Green Games Watch 2000
August 2000

The Green Building Legacy

Environmental Review of Sydney Olympic Facilities

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The views expressed in this report are not necessarily those of the Australian and New South Wales Governments, Sydney Organising Committee for the Olympic Games or Sydney Paralympic Organising Committee.

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Note:
Green Games Watch 2000 will cease to operate at the end of 2000. However, the GGW website will remain active: www.greengameswatch.org

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This brief Review[1] looks at the Sydney International Shooting Centre, Sydney Showground, Stadium Australia, Sydney SuperDome, Dunc Gray Velodrome, and Athletes' Village, and is intended to help disseminate Ecologically Sustainable Development (ESD) practices and lessons learnt from the Games' developments.

Environmental Guidelines

A number of reviews have assessed Sydney's environmental performance so far, but all focused on the extent to which the commitments in the *Environmental Guidelines for the Summer Olympic Games* (1993), have been met. It is now time to move beyond these, to look at the achievements of the newly completed facilities, to assess how far these have moved towards ESD and to disseminate this knowledge into the wider community. This Review looks not only at the measures implemented but also at the processes used—analysis of impacts, development of solutions and overcoming of obstacles. These will be relevant wherever ESD is implemented, not just in Sydney's Green Games.

Green Building

It is important to recognise that ESD has advanced rapidly over the last five years. Within that period, however, decisions have had to be made based on the tools and technologies available at the time.

The main lesson to be learnt from these facilities may thus be that 'green construction' is a direction rather than a specific set of solutions. Huge efforts have been made to 'green' the Olympic venues and the advances made should be applauded, though the results are by no means perfect. The test is whether the approach to ESD for the Games remains a 'one-off' or whether these significant endeavours are now repeated, to ensure a wider legacy.

Achieving Ecologically Sustainable Development

ESD is different from conventional development. Commitment to sustainability can be achieved by defining specific measures, by setting performance standards, or by asking tenderers to propose their own goals. The Olympic Coordination Authority (OCA) generally took the third approach, with its *'Environmental Tender Specification'* calling for design teams and developers, contractors and sub-contractors, manufacturers and suppliers all to identify their responses to the Guidelines in their tenders—forcing them to address the issues as part of the competitive process.

This approach appears to have had a strong educational value across the industry. A difficulty, however, was that at the time the Games development process began there was little experience of implementing ESD, and in a competitive situation it was often unclear how much should be built into tenders and design fees, for example, to optimise environmental performance. In the future there should be minimum benchmarks included in tender documents so that sustainability is not made uncompetitive compared to environmentally damaging approaches.

A considerable amount of research seems to have been called for in most of the facilities, and lessons have been learned in discovering just how much investigation is needed to ensure workable ESD solutions. This was difficult to assess in advance. Teams who experienced the process, however, are now in a much better position to budget accurately for future projects. It is now widely recognised that optimum environmental performance in a building is more likely to be achieved by a fully-integrated, multidisciplinary approach than through the conventionally segregated relationship between

different professions and disciplines. Thus the SuperDome team saw bringing all the main players together into a single design/ documentation office as one of its main strengths in introducing ESD initiatives. The Pavilions team made an up-front commitment to a multidisciplinary approach in their tender, resulting in a very close interlinking between the passive energy systems and the architecture. Lend Lease suggest that multidisciplinary 'design for environment' workshops carried out on the Village have resulted in changes to the way the whole organisation operates.

More conventional team structures on other projects, however, particularly when combined with a fixed fee, could result in specialists being called in only when perceived as necessary by the team leader - often 'at arms length' and on a limited basis. Sub-optimal results could thus occur when project managers or architects did not recognise a problem until too late, or when designs or specifications were amended by non-specialists without recognising the likely knock-on effects.

A number of teams saw the need for specialist ESD consultants from the start - in some cases appointed 'above' the architect, to ensure environmental co-ordination across the whole design process. Other ESD specialists, felt out 'on a limb'—unable to communicate directly with key team members, and poorly placed to influence outcomes. Some consultants were asked to provide considerable input during the design stage but little or nothing regarding construction or operation, leading to a lack of continuity, and possible conflicts between environmental goals and the eventual results.

Environmental Management Plans (EMPs)

Environmental Management Plans were also important, to ensure the issues were addressed thoroughly and systematically, rather than in an *ad hoc* or subjective manner, and particularly so that the decision-making process would be recorded. A number of projects trained workers and had an effective hierarchy of control down to site worker level, to monitor, audit and resolve any disputes about environmental matters.

The Legacy

One measure of success from the Games will be the extent to which lessons learned during design of the facilities help advance ESD in the community more generally. Some specific findings from review of the six individual venues are outlined broadly below, and the lessons from these will be likely to contribute significantly to the community's legacy from the Green Games.[2] This is particularly so for the Athletes' Village (Newington).

The Appendix here contains a series of benchmarks for urban development that developers and planners will find useful.

