



Environmental Risk Science and Audit

EXECUTIVE SUMMARY

INDEPENDENT REVIEW OF QUEENSLAND CULTURAL CENTRE'S DISASTER PLANNING, MANAGEMENT AND RECOVERY FRAMEWORK

ARTS QUEENSLAND

OCTOBER 2011

ERSA 1013
17 October 2011

EXECUTIVE SUMMARY

Introduction

The Queensland Cultural Centre (CC) precinct on the banks of the Brisbane River contains the greatest concentration of high value and largely irreplaceable public assets in Queensland, if not Australia.

As a result of the mid-January 2011 flooding in the Brisbane River, the CC suffered approximately \$28.6 million in direct damage. While the Lyric Theatre of the Queensland Performing Arts Centre reopened for performances of the international production of the musical *Wicked* on 25 January (13 days after the scheduled date), some of the facilities within the CC precinct remained closed to the public for more than three months.

The flooding put at risk public assets valued at more than \$1 billion, including irreplaceable items of great scientific, heritage and cultural significance. Equally important, but more difficult to quantify, was the potential threat to the national and international reputation of the CC facilities as a safe venue for hosting world-class exhibitions and theatrical performances.

The experience of this emergency event prompted the executive of AQ to commission Environmental Risk Science and Audit Pty Ltd (ERSA) to undertake an independent review of the CC disaster planning, management and recovery framework, with the aim of incorporating the lessons learned during the 2011 flood event into a more comprehensive and operationally relevant emergency management regime.

The response to the January 2011 flood impact provides a valuable case study through which to examine the application of the existing CC emergency management arrangements. It was, however, a singular event and the response effort undertaken will not necessarily be relevant to any other flood regardless of its magnitude, let alone the impact of other acute or chronic hazards. To address the 'what if' element of response strategies for events other than a repeat of the 2011 flood, ERSA employed a range of hypothetical risk scenarios to test the viability of the current strategies across the widest range of hazard impacts. Those scenarios were based on past flood events in Brisbane and on ERSA's experience of the risks inherent in the impact of other hazards in both Brisbane and in other localities.

This Executive Summary provides an overview of ERSA's approach and findings, including the range of hazards that may have a direct or indirect impact on the CC precinct, ERSA's assessment of the risks posed by disasters and emergencies to the precinct, and the strategies that would help to reduce or eliminate those risks. Details of the methodology and results are provided in ERSA's final report *Independent Review of Queensland Cultural Centre's Disaster Planning, Management and Recovery Framework*.

ERSA's Approach to Disaster Risk Management

The approach adopted for this review follows the risk management process established in *AS/NZS ISO 31000-2009 Risk management - principles and guideline* (SA/SNZ, 2009). Application of the risk assessment process facilitates:

- analysis of the complex (and at times competing) jurisdictional relationships that exist in the administration of the CC facilities and the wider emergency management regime that covers Brisbane
- identification of the range of natural and anthropogenic hazards that have the potential to impact on the CC precinct and the analysis of the potential consequences of such impacts
- analysis of the complex nature of the CC built environment and the infrastructures that support its operations together with their susceptibility to hazard impacts
- analysis of the potential exposure of staff, volunteers and visitors to the various facilities to the range of hazard impacts and their susceptibility to such exposure; and
- analysis of the potential exposure of the various collections housed in the CC facilities and their susceptibility to loss or damage as a direct or indirect consequence of a hazard impact.

Emphasis is given to the relationships between the various hazard phenomena, the elements within the precinct potentially exposed to those hazards and the characteristics that make those elements more or less susceptible to such an impact.

The Context

The CC precinct is located on the south bank of the Brisbane River, on a site measuring around 680m from north to south and 180m from east to west. It covers approximately 9.7 hectares. The location and buildings within the precinct are shown in Figure i.



Figure i: CC precinct location (Google Earth image, June 2009)

The CC precinct has evolved over the past 20 years to include the principal collections of art, writing, geoscience, biodiversity and heritage of Queensland as well as the State's premium performing arts venues. In addition to the more than \$1 billion worth of public assets owned by Queensland, the precinct hosts periodic exhibitions of works drawn from the leading galleries, museums and libraries of the world as well as hosting performers, orchestras and theatrical companies of international renown. Such exhibitions and performances are attracted to the CC precinct by the established reputation of the Brisbane centre as a safe, appropriate and appreciated venue. The CC precinct is clearly unique in its concentration of physical, social, cultural, heritage, scientific and artistic value. Its well established reputation as a safe venue is, none-the-less, potentially ephemeral.

