impacts of climate change on existing health facilities and to assess the suitability of proposed locations (or necessary re-locations) of future facilities.

The ROMS workshops suggested that our understanding of how extreme weather events will impact on health facilities should be addressed by a range of strategies, particularly those emphasising clear and effective communication with stakeholders. One strategy proposed suggested inviting influential or credible bodies of researchers to provide scientific information and evidence to point out the potential immediacy and severity of the likely impacts of extreme weather events on human health and health infrastructure in NSW. In particular, it was also noted that clarity of message and early assessment of gains from pursuing the adaptation route were important.

Other suggested strategies included:

- Releasing research publications reporting on influential forums and work by respected research bodies via those who can influence the community's climate change adaptation agenda. This may include seeking endorsement and dissemination of information through organisations such as the AMA, insurance bodies, hospitals, local government, etc
- Maintaining the relationship of project objectives to a wider national research agenda
- Engaging with leading and/or credible researchers in the area (particularly in terms of applied research)
- Clarifying the extent of problems and costs that may be associated with neglecting the necessary adaptation efforts
- Identifying possible adaptation strategies for health facilities in terms of suggested future projects, costs, programmes, actions and demonstrable outcomes.

PROJECT OBJECTIVE 2

Investigate the suitability and applicability of the suggested responses (gleaned from the existing literature) from a health infrastructure perspective.

In line with the above project objective, the workshop confirmed and further identified that "evidence-based practice" was an important factor to be considered when determining the suitability and applicability of potential strategies for health services and infrastructure in adapting to extreme weather events.

A range of suggested responses gleaned from the existing literature is set out in the table below.

POTENTIAL ADAPTATION RESPONSES FOR HEALTH INFRASTRUCTURE (compiled from the literature)

EVENT	STRATEGY	OPERATIONAL	DETAILS	Notes
1. Heatwaves	Facility planning	Urban design	Urban ventilation Air quality Thermal situation and shading conditions	
		Landscape design	Green spaces Water bodies Courtyards	
		Building design	Building layout Building orientation and shading Building height and shape Window size and location Colour of building Thermal properties of building materials	
	Facility maintenance	Fittings	Fans Water sprays Windows	
		Equipment	Fridge	
	Services	Cold menus	Water Ice Cold drinks	

		Thermal control	Draw curtains Put patients in cool room Ensure night ventilation	
2. Floods	Facility planning	Policy and legislation	Land-use planning and management Zoning delineation Development control of flood hazard areas Leaving floodplains with low-value infrastructure Buy-out land and property located in floodplains Flood proofing (by elevation, barriers, or sealing)	
		Building design	Deeper foundation Flood proofing (eg doors, walls, etc)	
		Building fitout	Emergency power generator Emergency communication system Emergency lighting	
	Facility maintenance	Fittings	Power generator Communication system Lighting	
	Services	Warnings	Water consumption advice Warnings to boil water Advice on possible contaminated foods Prohibit children from playing/bathing in flood waters Advice on mud removal from flooded households	
		Awareness raising	Information & education Actions in emergency	

			Community self-protection teams	
		Evacuation	Develop evacuation procedure Often without power Increased focus on oxygen-dependent patients	
3. Storm surges	Facility planning	(may follow flood protection measures)		
	Facility maintenance	(may follow flood protection measures)		
	Services	Evacuation	Understand location / extent of surge-prone areas (local Emergency Services / council) Decide on evacuation strategy to move to higher grounds Evaluate the best way to get there	

Table 2: Potential Adaptation Responses for Health Infrastructure gleaned from the literature

Current understanding

Case studies on the health impacts of previous extreme weather events, such as heatwaves, floods, and storm surges are available, although most are anecdotal. Some examples were listed in Table One under project objective #1 above**Error! Reference source not found.**. However, research efforts to understand the impacts of extreme weather events on health services and health facilities are few and to date have not provided a comprehensive understanding of effective response strategies. The table shows potential facility impacts already demonstrated to be associated with the health impacts generated by the identified list of extreme weather events. However, it is still difficult to find adequate examples of research, or indeed examples from real life projects for translation into a more generalisable and effective response strategy.

However, the health of the Australian community (or parts of it) will suffer due to an increasing incidence of extreme weather events. For example, the recent case studies of heatwave incidents on both the Central Coast of NSW and in Adelaide South Australia suggest that heatwaves in particular place pressures on health systems due to an increased rate of hospital admissions and excess demands on healthcare, especially for people with pre-existing medical conditions, who require more complex medical attention and potentially longer stays in hospitals. (Glenis – references?)

However, as noted in the previous section, precise quantification of these pressures is yet to be achieved and require further research by public health experts and those managing health services.

Barriers to enhancing understanding

The ROMS workshops indicated that an evidence-based approach must underpin adaptation strategies that are intended to respond to the threats posed by climate-related extreme weather events. However, the need to include adaptive strategies in the current health facility procurement processes has not yet been considered (i.e. design documentation and tender processes do not yet incorporate this requirement). Other difficulties in adopting this approach included the lack of evidence regarding the translation of adaptation strategies into facility requirements and designs, and the likely costs associated with these.

It should also be recognised that the current health facility procurement processes are derived from the commercial realities associated with competitive tendering processes, and exist in a political climate faced with increasing expenditure needs for health service delivery and facilities. Thus the need for greater apparent ‘efficiency’ in the spending of public monies often becomes the highest priority, and this usually involves the need for reductions in initial capital costs. This may often have implications for increased overall life cycle costs for such facilities but as these usually manifest well beyond the current term of the incumbent government they become of little consequence in making present day decisions, may be easily overlooked or sometimes even deliberately ignored.

Should the need for incorporation of adaptation strategies into healthcare design and facility maintenance be determined, this may well increase initial

health facility capital costs. This could conflict with current project delivery and funding processes as noted above, and thus provoke resistance in those funding health capital projects to incorporation of adaptation requirements.

Actions to enhance understanding

Several strategies were identified to encourage a better understanding of the suitability and applicability of adaptive responses through evidence-based practice. These included the development of innovative strategies through multi disciplinary research that should include accurate forecasting of implementation costs. To maximise the likelihood of implementation of these strategies, they should where possible align with current government policies and practices. In effect they would become an extension of existing processes and procedures and require minimal additional staff or equipment for implementation.

In addition, clinical and asset management practices could be influenced by means of demonstration projects showing the implementation of health infrastructural adaptation strategies and ongoing evaluation of these. In addition, practices could also be influenced directly through development and implementation of government policy.

In particular, future efforts should include:

- Translating research into a practical, applied format
- Disseminating information through appropriate sources, demonstration projects, etc
- Providing evidence of cost, safety, social benefits (including reduced operational costs, etc)
- Where possible develop strategies that require incremental adjustments to existing processes and procedures, rather than imposing new or additional burdens
- Influencing health care project procurement processes to ensure those assessing project tenders recognise and reward the value embodied in innovative adaptation strategies for health infrastructure.

PROJECT OBJECTIVE 3

Assess the "adaptive capacity" of health infrastructure in the light of healthcare, social, financial, technological, and political impacts in Australia resulting from climate change.