1. This report is largely based on Myer, Andrew. (2000), Environmental Design Review of the Olympic Facilities. A full copy of the report and other relevant reports can be viewed on the Green Games Watch website—www.greengameswatch.org

2. However, no environmental design review of the other Olympic venues seems to be planned at the moment, and it would be unfortunate if these were not investigated in similar detail. Considerable efforts were put into implementing a wide range of ESD measures for these also, and valuable knowledge is at risk of being lost. Such a review needs to happen sooner rather than later, preferably before OCA ceases to exist, before documents are archived, design teams dissipate, and personal memories are overwritten by later events.

ATHLETES' VILLAGE (NEWINGTON)

- ✓ use of 100% local native plant species for public areas in the Village and extensive use of indigenous vegetation in private gardens with care and planting advice provided to residents
- ✗ ongoing concerns about impacts on endangered wildlife in the adjoining wetlands, from unrestricted public access and the lack of barriers to exclude cats and dogs
- ✓ avoidance of through traffic and provision of pedestrian/cycle paths and a range of bus connections -'improved' rather than 'cutting edge' thinking making little attempt to address innovative transport solutions
- ✓ the reclaimed water system (WRAMS) is a significant environmental initiative[3]
- ✓ the solar power station (arrays on buildings) is a significant achievement which has pioneered new practices. The decision not to include arrays on apartment blocks is regrettable - but the installation is likely to help spread public and industry awareness
- ✓ the application of passive solar design to houses and the setting of energy standards
- ✗ the lack of energy standards for apartment units is disappointing, and more so because these increased from 25% to 40% of the final housing mix. It would be counter-productive for these to be linked with the Village's 'green credentials' if their performance is little or no better than other apartments elsewhere
- ✓ the improved solar water heaters (flush with the roof) on the houses seem likely to increase both environmental performance and consumer acceptability, reducing CO_2 emissions and eliminating the roof tank
- ✓ provision of gas cooktops and heater outlets, 6-star dishwashers and energy conservation advice
- ✓ the systematic approach to auditing energy performance should be applauded, though it is unclear if the NatHERS software is yet user-friendly enough for wide acceptance (and its inability to simulate apartment units is a severe limitation)
- ✓ commendable gains seem to have been made in material selection, with many manufacturers/ suppliers encouraged to develop 'greener' products, and the eco-rating system (Life Cycle Assessment) thought to have proved useful. Installing the materials list on the Ecospecifier website is a practical way to disseminate information to the design/development community, which should be welcomed. Ideally the materials used should become a 'test-bed', to feed into future development
- ✓ admirable efforts have been made to increase use of plantation timber
- ✓ the Village Construction EMP is systematic, particularly in its classification of environmental risks and the actions proposed to address these
- ✓ a manual was essential for the ESD initiatives at the Village, and the one provided to owners is user-friendly, comprehensive and informative
- ✓ the Village ESD Strategy included a number of specific quantifiable targets which could offer useful benchmarks for future developments (see Appendix)
- ✗ construction of the Village entailed destruction of more than 45 heritage items, so that the history of the site's use as an arms depot is no longer recognisable

3. the Olympic Park and Village area uses non-potable recycled water for toilet flushing and outside use, from the Water Recycling and Management System (WRAMS).

SYDNEY INTERNATIONAL SHOOTING CENTRE

Regional and site-related issues

- ✓ the SISC is a valuable case study of how development can be achieved while still maintaining biodiversity, and OCA should be applauded for its protection of the Cumberland Plain Woodland
- ✗ the SISC location conflicts with commitments for all Games sites to be accessible by public transport, and is a poor precedent for 'sustainable recreation'
- ✗ water and sewerage solutions are disappointing: irrigating grass to soak up 'unwanted' water, piping in potable water to flush toilets, and trucking sewage waste away are poor examples of what ESD could offer in remote locations
- ✓ approaches to erosion and protecting water quality to Kemps Creek appear comprehensive and thorough in both design and construction - but it will be important to continue monitoring in full operational mode
- ✓ simple daylighting, natural ventilation and the solar hot water system (despite its long pay-back in this situation, as electric water heating would have been the worst option for greenhouse emissions). The core facility could have been chosen to provide a demonstration of Australian renewable remote area power supply technologies
- ✓ qualitative Life Cycle Assessment (LCA) for selection of construction materials has generated environmentally responsible solutions. Extensive use of recycled timber—particularly for demonstrating simple approaches to 'chain of custody' and 'fitness for purpose'
- ✗ shooting waste from the indoor ranges is easily recycled, and seems well in hand. Lead shot from outdoor trap and skeet, however, may cause an environmental hazard, and the clean-up options seem comparatively complex or disruptive. Sydney apparently investigated use of alternative materials to lead but may have succumbed too readily to the *status quo*, rather than using its position as host of the Green Games to encourage the sport to move towards 'cleaner' solutions
- ✓ OCA's 'Reference guide for future management' of the SISC is a valuable step towards effective environmental management - as long as its recommendations are implemented by the operator in the long term