The CC precinct is administered by AQ (as landlord), a division of the Department of Premier and Cabinet. The precinct's six facilities are operated by four separate Arts Statutory Bodies (ASBs), each with its own legislated roles and functions. They are:

- Queensland Performing Arts Centre (QPAC)
- Queensland Museum Southbank Campus (QMSB)
- State Library of Queensland (SLQ) and The Edge (a stand-alone section of SLQ); and
- Queensland Art Gallery (QAG) and Gallery of Modern Art (GoMA).

This study has revealed that the CC precinct is not identified in the Risk Register of any State, District or Local Disaster Management Plan. The report observes that:

It would appear that unless the CC precinct (and other major State Government assets) is acknowledged in the [Queensland State Disaster Management Plan] and listed in the State Risk Register it will, in effect, be a 'disaster management orphan' - i.e. it will be left to its own resources to manage any disaster event. While the Disaster Management Act 2003 places the responsibility on local governments for disaster management at the local level there are major State assets, such as the CC precinct, that may fall within the geographic extent of the local government but are, for all intents and purposes, beyond the capability of the local government to protect.

Each ASBs has its own established emergency and security plans and procedures, there is, however, no overall precinct-wide disaster management plan.

The current level of risk posed by a range of hazards to the CC precinct, and the effectiveness of the risk reduction strategies suggested in this study, can be measured against the following criteria:

- reduce, to an acceptable level, the risk of death or injury to emergency and security personnel engaged in responding to any hazard impact
- reduce, to an acceptable level, the risk of death or injury to staff and volunteers
- reduce, to an acceptable level, the risk of death or injury to the general public
- reduce, to an acceptable level, the risk of destruction or damage to irreplaceable cultural and assets to the extent that loss of heritage is minimised
- reduce, to an acceptable level, the risk of destruction or damage to public infrastructure and facilities
- reduce, to an acceptable level, the risk of destruction or damage to private property
- minimise the impact on the QCC's business activities and the local economy; and

- manage the impact of hazards on the natural environment and the biodiversity of flora and fauna is maintained.

It is important to understand that the implied order of priority given here is that which would likely be applied in a coronial or other form of judicial enquiry after an event impact rather than how people on the ground might see their work responsibilities or business priorities on a day-by-day bases. This is the essence of the disaster risk management conundrum that this study seeks to clarify.

The Hazards

The damage caused by the 2011 floods has clearly demonstrated the risk posed to the CC precinct by inundation hazards. From the evidence presented to this review it is clear that the CC precinct actually 'dodged a bullet' in January 2011. Had flood waters risen another 300 to 500mm on 12 January the resulting damage to core services including air conditioning, power supply and telecommunications would have made the site unviable for at least twelve months. It is also evident that the precinct would not have been returned to operational condition as quickly as it was had it not been for the dedicated and thoroughly professional efforts of the staff of AQ and the ASBs together with the contractors and volunteers.

It is also clear from this review that inundation is not the only hazard that poses a direct threat to site, the people who work or visit there, nor the collections that the various facilities house. There are threats from future flood events, destructive winds, earth movement, fire, hazardous atmospheres and disease, any one of which could have an impact far more serious than that experienced in January 2011. The hazards reviewed in this study are listed in Table i.

Table i: Hazards considered in this study

Atmospheric	Earth	Biological	Human
tropical cyclone	earthquake	pandemic	transport accident
east coast low	tsunamis		structure fire
severe storm	landslides		hazardous materials
flood	subsidence		terrorism
bush fire			civil strife
heat wave			major utility failure
drought			
climate change			

The Elements Exposed and Their Vulnerability

A detailed level-by-level analysis was undertaken of each of the CC precinct facilities, their contents and their uses; the common services such as air conditioning provided; and the external infrastructures that are drawn on. The most obviously exposed facilities to flood are located at the lowest building levels such as the car parks. Also located at these levels are critical power sub-stations, air conditioning plants and storage facilities.

Apart from externally supplied power and telecommunications, the most critical lifeline to the functioning of the CC precinct is air conditioning. The loss of the River Cooling and Central Energy Plant (CEP) put at risk the collections of the galleries, the library and the museum and would cause the cancellation of

performances in the theatres. It is, after power supply and telecommunications, the most critical infrastructure.