Although research has been undertaken into the effects of climate change on the incidence of extreme weather events and to a lesser extent into the effects of changing climate on human health, comprehensive identification of the impacts on social, financial, technology and the political climate are still at a relatively early stage. The workshop identified the lack of certainty around how climate change will impact the Australian community, and that a sense of urgency was beginning to become apparent but was yet to be translated into policy and adaptation strategies.

However, the ROMS workshop did confirm that changing attitudes towards adaptation and then "ensuring behavioural change" is an important factor in enhancing the "adaptive capacity" of health facilities to cope with extreme weather events.

Current understanding

Table 3 summarises the various potential responses of health services and facilities to extreme weather events, which have been identified through existing research. These include immediate responses such as evacuations, as well as long-term responses to help mitigate the risk of facility failures. However, as noted in previous sections of this report the ability to translate these responses into facility planning policies and design is yet to be assessed in terms of the current adaptive capacity of existing health services and facilities.

Barriers to enhancing understanding

In the workshops, the attitude of those managing and funding health facility projects was identified as an impediment to the implementation of adaptation responses for health services and infrastructure. It was suggested that this might be partly be a result of the lack of understanding and certainty surrounding the likely additional impacts of extreme weather events on health services and facilities. In addition there may be a perception that inappropriate triggers / impractical targets may be set in response to current research efforts, and this would militate against this type of behavioural change.

Actions to enhance understanding

It was suggested that research is needed to provide more evidence (including practical examples and case studies) to improve community and health system understanding regarding the likely effect of increasing incidences of extreme weather events on health services and facilities, and the adaptation of these to cope with the predicted impacts. This is necessary to effectively influence community leaders and health system managers to ensure that their political influence is applied to implementation of strategies that will ensure "behavioural change" - in particular promotion of the climate change adaptation agenda.

A 'bottom-up' approach is an alternative strategy and could be pursued simultaneously. Those working in and using facilities could promote an adaptation strategy at facility level and seek endorsement from those at higher levels of the organisation. These local efforts are also more likely to be successful when underpinned by an understanding of the impacts and potential benefits of committing to an adaptation strategy. However it was recognised that such efforts ultimately require great levels of stakeholder perseverance and commitment to participation in the process.

However at a practical level, it was noted at the second workshop that asset planning strategies currently undertaken by NSW Health would be a suitable existing mechanism for assessing the adaptive capacity of health facilities. NSW Government policy requires that all NSW Health facilities are developed in accordance with an asset management strategy, and the condition of existing facilities regularly appraised to enable update of that strategy. Imposing an incremental additional work load to those assessing facilities would result in ongoing assessment of the adaptive capacity of all health facilities. Specific building related data is gathered from such an assessment in addition to site-related data, plus the condition of building services such as electrical and mechanical systems, integrity of the building fabric, etc, could be assessed as required at an appropriate level of detail.

Incorporation of a climate change adaptation focus into current asset strategic planning processes would commence the process of "behavioural change". This would be further developed by educating those undertaking asset condition surveys regarding the need to consider this additional requirement in determining the future value and suitability of health facilities.

In identifying the health service demands to be supported by both new and existing health facilities the need for 'spare' or 'surge' capacity to be provided to cope with the increasing demands associated with a greater number of extreme weather events should also be identified. This should be addressed in conjunction with those developing and implementing disaster management strategies, and this is discussed in more detail in the next section of this report.

SUMMARY OF POSSIBLE RESPONSES TO EXTREME WEATHER EVENTS	
Immediate	• Increased public awareness • Warning procedures for the community especially those at highest risk • Thermal control – airconditioning, close blinds, windows, etc (for heatwaves/bushfires) • Environmental control (to filter out smoke and dust, etc) • Emergency fire fighting response • Evacuation of those in immediate danger to safer facilities, surge hospitals, etc.
Long-term	<u>Urban planning</u> • Regulations – such as the Australian Standards, Building Codes, Health Facility Guidelines, Engineering Services guidelines – to ensure appropriate ventilation, air quality, thermal condition • Urban Design (eg land use, green spaces, water bodies) • Environmental management of high risk areas adjacent to urban areas or health facilities • Improved communication networks among urban planners • Redundancy built into road and transport networks to avoid isolation of facilities and emergency services • Availability of safe and environmentally controlled gathering spaces for the community to seek relief e.g. shopping centres, public libraries, etc, and to avoid unnecessary burdens being placed on health care facilities by those not in need of healthcare interventions. <u>Health System Responses</u> • Coordinated disaster responses – emergency services – ambulance, fire, police, etc that work with facilities to ensure health delivery is uninterrupted • Relief plan: surge hospitals, counselling, etc <u>Facility Management</u> • Site selection and utilisation • Facility design, detailing, and construction • Maintenance of equipment, e.g. airconditioning and facility fabric such as roofs and downpipes, so that structural failure is avoided in a disaster situation • Backup and spare capacity for building services e.g. electricity, water, ensuring uninterrupted supply

Table 3: Summary of possible responses for managing the risks associated with extreme weather events impacting on the community and its health facilities[19]

PROJECT OBJECTIVE 4

Align potential strategies with existing disaster planning strategies.

The final project objective was to consider alignment of potential adaptive strategies for health services and infrastructures with other existing strategies such as disaster management planning strategies. This objective was supported during the workshops by the identification of "Asset Management Planning" and "Integrated Planning" as two key common objectives between all workshop participants.

Current understanding

Currently, adaptation strategies to cope with extreme weather events are considered under the banner of disaster management and emergency planning in countries such as the US, UK, and Australia. However, such efforts do not embrace clear adaptation strategies nor do they often address practical implications for infrastructure in order to safeguard critical service functions such as healthcare delivery. Existing disaster management and planning strategies must be considered in conjunction with a framework of climate change adaptation initiatives for health facilities. This will then enable the development of a comprehensive and practical response strategy for health facilities exposed to extreme weather events, whether these occur naturally, or are generated increasingly by climate change.

Disaster planning strategies are already being considered in regard to the need to cope with terrorist attacks or outbreaks of infectious diseases within the Australasian community. There is concern being expressed regarding the ability of current health facilities to cope with these threats[20] particularly in terms of assessment of the existing capacity of emergency departments within Australasian hospitals. Given this opinion that does not yet consider additional burdens likely to be placed on health services by increased incidence of extreme weather events, it seems likely that existing health facilities would not be considered adequate should this additional response scenario be added to disaster response requirements.

Barriers to enhancing understanding

The quantum of additional facility requirements or indeed the location of these facility resources is not yet identified, partly because the science surrounding the additional burdens on human health that may be associated with climate change has not yet been robustly investigated for the Australian situation, as noted under Project Objective One. Disaster planning needs to be expanded to include this scenario and its likely impacts on health facilities.

In addition, health service authorities must consider this as part of the spectrum of community healthcare delivery needs, and this will likely fall within their areas of responsibility within the near future. Therefore, those responsible for guiding health asset strategies and planning processes must be encouraged to ensure that facilities of the future are capable of responding to this need.