Assessing the Risks

ERSA used seven dimensions of risk to produce a semi-quantitative risk index for a range of scenarios. They are:

- **Frequency** – events that occur frequently are scored more highly than those that rarely occur.
- **Seriousness** – events that have the potential for causing significant numbers of casualties and/or significant economic loss are scored more highly than those that produce few casualties or little loss.
- **Manageability** – those hazards that are difficult to control or manage by existing techniques, resources and warning systems are scored more highly than those that are more easy to manage.
- **Awareness** – hazards for which community understanding and awareness before the event have not led to active steps taken to reduce those risks are scored more highly than those for which risk reduction efforts have already been made. There are elements of voluntary versus involuntary risks in this assessment as well.
- **Urgency** – hazards that need to be addressed with some urgency because of a lack of preparedness, for example, are scored more highly than those that do not demand the implementation of risk reduction action so rapidly.
- **Growth** – hazards for which the risk is likely to grow either because the hazard could become more frequent or severe; or there is likely to be an increase in the number of community elements exposed; or there will be an increase in the vulnerability of those elements, are scored more highly than those hazards that pose a more constant level of risk.
- **Outrage** – the political dimension of risk is important because after the impact of an emergency, community outrage, at what is perceived to have been a lack of preparedness or an inadequate response, can generate unrealistic and unreasonable political demands rather than addressing the reality of community safety needs. Such hazards are scored more highly than those that tend to be seen as either voluntary risks or as being ‘acts of God’.

Scores out of five were assigned for each dimension for a direct impact on the CC precinct. By using the risk indexes developed for each individual risk scenario it was possible to rank these scenarios in order of their seriousness. These comparative risks are shown in the Table ii.

Table ii: Comparative risks

Hazard	Frequent	Serious	Manage	Aware	Urgency	Growth	Outrage	Score
300+ year ARI flood	2	5	5	4	4	3	5	28
100 year ARI flood	3	4	4	3	4	3	4	25
Heatwave	5	3	3	3	3	4	3	24
Category 3 cyclone	2	4	4	3	2	3	3	21
Super-cell storm	3	4	3	3	2	3	3	21
Pandemic	3	4	4	3	2	2	3	21
Overland flows	5	2	2	3	2	3	3	20
Major utility failure	2	4	2	3	2	3	3	19
50 year ARI flood	4	3	3	2	1	2	3	18
Category 2 cyclone	3	3	2	2	2	3	2	17
Hazardous atmosphere	4	2	2	3	2	1	3	17
East coast low	3	2	2	2	2	3	2	16
MM VII intensity quake	1	3	2	3	2	2	3	16
Fire	4	3	1	2	1	1	3	15
MM VI intensity quake	2	2	2	3	2	1	2	14
King tide	5	0.5	1	1	1	2	1	11.5
MM V intensity quake	3	1.5	1	3	1	1	1	11.5
MM IV intensity quake	4	0.5	1	3	1	1	1	11.5

From this analysis, it is clear that flood hazards pose the greatest threat, primarily because of the extensive area that is impacted and the threat to essential services, including the air conditioning system and power supply.

Treating the Risks

There are four broad options for risk treatment to achieve the risk management objectives identified in establishing the context:

- eliminate the risk – whilst this is the theoretical ideal, this option is very difficult to achieve in practice because it would require one or more of the risk elements (hazard, exposure, vulnerability) to be reduced to zero
- reduce the risk – this is typically the most practical option, however, it inevitably involves setting thresholds beyond which risk reduction is deemed to be either impractical or uneconomic. This involves the difficult and often contentious task of establishing what the 'community' considers to be a level of 'acceptable' or 'tolerable' risk
- transfer the risk – administratively, this is frequently done by a higher level of government passing responsibility to the next level down the line, or governments passing responsibility to individual property owners. When available, insurance is the most common strategy employed to transfer financial risk. Risk transference does not appear to be an available option where the CC precinct is concerned; and

- accept the risk – where it is not possible to eliminate, reduce further, or fully transfer the risk, the residual risk is simply accepted or tolerated. Acceptance typically relates to those risks that are either relatively common, but their impact represents an inconvenience rather than a significant threat (i.e. not worth worrying about); or those that may have a devastating impact but their occurrence is extremely rare (i.e. impossible to control or manage).

There is broad agreement that the protection of life and the irreplaceable CC collections should take precedence over broader property protection, commercial activities or environmental protection. That said, these are cascading priorities - i.e. if a hazard scenario poses no threat to life and limb (or if that risk has been resolved) then protection of the CC collections takes priority over property and commercial aspects. It should also be acknowledged that by protecting the property and infrastructure within the precinct, commercial operations will also be largely protected. It is also acknowledged that should QPAC be rendered inoperable for an extended period there is a potentially large commercial risk to QPAC that could resonate into other performing arts industry segments.

This study has identified 43 risk treatment strategies that AQ and the ASBs may consider adopting to reduce the risks posed to the CC precinct from the natural and anthropogenic hazards outlined above. They are arranged as follows:

- treatment strategies that address contextual issues
- treatment strategies that address research, information and analysis issues
- treatment strategies that address risk modification issues
- treatment strategies that address readiness issues
- treatment strategies that address response issues; and,
- treatment strategies that address recovery issues.

Context Strategies

A number of jurisdictional and administrative issues that clearly contribute to the overall risk of the CC precinct were identified. At the broadest philosophical level, the importance of protecting the artistic, cultural and heritage assets and resources of Queensland is simply not acknowledged in the *Disaster Management Act 2003*, the *Disaster Management Strategic Policy Framework*, or the procedures and plans that flow from them. These assets and resources are largely unique and irreplaceable. Their value is best measured in terms of community spirit and resilience rather than in dollar terms. The suggested context strategies are aimed at redressing this lack of recognition.

Context Strategy 1: The DDG of AQ write to the Chair of the SDMG requesting that the significance of the State's art, culture and heritage assets and resources be specifically recognised in the *Disaster Management Strategic Policy Framework* to ensure that they are taken into account in all local and district disaster management plans and risk registers where appropriate.

Context Strategy 2: The DDG of AQ consider writing to the Chair of the SDMG recommending that, at a future revision, the definition of 'serious disruption' in Section 13 (2) of the *Disaster Management Act 2003* be amended to read:

“serious disruption” means—

- (a) loss of human life, or illness or injury to humans; or
- (b) widespread or severe property loss or damage; or
- (c) widespread or severe damage to art, cultural or heritage assets; or
- (d) widespread or severe damage to the environment.

Context Strategy 3: In writing to the Chair of the SDMG, the DDG also request that AQ be recognised as an occasional member of the SDMG to ensure that disaster management issues relating to the protection and preservation of the State’s art, cultural and heritage assets are adequately addressed when such assets may be at risk during a disaster event.

Context Strategy 4: AQ pass a copy of the risk assessment contained in this review to the Chair of the SDMG to ensure that EMQ includes the CC precinct in the State Risk Register.

At a practical level several strategies have been designed to enhance existing disaster management arrangements within the CC precinct.

Context Strategy 5: AQ, in consultation with the Disaster District Coordinator, formally establish a CC Local Disaster Management Group (LDMG) in line with the *Disaster Management Act 2003* and the *Disaster Management Strategic Policy Framework*.

Context Strategy 6: The CC LDMG create and implement a CC Local Disaster Management Plan (LDMP).

Context Strategy 7: AQ and the ASBs agree on levels of risk that they see as acceptable or tolerable as part of the development of the CC LDMP.

Context Strategy 8: The CC LDMG establish and manage a program of training in the operation of the LDMP including exercises and ‘live’ evacuation drills.

Context Strategy 9: AQ offer to host one meeting each year of the Brisbane Disaster District Management Group at the CC precinct.

Context Strategy 10: AQ host a disaster planning workshop in November each year involving the members of the CC LDMG to update pre-season preparations based on the input from the Brisbane DDMG, EMQ and BoM.

Research, Information and Analysis Strategies

In this review of the CC precinct it has been evident that there is currently no consolidated collection of information in AQ or the ASBs to underpin decision-making in a disaster or emergency involving the CC precinct. There is anecdotal evidence that the unavailability of such information during the January 2011 floods hampered coordinated decision making. The following strategies are aimed at redressing this situation. Most of these strategies can be implemented at the operational level of the Arts Property and Facilities (APAF) Branch of AQ.

RI&A Strategy 1: AQ consider migrating their CAD-based assets management system to a suitable GIS environment as soon as possible to maximise their ability to integrate spatial data relating to the precinct from outside sources.

RI&A Strategy 2: As part of the migration of the AQ assets management system to a GIS environment, AQ negotiate with DERM, BCC and other data custodians for access to data sets that are relevant to the management of the CC precinct.

RI&A Strategy 3: AQ establish a project to record in an appropriate form, the local knowledge of experienced assets management staff. That knowledge should be linked where possible to the locations that it relates to.