One of the key impediments to understanding this issue that emerged from the ROMS workshop was the current lack of focus on the issue of climate change adaptation strategies within NSW Health itself. In particular those responsible for design and procurement of health assets have not yet embraced the need for the assessment of the adaptive capacity of health care infrastructure within its asset planning framework. Adequate responses to the issue require firstly acknowledgement of its existence, then a willingness to consider and to support development of appropriate responses, all requiring a heightened sense of urgency from those in NSW Health responsible for planning and funding the development of health facilities. The reasons behind this current lack of focus were thought to include a lack of understanding of the nature of climate change for Australia (particularly for NSW) and how it may impact on health and health facilities by both the government and its agency.

Once the importance of the issue is recognised at a more strategic level, another barrier to the development of suitable responses, as previously noted, is the lack of integration (or recognition of the essential interrelationship) of Capital Expenditure and Operational Expenditure budgets. This interrelationship is not always apparent during the planning phases of health facility projects, with short term decisions sometimes made that cut capital costs in the shorter term, but often significantly increase operational costs over the longer term.

In addition, at a more strategic level, difficulties resolving planning issues are not uncommon due to the myriad different government authorities currently involved in planning the NSW urban environment. Therefore, this could also be expected to be a factor in creating difficulties in addressing the potential impacts of increasing incidences of extreme weather events on all community infrastructure, not solely that for healthcare. Appropriate governance structures and high level coordination of efforts to overcome these difficulties were perceived to be lacking in many instances. This problem tends to be exacerbated by the inconsistencies in process and efforts between the different responsible authorities, plus the lack of continuity in the government bodies representing the different sectors due to their frequent changes in personnel, shifting areas of responsibility and thus their effective realms of influence.

Actions to enhance understanding

NSW Health must formally work with the current disaster planning agencies to ensure that existing strategies relying on health facility capacity for implementation are able to respond to the additional challenges likely to be imposed by increasing incidences of the extreme weather events associated with climate change. Once these strategies acknowledge the additional likely threat to the community and its infrastructure, the assessment of health infrastructure and its adaptive capacity becomes more meaningful and targeted. The role of health facilities should be to support health system responses in disaster situations and so must be planned to assist in this response by not failing when placed under such additional pressure.

Suggestions made at the workshop to address this requirement included the need for applied research to be more prescriptive in its outcomes

specifications and to include the prioritisation of efforts to respond to disaster planning strategies within agreed adaptation frameworks. As part of an expanded disaster response strategy, health infrastructure becomes even more critically important to the community, and this fact should assist those asserting the importance of adapting health facilities to cope more effectively with extreme weather events. In practical terms, this provides an extremely robust argument for influencing the Asset Management Planning policies of NSW Health.

As noted previously, to assist in the implementation of adaptation measures, costs and operational benefits must be identified by those advocating climate change adaptation strategies. These benefits should be identified and tested against performance measures specifically developed for health services and health facilities. These may include business continuity issues in disaster situations, with health services required to maintain current, or even increased, levels of health service delivery within a community in disaster situations. To develop performance measures of this type would require engagement with building industry experts (contractors and facility managers) in an arena set apart from the prevailing contract arrangements in place for current projects.

In particular, collaborations with key stakeholders in the development of adaptation strategies for health infrastructure would be needed. This must include the alignment of business continuity and other risk management strategies with existing strategies, including disaster management plans developed by others. To do this, it was noted that the following might be useful:

- Keeping the dialogue simple
- Establishing a mechanism to facilitate cross sectional communications
- Encouraging health services to be proactive in accelerating change and being brokers in determination of action agendas.

DRAFT ACTION PLAN FOR IMPLEMENTATION OF PROJECT OBJECTIVES IN RESPONSE TO WORKSHOP FINDINGS

OBJECTIVE	ACTIONS/RESPONSIBLE			ESTIMATED COSTS
	Short term	Medium term	Long term	
1. *Explore the impacts that extreme weather events may have on health buildings specifically in the context of the NSW climate (but with reference to the wider Australian context), focussing on the differing requirements by location.*	Literature review – keep current and comprehensive Review research reports and case studies from Australia and overseas Attend conferences to keep up to date with latest research Consult with recognised experts (Australia and overseas) to understand current research directions and applicability to the health sector Invite experts to present research findings to health industry forums in order to disseminate information and commence the education process Releasing research publications reporting on influential forums and work by respected research bodies via those who can influence the	Develop research agenda to determine more precisely the likely effects of extreme weather events on health care infrastructure Research grant proposals for targeted investigations including the link between climate change related effects on human health and increased/changes in demand for health services delivered Investigate and write case studies examining the impact of recent extreme weather events on the Australian community's health and health infrastructure Use GIS and LIDAR modelling, and building assessment tools to model the risk to NSW Health infrastructure from predictions of increased incidences of extreme	Monitor the effects of extreme weather events on health infrastructure with a view to developing evidence that health buildings are coping or not with the impact of extreme weather events – including a framework for evaluation Develop collaborative research grant proposal(s) for longer term funding to investigate and research the issue for the Australian setting, with practical costed outcomes to be implemented by identifiable parties Communicate findings to community, academia and government	

OBJECTIVE	ACTIONS/RESPONSIBLE			ESTIMATED COSTS
	Short term	Medium term	Long term	
	community's climate change adaptation agenda, including seeking endorsement and dissemination of information through organisations such as the AMA, insurance bodies, hospitals, local government, etc	weather events. Develop education agenda to both inform and reassure the community that these issues are being researched and addressed Maintaining the relationship of project objectives to a wider national research agenda Engaging with leading and/or credible researchers in the area (particularly on applied research) Clarifying the extent of problems and costs that may be associated with neglecting the necessary adaptation efforts Identifying possible adaptation strategies for health facilities in terms of suggested future projects, costs, programmes, actions and demonstrable outcomes.		
2. *Investigate the suitability and applicability of the suggested responses (gleaned from the existing literature) from a health*	Literature review and summarise results in 'issues' document (already commenced for this project); draw on overseas experience and proposed action	Review practices from other industry areas; compile proposal to research the applicability of these to the health sector and the costs of doing so.	Develop research grant proposal(s) for longer term funding to investigate and research the issue for the Australian setting, with practical costed outcomes to	

OBJECTIVE	ACTIONS/RESPONSIBLE			ESTIMATED COSTS
	Short term	Medium term	Long term	
infrastructure perspective	strategies from UK, US, etc Influence health care project procurement processes to ensure those assessing project tenders recognise and reward the value embodied in innovative adaptation strategies for health infrastructure	Develop education agenda to both inform and reassure the community that these issues are being researched and addressed Develop innovative strategies through multi disciplinary research for accurate forecasting of implementation costs. To maximise the likelihood of implementation of these strategies, where possible align with current government policies and practices. Coordinate clinical and asset management practices by means of demonstration projects showing the implementation of health infrastructural adaptation strategies and ongoing evaluation of these. Influence practices directly through development and implementation of government policy.	be implemented by identifiable parties Communicate findings to community, academia and government Future efforts should include: • Translating research into a practical, applied format • Disseminating information through appropriate sources, demonstration projects, etc • Providing evidence of cost, safety, social benefits (including reduced operational costs, etc) • Where possible develop strategies that require incremental adjustments to existing processes and procedures, rather than imposing new or additional burdens	
3. Assess the "adaptive capacity" of health infrastructure in the light of	Work with NSW Health Asset and Contract Services (A &CS) Branch, and other key stakeholders, to	Use GIS and LIDAR modelling, and building assessment tools to model the risk to NSW Health	Develop research grant proposal(s) for longer term funding to investigate and research the	