RI&A Strategy 4: AQ negotiate with BCC to gain access to high resolution three-dimensional details of flood modelling in the area of the CC precinct, updated following the January 2011 floods up to the 100 year ARI level as a minimum and preferably up to the 500 year ARI level.

RI&A Strategy 5: AQ establish their interest in being kept informed of the outcome of the modelling to be undertaken for SEQWater in response to the QFCI interim report and its potential significance to disaster planning at the CC precinct.

RI&A Strategy 6: AQ establish liaison with the appropriate sections of BCC and DERM to monitor proposals to develop upstream structural mitigation works to ensure that the concerns of AQ regarding the flood risk at the CC precinct are well understood and accounted for.

RI&A Strategy 7: AQ seek advice from the BoM about the installation of an appropriate AWS, at a site within the CC precinct, to support warnings of potential localised flooding.

RI&A Strategy 8: AQ approach the structural engineers responsible for the design and construction of the precinct buildings to determine the wind loads used in the design and construction.

RI&A Strategy 9: AQ seek advice from the BoM about the installation of anemometer instruments on the roofs of each (or selected) building within the precinct to record wind speeds.

RI&A Strategy 10: AQ approach the engineering departments of QUT or UQ to undertake a detailed wind risk modelling of the buildings in the CC precinct and provide advice on establishing a regime of inspections following every significant storm event.

RI&A Strategy 11: AQ approach the structural engineers responsible for the design and construction of the precinct buildings to determine the earthquake loads used in the design and construction.

RI&A Strategy 12: AQ approach the engineering departments of QUT or UQ to undertake a detailed earthquake geotechnical risk modelling in the CC precinct to determine the likely performance of the buildings under different earthquake loads.

Risk Modification Strategies

Strategies to modify the risks posed by the range of hazards considered in this review are designed to act on one or more of the three dimensions of risk - the hazard, the elements exposed and the vulnerability of those elements. There is very little that CC can do about the various hazards described so the risk modification strategies described here will concentrate on the exposure and vulnerability aspects.

Risk Modification Strategy 1: AQ, in consultation with the ASBs, commission a study of the feasibility of developing a purpose-built off-site secure storage facility and emergency management centre for the CC collections and research activities.

Risk Modification Strategy 2: AQ commission a study into the power, water supply and air conditioning systems of the precinct to determine whether they can be modified to make them less exposed and vulnerable to the impact of flooding and other hazards.

Risk Modification Strategy 3: AQ establish as policy the requirement that when planning refurbishment or re-development projects involving CC precinct buildings reduction in the vulnerability of structures and infrastructure be given priority consideration.

Risk Modification Strategy 4: As part of every major refurbishment project throughout the CC AQ require that the redesign and relocation of all critical elements of power supply infrastructure to ensure adequate flood immunity is undertaken.

Risk Modification Strategy 5: AQ and QPAC staff investigate options for employing external stand-by generators to power the QPAC venues in the event of a major power outage.

Risk Modification Strategy 6: AQ investigate the feasibility of developing alternative sustainable power sources employing the roof areas of the CC precinct buildings.

Readiness Strategies

There is a well established view amongst disaster managers that *an aware community is a prepared community*. The general lack of awareness of the flood potential of the Brisbane River undoubtedly contributed to the impact of the January 2011 floods because people, including CC precinct managers, were not adequately prepared for the event. In part some of the lack of preparedness can be attributed to difficulty in translating flood height forecasts and warnings given relating to the Brisbane City Gauge to a specific locality such as the CC precinct.

Readiness Strategy 1: AQ consider commissioning a structure designed to illustrate historic flood levels (1841, 1893, 1974 and 2011 at least), to be placed in an appropriate location within the CC precinct.

Readiness Strategy 2: AQ, in consultation with EMQ and the LGAQ, consider the development of a campaign to encourage schools and other community groups to use artistic works, such as murals or decorated power poles, to record historic flood events in all flood-prone communities in Queensland.

Readiness Strategy 3: AQ mark actual inundation levels within the CC precinct as a permanent record of the January 2011 flood.

Readiness Strategy 4: AQ encourage the QM Board consider the development of a permanent display of natural hazard phenomena including weather and earthquake information in collaboration with the BoM, Geoscience Australia and EMQ.

Readiness Strategy 5: AQ encourage the SLQ and QMSC, in conjunction with the BoM, to produce a series of histories of major floods in Queensland, with those in SEQ being the first to be produced.