OBJECTIVE	ACTIONS/RESPONSIBLE			ESTIMATED COSTS
	Short term	Medium term	Long term	
healthcare, social, financial, technological, and political impacts in Australia resulting from climate change	incorporate this assessment into current asset assessment practices. Seek feedback from industry players and draw conclusions as to current adaptive capacity and how this fits with other performance requirements for health buildings – including balance between capital and operational cost issues, commercial tender processes, etc Undertake targeted areas of research to test adaptive capacity of health buildings and how this fits with other urban planning strategies and disaster management plans. Consider alternative strategies to manage the risks to communities and health infrastructure from increasing incidences of extreme weather events by drawing conclusions from other settings e.g. Cyclone Katrina.	infrastructure from predictions of increased incidences of extreme weather events as per research agenda noted above. Work with NSW Health A &CS Branch, and other key stakeholders including clinicians, health service managers and consumers, to develop strategies to ensure health facilities have sufficient adaptive capacity to cope with extreme weather events. Translate requirements into technical guide documents including the Health Facility Guidelines, TS11 and other standards, in order to influence designers Evaluate facilities completed in requirement with these standards in terms of providing adaptive capacity to cope with catastrophic events Consider alternative risk management strategies e.g. surge hospitals, and develop an	issue for the Australian setting, with practical costed outcomes to be implemented by identifiable parties Communicate findings to community, academia and government	

OBJECTIVE	ACTIONS/RESPONSIBLE			ESTIMATED COSTS
	Short term	Medium term	Long term	
		implementation strategy for these proposals.		
4. *Where possible, align potential strategies with existing disaster planning strategies*	Determine how existing disaster planning strategies acknowledge the importance of health infrastructure, etc by working with key stakeholders and disaster management experts to understand current initiatives. In response to findings, determine strategies to ensure 'business continuity' for health buildings in the event of extreme weather events so as to support disaster management initiatives Working within existing disaster management and adaptation frameworks, identify the costs and benefits associated with climate change related adaptation of health infrastructure to influence decision makers. Facilitate cross sectional communications e.g. bring together stakeholders in collaborative forum. Encourage health services to be	Develop collaborative research agenda around 'business continuity' issues for health buildings; target areas of research funding that could enable this agenda to be realised. With input of industry stakeholders (outside of the commercial arena) determine performance measures for health care infrastructure that would ensure business continuity in the event of natural disasters. Work with other experts to ensure that the health infrastructure component is not neglected in development of whole of community responses to climate change extreme weather event issues Consider alternative risk management strategies including surge hospitals, 'havens' in the community for those suffering	Develop research grant proposal(s) for longer term funding to investigate and research the issue for the Australian setting, with practical costed outcomes to be implemented by identifiable parties Communicate findings to community, academia and government	

OBJECTIVE	ACTIONS/RESPONSIBLE			ESTIMATED COSTS
	Short term	Medium term	Long term	
	proactive in accelerating change and being brokers in determination of action agendas	from the impact of extreme weather events, etc. Develop an implementation strategy for these proposals in conjunction with disaster management experts. Develop education agenda to both inform and reassure the community that these issues are being researched and addressed		

Table 4: Draft Action Plan

CONCLUSION

From the workshops, it was evident that the current lack of understanding of the problems (nature, frequency, severity, and relevance) associated with extreme weather events in Australia (including NSW) has led to perceived uncertainty surrounding the need for adaptive strategies for health services and infrastructure in response to the increasing incidence of extreme weather events likely to be associated with climate change. Consequently, further research is needed to increase the understanding of the impacts of extreme weather events on both healthcare service needs and health infrastructure to ensure uninterrupted delivery of these services. This involves the quantification of such impacts, including the risks associated with ignoring them and not acting, as well as the benefits associated with a prompt response. The information should be made available and communicated in a form that may be clearly understood by the public. Results from this undertaking should then be distributed in seminars and forums and through other influential bodies that endorse climate change adaptation agendas.

Finally, as further research is undertaken and adaptation strategies implemented, an education and communication strategy should be developed to inform key stakeholders regarding:

- The likely impacts of climate change on the demands for health services in NSW health facilities
- The adequacy of current NSW health infrastructure capacity to cope with the additional demands likely to be imposed
- Implementation strategies for reconfiguring or augmenting capacity to cope with the identified demands
- The costs associated with this reconfiguration or augmentation, and assurances given that these will be met in order to ensure business continuity within the health sector in the event of natural disasters now and into the future
- Confidence that an integrated disaster planning and management strategy is in place that will ensure the continuity of operation of health facilities in the event of natural disasters associated with the increasing incidence of extreme weather events likely to be associated with climate change.

APPENDIX A – WORKSHOP PARTICIPANTS

On 25th September 2006, a stakeholder analysis was conducted by Glenis Lloyd, Jane Carthey, Venny Chandra and Martin Loosemore that identified key project stakeholders who were subsequently invited to attend the ROMS workshop. In accordance with the guidance provided in Appendix C of the ROMS (Consultation Guidelines), the agreed stakeholder consultation plan for the project required:

- Key stakeholders to be consulted individually by meeting, to identify their objectives in responding to this problem.
- Important stakeholders to be kept informed of the ROMS process.
- Minor stakeholders to be informed of the ROMS process if considered necessary.

Workshop One – 1 March 2007

In accordance with this requirement the following key stakeholders were invited to participate in the ROMS workshop on Thursday 1 March at Gladesville Hospital.

Name	**Representing**
Ms Glenis Lloyd	Environmental Health Branch, NSW Health
Mr Mathew Pedrana	Asset and Contract Services Branch, NSW Health
Ms Coral Choi and Mr David Koop	Ambulance / Emergency Management Services
Mr Charlie Reilly	Multiplex
Mr Phil Rose	Dept of Commerce/NSW Govt Architect
Ms Kim McClymont	Statewide Services Development Branch, NSW Health
Mr Peter Lewis Dr Philip Hoyle	NSCC Area Health Service
Dr Matthew Chu	Australian College of Emergency Medicine (ACEM)
Mr Geoff Barnden	NSW Greenhouse Office
Ms Annette Schmiede	Catholic Health Australia

Attendance at the first workshop was in accordance with the above list with the exception of the representatives of the Ambulance/Emergency Services who were unable to attend.

Workshop Facilitation

The following participants facilitated the conduct of the workshop including prior preparation of the workshop briefing documents, and subsequent preparation of this report:

Prof Martin Loosemore	FBE, UNSW, (Workshop Facilitator)
Ms Jane Carthey	CHAA, FBE, UNSW (Project Chief Investigator)
Ms Venny Chandra	CHAA, FBE, UNSW (Research Assistant)

Invited Observer

The following participant attended the first workshop by invitation as an observer to the proceedings.