Readiness Strategy 6: AQ encourage the SLQ to promote and facilitate the development of a project to collect and store the oral histories of people who have lived through significant disaster events utilising the State-wide network of local studies librarians.

One of the most effective readiness strategies is to receive adequate warnings of an impending hazard impact.

Readiness Strategy 7: AQ, in consultation with EMQ and BoM, develop standard warning messages to be used within the CC precinct to inform staff and visitors of approaching hazards, especially severe thunderstorms. Such messages would only be broadcast from the OS1 on the authority of the Chair of the CCPAC or the Chair of the CCEPCC.

Readiness Strategy 8: During the summer storm season AQ and OS1 staff monitor the BoM radar site so as to better develop warnings to staff and visitors.

Response Strategies

A successful response is predicated on the development of appropriate plans and the degree to which they are understood. Development of the CC LDMP recommended in Context Strategy 6 is therefore critical to an effective response. It is also critical that the various sub-plans (e.g. for a 50 year ARI flood, a 100 year ARI flood, etc.) be rehearsed and exercised regularly to create 'future memory', so that when a real event approaches those responsible for emergency management know what they need to do and how to do it.

Response Strategy 1: In developing the CC LDMP AQ consider developing a range of specific scenario-based sub-plans to address the contingencies most likely to be faced by the CC precinct.

Response Strategy 2: In re-negotiating service contracts for the CC precinct AQ consider adding clauses to cover contingencies, such as the need for an increase in the availability of specific tradesmen at short notice ahead of a disaster event.

Recovery Strategies

In the recovery from the January 2011 floods a number of conflicts emerged that may have been avoided if there had been appropriate planning ahead of the event. The priority to be given to restoring the various ASBs to operational levels, for example, became a distraction for those running the restoration process. There should be an agreed priority established as part of the CC LDMP that reflects the risk management criteria on which this review is based.

Recovery Strategy 1: The priorities to be applied to the restoration of CC buildings and services should be spelt out in the CC LDMP.

Recovery Strategy 2: In the development of the CC LDMP the resources required to restore the affected sites should be identified. Where appropriate, clauses should be added to service contracts to cover surge requirements.

Recovery Strategy 3: AQ develop with DERM protocols relating to the pumping of flood waters from the CC precinct to the Brisbane River.

Recovery Strategy 4: AQ conduct or commission an audit of the response and recovery operations following each disaster impact.

Recovery Strategy 5: Based on the outcome of the audit of post-disaster response and recovery the CC LDMP be updated and amended.

Treatment Priorities

This study has identified 43 risk treatment strategies that AQ and the ASBs may consider adopting to reduce the risks posed to the CC precinct from a range of natural and anthropogenic hazards. Some of these strategies involve simple, low cost actions that can be implemented quickly while a few will require a substantial effort and cost over time. It will be necessary, therefore, for AQ to establish priorities for their implementation over the next five years or so.

The 43 strategies are listed in the Appendix grouped in a suggested priority order as follows:

- Priority 1: Strategy to be implemented before the end of 2011
- Priority 2: Strategy to be implemented before the end of 2012
- Priority 3: Action to be commenced by the end of 2013 and completion by the end of 2016.

Study Conclusions

The events of January 2011 clearly demonstrated that the CC precinct, its precious collections and the valuable services it provides to the community, are at risk from a major flood in the Brisbane River. This study has identified a number of other potential risks posed by a wider range of natural and anthropogenic hazards. While it may not be possible to completely eliminate all of these risks, a range of strategies has been suggested that, if implemented, would substantially reduce those risks.

It is clear from the interest and involvement of senior AQ and ASA managers throughout this study that a healthy risk management culture exists across the CC precinct. While this commitment to risk management was undoubtedly reinforced by the experiences of January 2011 and the realisation that the CC came within centimetres of a catastrophic outcome, **it was not created by that experience**. Had there not been such a culture already in place then the response to the events of January 2011 would not have been as effective as they clearly were. It is clearly evident that the risk management culture that already existed within the senior management of AQ and the ASBs has been reinforced by the outcomes of this study.

The Queensland Flood Commission of Inquiry has noted (in Recommendation 3.2 of its interim report) that:

Risk management is fundamentally important to disaster management.

The strong commitment to disaster risk management demonstrated by AQ and the ASBs should place them in a good position to manage any future disaster.