Mr Devon Diggle	NZ Ministry of Health

Workshop Two – 4 April 2007

Attendance at the second workshop on 4 April was as follows:

Name	**Representing**
Ms Glenis Lloyd	Environmental Health Branch, NSW Health
Mr Mathew Pedrana	Asset and Contract Services Branch, NSW Health
Mr Phil Rose	Dept of Commerce/NSW Govt Architect
Prof Martin Loosemore	FBE, UNSW, (Workshop Facilitator)
Ms Jane Carthey	CHAA, FBE, UNSW (Project Chief Investigator)
Ms Venny Chandra	CHAA, FBE, UNSW (Research Assistant)

APPENDIX B – WORKSHOP REPORT

NSW HEALTH ENVIRONMENTAL HEALTH BRANCH AND CHAA WORKSHOP

Held on 1 March 2007 and 4 April 2007

IMPACTS OF CLIMATE CHANGE ON NSW HEALTHCARE INFRASTRUCTURE

Workshop objective:

To develop an action-plan to ensure that health-care facilities can cope with the potential health impacts of extreme weather events.

Methodology - ROMS:

ROMS was originally developed for Multiplex Facilities Management and subsequently developed and used by many major public and private sector organisations throughout Australia and Asia. ROMS complies with AS/NZS 4360:2004; is internationally benchmarked; is currently used by 2008 Beijing Olympic Organising Committee and; received an innovation award from UK's Chartered Institute of Building in 2006. The principles underlying ROMS have been published in *Risk Management in Project*s by Loosemore, M, Raftery J, Reilly, C and Higgon, D (2005).

NSW HEALTH

CENTRE FOR HEALTH ASSETS AUSTRALASIA

Day One – 1 March 2007

ROMS process:

(8.45 – 9.45) – **Agreeing** common objectives

Break (9.45 – 10.00)

(10.00 – 11.30) – **Identifying** risks and opportunities.

Break (11.30 – 11.45)

(11.30 – 1.30) – **Prioritising** risks and opportunities.

Lunch (1.00 – 1.30)

(1.30 – 3.30) – **Developing an "Action Plan"** to minimise risks and maximise opportunities.

Conclusion (3.30 – 3.45)

STEP 1 Agreeing common objectives

Describe decision: How do we ensure that health-care facilities can cope with the potential health impacts of extreme weather events.	Ref: Climwksp1

Key stakeholders*	Key stakeholder objectives	Rank 5 common objectives
Glenis Lloyd Environmental Health Branch, NSW Health	• Be prepared and respond effectively • Design - Health care buildings are not clogged • Physically able to cope and not compound problem by being too hot etc – design, airconditioning etc • Ability to go 24 hours • Linking climate/health-care research with designers (links with other organisations like defence, insurance etc)	1. Quantifying impacts – to develop a research program to identify, analyse and assess impacts of extreme weather events on health infrastructure. 2. Evidence-based practice – identify facility-related responses to the health-care challenges posed by climate change; ensure practitioner/researcher engagement to facilitate evidence-based practice; operationalising research; ensuring research is relevant, practical and disseminated in a usable format. 3. Asset management planning – to ensure procurement, design, FM, urban planning and asset management planning strategies enable effective health-care responses to climate change and do not exacerbate problems in event of a crisis. 4. Ensuring behavioural change – to raise awareness of climate change; changing public expectations and behaviours to alleviate pressures; securing buy-in from industry stakeholders; communication; education. 5. Integrated planning – to ensure a coordinated cross jurisdictional response to climate change at internal, local and society level involving: disaster planning; emergency services, private health care sector; other non-health care community services.
(David Gates) Matthew Pedrana Asset and Contract Services Branch, NSW Health	• Appropriate location – flood plains, fire risk areas etc • Design – thermal mass etc • Support facilities – eg. Basic re-hydration stations within the community • Staying operational – back up systems/redundancy	
Devon Diggle NZ MOH (observer by invitation)	• Asset management planning – • Tool to assess vulnerability -	
Charlie Reilly Multiplex MFM	• Changing mindset of users – can things work in another way • Flexibility of building use/reconfiguration • Communication/education strategies to prevent impacts – prevent panic	

(Peter Mould) Phil Rose Dept of Commerce/NSW Govt Architect	• Existing v new – mostly existing, although future planning essential • Urban design – approaches, travel, parking etc • Internal environment – air conditioning, natural ventilation (smoke ingress etc) • Alter design tolerances/design criteria • Future planning strategies must take account of climate change	Note: aged care should be a focus.
Dr Peter Lewis / Dr Phil Hoyle NSCC Area Health Service	• Design – for increased demand, nature of demand, • Ensuring other support community facilities can cope – overflow into health care, via accreditation etc • Forcing functions - Linking into standard setting - avoid procurement which separates design from users, mandatory standards, design guidelines, • Disaster planning – internal, local, society level • Secondary support facilities - Conversion of other community facilities into health care facilities	
Matthew Chu, ACEM	• Design for Flexibility – ability to adapt buildings to cope with change in needs • Services - Back-up/redundancy, temperature stability, 24 hour provision in critical areas etc • Disaster planning - Linking between different health facilities in area • Communications with community	
Geoff Barnden NSW Cabinet Office	• Overall strategy – NSW state government • Ensure design – does not exacerbate problem • Minimum impact of emergency on infrastructure, on existing waiting lists etc • Private and public sector – prioritisation • Strategic planning processes – climate change imbedded • Integrated into disaster planning	
(Paul Sadler) Annette Schmiede Catholic Health Australia	• To keep residents out of acute facilities • Communications – early warning systems to recognise onset of risk event • Coordinate multiple providers • Internal organisation -	
Compiled by: Martin Loosemore*	See stakeholder analysis – Appendix A	Date: 1/3/07

STEP 2 Identification of risks and Opportunities

Describe decision: How do we ensure that health-care facilities can cope with the potential health impacts of extreme weather events.	Ref: Climwksp1

List ranked objectives (from Step 1)	List risks and opportunities*
Quantifying impacts	• No political will to fund research – short cycle of politicians, election, not core business • Competing priorities - Resource allocation • Fear – opening a can-of-worms • Not recognised as a problem – creeping crisis • No research on how this will roll-out • No influence on funding bodies • Inviting influential/credible bodies people to provide information – leverage global concern • Provide a win to political masters – demo projects • News – timing, do it now • Shock – sense of urgency, communicating implications of events • Be clear in the message you provide
Evidence-based practice	• Entrenched ways – standard practice does not always equate with evidence based practice • Lack of evidence of how to translate climate change demands into facility design • Development of solutions which can cope with health care demands of climate change without increasing climate change problem • Not being required/encouraged to take climate change into account in tenders etc • Innovative responses • High quality evidence • Set high expectations • Linking researchers and practitioners • Take a lead – make a statement, lead by example