APPENDIX: IMPLEMENTATION PRIORITIES

STRATEGY NUMBER	STRATEGY	RESPONSIBLE AGENCY	PRIORITY
Context 1	The DDG of AQ write to the Chair of the SDMG requesting that the significance of the State's art, culture and heritage assets and resources be specifically recognised in the <i>Disaster Management Strategic Policy Framework</i> to ensure that they are taken into account in all local and district disaster management plans and risk registers.	AQ	1
Context 3	In writing to the Chair of the SDMG, the DDG also request that AQ be recognised as an occasional member of the SDMG to ensure that disaster management issues relating to the protection and preservation of the State's art, cultural and heritage assets are adequately addressed when such assets may be at risk during a disaster event.	AQ	1
Context 4	AQ pass a copy of the risk assessment contained in this review to the Chair of the SDMG to ensure that EMQ includes the CC precinct in the State Risk Register.	AQ	1
Context 5	AQ, in consultation with the Disaster District Coordinator, formally establish a CC LDMG in line with the <i>Disaster Management Act 2003</i> and the <i>Disaster Management Strategic Policy Framework</i> .	AQ	1
Context 7	AQ and the ASBs agree on levels of risk that they see as acceptable or tolerable as part of the development of the CC LDMP.	AQ, ASAs	1
RI&A 8	AQ approach the structural engineers responsible for the design and construction of the precinct buildings to determine the wind loads used in the design and construction.	AQ	1
Risk Modification 4	As part of every major refurbishment project throughout the CC AQ require that the redesign and relocation of all critical elements of power supply infrastructure to ensure adequate flood immunity is undertaken.	AQ	1
Risk Modification 5	AQ and QPAC staff investigate options for employing external stand-by generators to power the QPAC venues in the event of a major power outage.	APAF, QPAC	1
Readiness 7	AQ, in consultation with EMQ and BoM, develop standard warning messages to be used within the CC precinct to inform staff and visitors of approaching hazards, especially severe thunderstorms. Such messages would only be broadcast from the OS1 on the authority of the Chair of the CCPAC or the Chair of the CCEPCC.	AQ, ASBs	1
Readiness 8	During the summer storm season AQ and OS1 staff monitor the BoM radar site so as to better develop warnings to staff and visitors.	AQ, OS1	1
Recovery 1	The priorities to be applied to the restoration of CC buildings and services should be spelt out in the CC LDMP.	AQ, ASBs	1
Context 6	The CC LDMG create and implement a CC Local Disaster Management Plan.	AQ, ASBs	2
Context 8	The CC LDMG establish and manage a program of training in the operation of the LDMP including exercises and 'live' evacuation drills.	AQ, ASBs	2

STRATEGY NUMBER	STRATEGY	RESPONSIBLE AGENCY	PRIORITY
Context 9	AQ offer to host one meeting each year of the Brisbane Disaster District Management Group at the CC precinct.	AQ	2
Context 10	AQ host a disaster planning workshop in November each year involving the members of the CC LDMG to update pre-season preparations based on the input from the Brisbane DDMG, EMQ and BoM.	AQ, ASBs	2
RI&A 1	AQ consider migrating their CAD-based assets management system to a suitable GIS environment as soon as possible to maximise their ability to integrate spatial data relating to the precinct from outside sources.	AQ	2
RI&A 2	As part of the migration of the AQ assets management system to a GIS environment, AQ negotiate with DERM, BCC and other data custodians for access to data sets that are relevant to the management of the CC precinct.	AQ	2
RI&A 3	AQ establish a project to record in an appropriate form, the local knowledge of experienced assets management staff. That knowledge should be linked where possible to the locations that it relates to.	AQ	2
RI&A 4	AQ negotiate with BCC to gain access to high resolution three-dimensional details of flood modelling in the area of the CC precinct, updated following the January 2011 floods up to the 100 year ARI level as a minimum and preferably up to the 500 year ARI level.	AQ, AQ	2
RI&A 5	AQ establish their interest in being kept informed of the outcome of the modelling to be undertaken for SEQWater in response to the QFCI interim report and its potential significance to disaster planning at the CC precinct.	AQ	2
RI&A 6	AQ establish liaison with the appropriate sections of BCC and DERM to monitor proposals to develop upstream structural mitigation works to ensure that the concerns of AQ regarding the flood risk at the CC precinct are well understood and accounted for.	AQ	2
RI&A 11	AQ approach the structural engineers responsible for the design and construction of the precinct buildings to determine the earthquake loads used in the design and construction.	AQ	2
Risk Modification 1	AQ, in consultation with the ASBs, commission a study of the feasibility of developing a purpose-built off-site secure storage facility and emergency management centre for the CC collections and research activities.	AQ, ASBs	2
Risk Modification 2	AQ commission a study into the power, water supply and air conditioning systems of the precinct to determine whether they can be modified to make them less exposed and vulnerable to the impact of flooding and other hazards.	AQ	2
Risk Modification 3	AQ establish as policy the requirement that when planning refurbishment or re-development projects involving CC precinct buildings reduction in the vulnerability of structures and infrastructure be given priority consideration.	AQ	2
Readiness 1	AQ consider commissioning a structure designed to illustrate historic flood levels (1841, 1893, 1974 and 2011 at least), to be placed in an appropriate location within the CC	AQ	2