Asset management planning	• Business as usual being acceptable - • No sense of urgency • Fragmented • No integration of Cap X and Op X in planning strategies • Political constraints – public opinion • Conflicting interests • Unwillingness to sign-off on strategies since climate change is a moving target – uncertainty about climate change, population impacts. • Better proving the life-cycle financial benefits of adaptation strategies. • Being more prescriptive in outcome-based specification in certain high priority elements. • Communicating the value of operating costs as well as capital costs. • Developing better performance measures • Demonstrate that there are spin-off benefits • Amendment to asset management policies to provide a structured way to think about climate change and recognise that asset planning lies at centre of this problem • Generating positive public opinion which then helps to generate informed priorities • Engage with industry in a structured program of dialogue outside of tender process to ensure a partnership/sharing risks and benefits
Ensuring behavioural change	• Not coming up with culturally relevant solutions • Developing impossible /impractical targets • Encourage change and nothing happens – ensuring feedback • Setting the bar too low – triggers for response are inappropriate. • Change the dominant culture • Capitalise on high currency of climate change • Emphasise long-term $ benefits of climate change strategies • Using recognisable leaders to promote agenda • Influence political will • Sharing potential benefits • Perseverance and commitment from key stakeholders • Using champions – demo projects/case studies
Integrated planning	• One jurisdiction/sector/agency/utility responds in a way which causes a problem for someone else. • Silo mentality • Lack of coordination/ poor governance strategies • Changes in bodies representing different sectors consistency/continuity • Mechanism to facilitate cross sectional communications (horizontal structures) • Health services being proactive in accelerating change and facilitating brokering agency actions • Keep dialogue simple
Compiled by: Martin Loosemore	Date: 1/3/07

STEP 3 Assessment and prioritisation

Describe decision: How do we ensure that health-care facilities can cope with the potential health impacts of extreme weather events.	**Ref**: **Climwksp1**

List Risks and Opportunities (from step 2)	Existing controls Inadequate Adequate Good Excellent	Probability Rare Unlikely Possible Likely Almost certain	Consequences Insignificant Minor Moderate Major Extraordinary	Level Low Medium High	Imminence Low Medium High	Controllability Low Medium High	Ranking (see appendix D)
QUANTIFYING IMPACTS							
No political will to fund research – short cycle of politicians, election, not core business	E	U	MOD	L	L	L	27
Competing priorities - Resource allocation	A	AC	MAJ	H	H	M	2
Fear – opening a can-or-worms	I	L	MAJ	H	H	H	1
Not recognised as a problem – creeping crisis	G	U	MAJ	M	L	M	19
No research on how this will roll-out	I	L	MAJ	H	H	M	2
No influence on funding bodies	I	L	MAJ	H	H	H	1
Inviting influential/credible bodies people to provide information – leverage global concern	A	P	MAJ	H	H	M	2
Provide a win to political masters – demo	E	L	MAJ	H	H	M	2

List Risks and Opportunities (from step 2)	Existing controls Inadequate Adequate Good Excellent	Probability Rare Unlikely Possible Likely Almost certain	Consequences Insignificant Minor Moderate Major Extraordinary	Level Low Medium High	Imminence Low Medium High	Controllability Low Medium High	Ranking (see appendix D)
projects							
News – timing, do it now	G	L	MAJ	H	H	H	1
Shock – sense of urgency, communicating implications of events	I	U	MAJ	M	M	L	16
Be clear in the message you provide -	I	L	MAJ	H	H	H	1
EVIDENCE-BASED PRACTICE							
Entrenched ways – standard practice does not always equate with evidence based practice	I	P	EXT	H	H	H	1
Lack of evidence of how to translate climate change demands into facility design	I	L	EXT	H	M	H	4
Development of solutions which can cope with health care demands of climate change without increasing climate change problem	G	L	MOD	M	L	H	17
Commercial reality – driven by cost	I	AC	MAJ	H	L	H	9
Not being required/encouraged to take climate change into account in tenders etc	I	AC	EXT	H	H	M	2
Innovative responses	I	AC	MAJ	H	H	H	1
High quality evidence	I	P	MAJ	H	L	L	13
Set high expectations	I	L	MAJ	H	M	M	5
Linking researchers and practitioners	I	P	EXT	H	L	M	10
Take a lead – make a statement, lead by example	A	L	EXT	H	H	H	1

List Risks and Opportunities (from step 2)	Existing controls Inadequate Adequate Good Excellent	Probability Rare Unlikely Possible Likely Almost certain	Consequences Insignificant Minor Moderate Major Extraordinary	Level Low Medium High	Imminence Low Medium High	Controllability Low Medium High	Ranking (see appendix D)
ASSET MANAGEMENT PLANNING							
Business as usual being acceptable -	I	P	EXT	H	H	H	1
No sense of urgency - Missed opportunities –	A	L	EXT	H	H	H	1
Fragmented – silos	A	P	MOD	M	M	H	12
No integration of Cap X and Op X in planning strategies	I	AC	EXT	H	H	L	3
Political constraints – public opinion	E	U	MOD	L	L	L	27
Conflicting interests – EG. aircon causing increasing emissions etc	G	L	MOD	M	L	H	17
Unwillingness to sign-off on strategies since climate change is a moving target – uncertainty about climate change, population impacts.	A	L	MOD	M	H	H	6
Better proof of life-cycle financial benefits of adaptation strategies.	I	P	MAJ	H	L	M	10
Being more prescriptive in outcome-based specification in certain high priority elements.	I	P	EXT	H	H	H	1
Communicating the value of operating costs as well as capital costs.	I	AC	MAJ	H	H	H	1
Developing better performance measures	I	AC	MOD	H	H	H	1
Demonstrate that there are spin-off benefits	A	L	MOD	M	M	M	14
Amendment to asset management policies to provide a structured way to think about climate change and recognise that asset planning lies at centre of this problem	E	L	EXT	H	H	H	1

List Risks and Opportunities (from step 2)	Existing controls Inadequate Adequate Good Excellent	Probability Rare Unlikely Possible Likely Almost certain	Consequences Insignificant Minor Moderate Major Extraordinary	Level Low Medium High	Imminence Low Medium High	Controllability Low Medium High	Ranking (see appendix D)
Generating positive public opinion which then helps to generate informed priorities	I	P	EXT	H	M	H	4
Engage with industry in a structured program of dialogue outside of tender process to ensure a partnership/sharing risks and benefits	I	P	MAJ	H	H	H	1
ENSURING BEHAVIOURAL CHANGE							
Not coming up with culturally relevant solutions	I	L	MOD	M	L	H	17
Developing impossible /impractical targets	I	P	MAJ	H	M	H	4
Encourage change and nothing happens – ensuring feedback	I	L	MAJ	H	H	H	1
Setting the bar too low – inappropriate triggers	A	P	EXT	H	H	H	1
Change the dominant culture	A	L	EXT	H	H	H	1
Capitalise on high currency of climate change	G	L	MAJ	H	H	H	1
Emphasise long-term $ benefits of climate change strategies	I	P	MAJ	H	L	M	10
Using recognisable leaders to promote agenda	A	P	MAJ	H	H	M	2
Influence political will	E	L	MAJ	H	H	M	2
Sharing potential benefits	I	P	MAJ	H	M	L	7
Perseverance and commitment from key stakeholders	A	AC	MAJ	H	M	H	4

List Risks and Opportunities (from step 2)	Existing controls Inadequate Adequate Good Excellent	Probability Rare Unlikely Possible Likely Almost certain	Consequences Insignificant Minor Moderate Major Extraordinary	Level Low Medium High	Imminence Low Medium High	Controllability Low Medium High	Ranking (see appendix D)
Using champions – demo projects/case studies	A	L	MAJ	H	M	H	4
INTEGRATED PLANNING							
One jurisdiction/sector/agency/utility responds in a way which causes a problem for someone else.	A	P	MOD	M	M	H	12
Lack of coordination/poor governance strategies	I	AC	MIN	M	H	M	8
Changes in bodies representing different sectors consistency/continuity	I	AC	MIN	M	H	M	8
Mechanism to facilitate cross sectional communications (horizontal structures)	I	P	EXT	H	L	L	13
Health services being proactive in accelerating change and facilitating brokering agency actions	I	P	EXT	H	L	L	13
Keep dialogue simple	I	P	EXT	H	H	H	1
Compiled by: Martin Loosemore							Date: 1/3/07

STEP 4 Strategy and action plan

Describe decision: How do we ensure that health-care facilities can cope with the potential health impacts of extreme weather events.	Ref: Climwksp1

Rank (1–27)	Risks and Opportunities in rank order (considering existing control) (from step 3)	Recommended actions
	QUANTIFYING IMPACTS	
1	No influence on funding bodies	Publish/present result of this workshop – in influential forums (such as CSIRO greenhouse conference etc) Release this report to the national greenhouse office! With a wider national research agenda with costings.
1	Fear – opening a can-of-worms	Prioritise future research projects with deliverables and costs. Keeping abreast of research.
2	No research on how this will roll-out	Clarifying extent of the problem and strategies to manage. Add a summary and recommendation to report with a series of suggested projects, costed and programmed with clear outputs.
2	Competing priorities - Resource allocation	Prioritise future research projects with deliverables and costs. Interdisciplinary nature of the work means that costs and benefits will be shared. Approach bodies as groups not individually.
19	Not recognised as a problem – creeping crisis	Above
27	No political will to fund research – short cycle of politicians, election, not core business	Above
1	Inviting influential/credible bodies people to provide information – leverage global concern	Engage with leading/credible researchers in this field (particularly applied research).

		No credible academic body of applied research on human health and climate change. No research there to underpin health policy. Industry endorse/support to report to Greenhouse Office. Willingness to be partners in research and share costs. Endorsement - AMA, insurance, hospitals, local government
1	Provide a win to political masters – demo projects	Focus on those who are engaged in applied research which can be used to underpin evidence-based policy.
2	News – timing, do it now population impacts.	Do it now – action plan with timeframes
2	Be clear in the message you provide -	Produce a simple prioritised program. Key message up front and bold. Eg. suggest further work needs to be done to get key practical outputs and assurances that health facilities will be safeguarded against health impacts of climatic change. Give early wins to funders.
16	Shock – sense of urgency, communicating implications of events	Above
	EVIDENCE-BASED PRACTICE	
1	Entrenched ways – standard practice does not always equate with evidence based practice	Translate research into practical format and providing clear practical applied advice/strategies to help people respond to climate change risks. Shock tactics. Eg. use mapping tools to illustrate the importance of the problem. Disseminate through sources that practitioners use. Running seminars etc.
2	Not being required/encouraged to take climate change into account in tenders etc	Produce guidelines – to set standards. Produce evidence that climate change strategies do not always cost more. Influence bodies who assess hospital bids to make climate change strategies a top priority.
4	Lack of evidence of how to translate climate change demands into facility design	Above
9	Commercial reality – driven by cost	Above
17	Development of solutions which can cope with health care demands of climate change without increasing climate change problem	Above
1	Innovative responses	Research – working across disciplines. Strategies with a range of impacts and government policy directions/requirements.
1	Take a lead – make a statement, lead by example	Demonstration projects - adaptation.

		Influence bodies who assess hospital bids to make climate change strategies a top priority. Influence tenants to insist on buildings that consider climate change.
5	Set high expectations	Holistic targets need to be set for adaptation and mitigation together (in addition to existing targets for mitigation).
10	Linking researchers and practitioners	Above
13	High quality evidence	Above
	ASSET MANAGEMENT PLANNING	
1	Business as usual being acceptable -	Ensure that health department process of asset strategic planning includes the objective of climate change adaptation.
1	No sense of urgency - Missed opportunities –	Shock tactics. Eg. use mapping tools to illustrate the importance of the problem. Require immediate changes in practices on existing projects. Support for initiatives such as dedicating parts of project budgets to adaptation and mitigation.
3	No integration of Cap X and Op X in planning strategies	There is a process where a business case is required to look at Cap X and Op X. But not used after project sign-off. Need to ensure monitoring / auditing/researching of OP X and feedback to original business case and adjustment of future practices to take this into account in future business plans. Demonstrate negative health, social and political consequences of not considering Op X.
6	Unwillingness to sign-off on strategies since climate change is a moving target – uncertainty about climate change, population impacts.	Use mapping tools to illustrate the likelihood and magnitude of the problem. Talk about climate change as a given. No uncertainty in message.
12	Fragmented – silos	Above
17	Conflicting interests – EG. aircon causing increasing emissions etc	Above
27	Political constraints – public opinion	Above
1	Being more prescriptive in outcome-based specification in certain high priority elements.	Reduce confusion in research results and make practical and easy to implement in terms of policy/application.
1	Communicating the value of operating costs as well as capital costs.	Demonstrate negative health, social and political consequences of not considering Op X.
1	Developing better performance measures	Business continuity measures are needed to measure effectiveness of adaptation strategies to keep functioning in the event of an extreme weather event etc (ie: health service measures rather than building performance measure).
1	Amendment to asset management policies to provide a structured way to think about climate	See above

	change and recognise that asset planning lies at centre of this problem	
1	Engage with industry in a structured program of dialogue outside of tender process to ensure a partnership/sharing risks and benefits.	Adjust tender workshop formats to facilitate more interaction and exchange of ideas with private sector. Better engagement with private sector outside tender process.
4	Generating positive public opinion which then helps to generate informed priorities	Above
10	Better proof of life-cycle financial benefits of adaptation strategies.	Above
14	Demonstrate that there are spin-off benefits	Above
	ENSURING BEHAVIOURAL CHANGE	
1	Encourage change and nothing happens – ensuring feedback	Write-up successful projects and disseminate results. Rating scheme – reward good behaviour.
1	Setting the bar too low – inappropriate triggers	Research will give an idea of where the bar should be set.
4	Developing impossible/impractical targets	Collaboratively develop them in research projects and test them.
17	Not coming up with culturally relevant solutions	
1	Change the dominant culture	Education, demo projects, champions, evidence.
1	Capitalise on high currency of climate change	Act now… keep it simple. Communicate this.
2	Using recognisable leaders to promote agenda	Encourage Chief Executives to promote change.
2	Influence political will	Above
4	Perseverance and commitment from key stakeholders (industry, funders, tax-payers, politicians, planners, designers, clinicians etc)	Continually involve stakeholders in policy development and implementation (buy-in). Bottom-up approach.
4	Using champions – demo projects/case studies	Above
7	Sharing potential benefits	Performance contracts. Develop tools to measure the benefits of adaptation strategies.
10	Emphasise long-term $ benefits of climate change strategies	Above
	INTEGRATED PLANNING	