STRATEGY NUMBER	STRATEGY	RESPONSIBLE AGENCY	PRIORITY
	precinct.		
Readiness 2	AQ, in consultation with EMQ and the LGAQ, consider the development of a campaign to encourage schools and other community groups to use artistic works, such as murals or decorated power poles, to record historic flood events in all flood-prone communities in Queensland.	AQ	2
Readiness 3	AQ mark actual inundation levels within the CC precinct as a permanent record of the January 2011 flood.	AQ	2
Readiness 4	AQ encourage the QM Board to consider the development of a permanent display of natural hazard phenomena including weather and earthquake information in collaboration with the BoM, Geoscience Australia and EMQ.	AQ, QM	2
Readiness 5	AQ encourage the SLQ Board and QM Board, in conjunction with the BoM, to produce a series of histories of major floods in Queensland, with those in SEQ being the first to be produced.	AQ, SLQ, QM	2
Readiness 6	AQ encourage the SLQ Board to promote and facilitate the development of a project to collect and store the oral histories of people who have lived through significant disaster events utilising the State-wide network of local studies librarians.	AQ, SLQ	2
Response 1	In developing the CC LDMP AQ consider developing a range of specific scenario-based sub-plans to address the contingencies most likely to be faced by the CC precinct.	AQ, ASBs	2
Response 2	In re-negotiating service contracts for the CC precinct AQ consider adding clauses to cover contingencies, such as the need for an increase in the availability of specific tradesmen at short notice ahead of a disaster event.	AQ, AQ	2
Recovery 2	In the development of the CC LDMP the resources required to restore the affected sites should be identified. Where appropriate, clauses should be added to service contracts to cover surge requirements.	AQ, AQ	2
Recovery 3	AQ develop with DERM protocols relating to the pumping of flood waters from the CC precinct to the Brisbane River.	AQ, AQ	2
Recovery 4	AQ conduct or commission an audit of the response and recovery operations following each disaster impact.	AQ	2
Recovery 5	Based on the outcome of the audit of post-disaster response and recovery the CC LDMP be updated and amended.	AQ, ASBs	2
Context 2	The DDG of AQ write to the Chair of the SDMG recommending that, at its next revision, the definition of 'serious disruption' in Section 13 (2) of the <i>Disaster Management Act 2003</i> be amended to read: "serious disruption" means— (a) loss of human life, or illness or injury to humans; or (b) widespread or severe property loss or damage; or (c) widespread or severe damage to art, cultural or heritage assets; or (d) widespread or severe damage to the environment.	AQ	3

STRATEGY NUMBER	STRATEGY	RESPONSIBLE AGENCY	PRIORITY
RI&A 7	AQ seek advice from the BoM about the installation of an appropriate AWS, at a site within the CC precinct, to support warnings of potential localised flooding.	AQ	3
RI&A 9	AQ seek advice from the BoM about the installation of anemometer instruments on the roofs of each (or selected) building within the precinct to record wind speeds.	AQ	3
RI&A 10	AQ approach the engineering departments of QUT or UQ to undertake a detailed wind risk modelling of the buildings in the CC precinct and provide advice on establishing a regime of inspections following every significant storm event.	AQ	3
RI&A 12	AQ approach the engineering departments of QUT or UQ to undertake a detailed earthquake geotechnical risk modelling in the CC precinct to determine the likely performance of the buildings under different earthquake loads.	AQ	3
Risk Modification 6	AQ investigate the feasibility of developing alternative sustainable power sources employing the roof areas of the CC precinct buildings.	AQ	3

The priorities are as follows:

- Priority 1: Strategy to be implemented before the end of 2011
- Priority 2: Strategy to be implemented before the end of 2012
- Priority 3: Action to be commenced by the end of 2013 and completion by the end of 2016.