8	Lack of coordination/poor governance strategies	Collaboration of key stakeholders in development of adaptation strategies. Ensure that adaptation strategies are consistent with state disaster plans etc.
8	Changes in bodies representing different sectors consistency/continuity	Continual updating of strategies.
12	One jurisdiction/sector/agency/utility responds in a way which causes a problem for someone else.	Above
1	Keep dialogue simple	Above
13	Mechanism to facilitate cross sectional communications (horizontal structures)	Above
13	Health services being proactive in accelerating change and facilitating brokering agency actions	Above
Compiled by: Martin Loosemore		Date: 4/4/07

Attachment A – Stakeholder analysis

On 25th September 2006, a stakeholder analysis was conducted by Glenis Lloyd, Jane Carthey, Venny Chandra and Martin Loosemore. The following stakeholders were identified:

Your ability to affect their objectives \ Their ability to affect your objectives	
Minor stakeholders: Clinicians Green Building Code	*Important stakeholders:* Experts/scientists Aus Building Codes Board Peak bodies (FMA etc) Private Hospital Associations
Important stakeholders: Rural services Aged care Community services Nursing care Mental health Local government Planning EMA	***Key stakeholders:*** Asset and Contract Services Ambulance / Emergency Management Services – D&C private / Dept of Commerce Statewide services NSW Environmental Health Branch Area Health Service – NSCCAHS ACEM NSW Greenhouse Office Aged Care (ACSA)

In accordance with the guidance provided in Appendix C of the ROMS (Consultation Guidelines), the stakeholder consultation plan involved:

- Key stakeholders - consulted individually by meeting, to identify their objectives in responding to this problem.
- Important stakeholders – kept informed of the ROMS process.
- Minor stakeholders – informed of the ROMS process if considered necessary.

Attachment B - Assessing risk and opportunity

QUALITATIVE PROBABILITY LABELS	
Descriptor	Description
Rare	This event may occur in exceptional circumstances only.
Unlikely	This event is not likely to occur.
Possible	This event could occur at some time.
Likely	This event has happened before and will probably occur again.
Almost certain	This event is common and is expected to occur in most circumstances.

QUALITATIVE CONSEQUENCE LABELS (i.e. for our business objectives of delivering health care)		
Label	**Description for risks**	**Description for opportunities**
Insignificant	Negligible operational impact on health-care operations. No measurable extra resource requirements or time required to deliver normal health care services. Negligible adverse impact on quality of health care we could provide. Negligible adaptation of current facilities required. Negligible impact on health of patients.	Negligible operational impact on health-care operations. No measurable savings of resources or time required to deliver normal health care services. Negligible positive impact on quality of health care we could provide. Negligible improvement in suitability of current facilities. Negligible positive impact on health of patients.
Minor	Slight adverse impact on some areas of health-care operations/ Some but little extra resource requirements or time required to deliver normal health care services. Little adverse impact on quality of health care we could provide. Some adaptation of current facilities required. Slight adverse impact on health of patients.	Slight beneficial operational impact on health-care operations. Some but little savings of resources or time required to deliver normal health care services. Slight positive impact on quality of health care we could provide. Slight improvement in suitability of current facilities. Slight positive impact on health of patients.
Moderate	Adverse impact on some areas of health-care services/operations/ Extra resource requirements or time required to deliver services. Adverse impact on quality of health care we could provide. Some adaptation of current facilities required. Moderate impact on health of patients resulting in significant injuries to patients.	Positive impact on health-care operations. Measurable savings of resources or time required to deliver services. Positive impact on quality of health care we could provide. Some improvement in suitability of current facilities. Some positive impacts on the health of patients resulting in an ability to reduce patient injuries.
Major	Serious adverse impact on numerous areas of health-care operations/ Significant extra resource requirements or time required to deliver normal health care services.	Significant positive operational impact on health-care operations. Significant savings of resources or time required to deliver normal health care services.

	Serious adverse impact on quality of health care we could provide. Significant adaptation of current facilities required. Serious impact on health of patients resulting in significant injuries and/or possible loss of life.	Significant positive impact on quality of health care we could provide. Significant improvement in suitability of current facilities. A very positive impact on health of patients resulting in a significant reduction in patient injuries/fatalities.
Extraordinary	Critical adverse impact on all areas of health-care services/operations Huge extra resource requirements or time required to deliver normal health care services. Massive adverse impact on quality of health care we could provide. Massive adaptation of current facilities required. Critical impact on health of patients with current facilities resulting in significant loss of life.	Significant positive operational impact on health-care operations. Significant savings of resources or time required to deliver normal health care services. Significant positive impact on quality of health care we could provide. Significant improvement in suitability of current facilities. A very positive impact on health of patients resulting in a significant reduction in patient injuries/fatalities.

Probability	Consequences				
	Insignificant	Minor	Moderate	Major	Extraordinary
Almost certain	Low	Medium	High	High	High
Likely	Low	Medium	Medium	High	High
Possible	Low	Low	Medium	High	High
Unlikely	Low	Low	Low	Medium	High
Rare	Low	Low	Low	Low	High

Attachment C - Rules for risk and opportunity ownership

Responsibility for managing a risk and/or opportunity should be allocated to those who:

- Have been made fully aware of the risk/opportunity for which they are responsible.
- Are best able to mitigate the risk and maximise the opportunity (in terms of expertise, knowledge and resources).
- Have the appetite to want to take the risk/opportunity.
- Have been given the opportunity to charge an appropriate premium for accepting the responsibility.
- Have the resources to cope if the residual risk/opportunity eventuated.

Attachment D - Rules for risk and opportunity ranking

In ranking risks and opportunities it is not possible to assume that all high risks will be more important than all medium risks because a medium risk with high imminence is likely to be more important than a high risk which is not imminent: Although the ranking of risks and opportunities is essentially one of personal choice, the following ranking system takes this into account by assuming that in the ranking process, risk is more important than imminence and that imminence is more important than controllability. This is reflected in the scores in the following table which are used to rank each combination of risk imminence and controllability. It is important to stress that this reflects OUR own judgement about the relative importance of each factor and that this could be adapted if we wish.

With this qualification in mind, the scoring system proposed is as follows. It results in a sensible ranking and involves attributing a different high, medium and low score in each category (risk, imminence and controllability) as illustrated in the following table. It can be adjusted at any time, if appropriate.

	Risk	imminence	controllability
high	9	6	3
medium	6	4	2
low	3	2	1

The ranking which results is:

	Risk, Imminence, Controllability		Risk, Imminence, Controllability		Risk, Imminence, Controllability
1	High, High, High	11	Medium, High, Low	21	Low, Medium, High
2	High, High, Medium	12	Medium, Medium, High	22	Medium, Low, Low
3	High, High, Low	13	High, Low, Low	23	Low, Medium, Medium
4	High, Medium, High	14	Medium, Medium, Medium	24	Low, Medium, Low
5	High, Medium, Medium	15	Low, High, High	25	Low, Low, High
6	Medium, High, High	16	Medium, Medium, Low	26	Low, Low, Medium
7	High, Medium, Low	17	Medium, Low, High	27	Low, Low, Low
8	Medium, High, Medium	18	Low, High, Medium		
9	High, Low, High	19	Medium, Low, Medium		
10	High, Low, Medium	20	Low, High, Low		

APPENDIX C - REFERENCES

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