ROYAL AGRICULTURAL SHOWGROUND

- ✓ OCA efforts in protecting the Green and Golden Bell Frog population at Homebush Bay, and particularly for resisting pressures to utilise the Brickpit for commercial uses. Showground-related activities, however, could still affect both the frogs and Brickpit adversely and need to be managed accordingly
- ✓ retention of the magnificent on-site fig trees is a real gain, and a pointer towards retention of mature trees more widely in future developments
- ✓ natural ventilation in the pavilions and exhibition halls, which have considerable potential to help communicate the idea to the industry. The decision not to implement underfloor ducts in the exhibition halls could result in air-conditioning being installed later, which would prove a poor 'saving'. The computer modelling is a big step forward and would not have been possible even a few years earlier
- ✓ provision of daylighting in the animal pavilions

- considerable attention was paid to material selection. Examples include: the qualitative eco-rating system, which is reported to have worked well; extensive use of plantation and recycled timber (though regrettably, no certified, sustainably harvested Australian hardwood); and significantly reduced PVC use (especially the choice of steel for the Showring roof instead of PVC-coated fabric, and extensive below-ground polyethylene pipe)
- the environmental management plan for construction of the Showground was particularly clear and methodical, and the electronic document tracking system also provided major benefits. Both of these approaches were highly innovative at the time (if more common now)
- the operators of the RAS will need to retain a commitment to utilising the building's environmental features as planned and monitoring performance for future application, rather than reverting to conventional occupational practices (air conditioning, artificial lighting, more car parks)

STADIUM AUSTRALIA

- storage and re-use of roof water to meet the Stadium's high irrigation demand which is also likely to make good economic sense for the operators
- the commitment to buy 100% 'green power' (which hopefully will continue beyond the current 5-year contract)
- cogeneration at the Stadium is welcomed in principle, but is less 'cogeneration' than 'generation', with more heat thrown away than used. Multiplex considered supplying hot water to other facilities but in the absence of an integrated Energy Strategy for Homebush Bay no funds were available for the infrastructure. Furthermore, the generators are currently only operating during events, rather than supplying the daily base load - though this is under investigation (particularly because running the system continuously would save money)
- the commitment to buy 100% green power at a premium tariff
- water reduction measures have not only reduced demand significantly but have an admirable target for less than 20% of the water to come from the mains
- it is unfortunate that the revolutionary, energy-saving microwave sulphur lamp could not have been used for arena lighting, but the product seems simply not to have been ready in time
- daylighting in indoor areas was always restricted by the building's orientation and geometry, but the intention to encourage daylight does not seem to have been fully optimised - in part because the 'cutting edge' software did not prove as useful a design tool as had been hoped. While such software is considerably more common now, it will only realise its full potential when thoroughly integrated into the design process
- the approach to natural ventilation (intended to reduce mechanical ventilation and air conditioning, rather than achieve a fully naturally ventilated building). A post-occupancy study would be of considerable value to the design/development community
- the construction waste strategy achieved almost 75% recycling, well ahead of the 60% target. A valuable benchmark for future developments
- LCA processes at the Stadium are 'world first' ESD initiatives. Materials selection questionnaires used in the subcontract/supply tendering process have apparently had significant influence on the industry, and the fully quantified whole building analysis has helped advance the field of LCA internationally, as well as providing a much improved understanding of the building's interactions with the environment

SYDNEY SUPERDOME

- ✓ Energy Australia's roof-mounted PV 'power station'
- ✓ the Millennium Group's commitment to 100% green power (much of the extra cost will be met by the promoters and concession-holders)
- ✗ use of HCFCs in the cooling system contravenes Guideline commitments, but Abigroup argues that Greenpeace's preferred alternative, ammonia, would have resulted in higher CO_2 emissions, was more prone to leak, and that toxicity and flammability problems were insurmountable. A single Olympic Park refrigeration plant, as proposed by both green groups and developers, could have supplied cooling to all the venues, run on zero-ozone ammonia (but this approach is understood not to have been considered by OCA)
- ✓ a combination of measures to reduce air-conditioning demand (for example, passive solar design, demand sensitive ventilation) are likely to offer significant energy savings
- ✓ trialling new materials at the Olympic facilities, such as cellulose insulation and low-VOC paints, can help make them more accessible to the market. Manufacturers proved willing to provide far more environmental data on their products than previously, and the eco-charts generated were used to help balance environmental impacts against other material selection parameters
- ✓ the target of 50% reduction in potable water use
- ✗ more effort could have been made to improve efficiency of artificial lighting because of the venue's high electricity demand when in use, and to help offset the increased running costs from its commitment to green power
- ✓ targets for reducing construction waste seem to have been more than met, and this is thought already to have influenced different areas of the industry
- ✓ the operational EMP for the SuperDome (including waste management) was admirably methodical and comprehensive, and if implemented as proposed could offer a valuable model of environmental management in practice

OLYMPIC VELODROME

- ✗ (the leader of this design team chose not to participate in the Review, so no talks were held with the team. The venue is thus covered in less detail than the others)
- ? measures proposed to avoid impact on adjoining bush areas seem well thought out. It is hoped these have been fully implemented and that management of the venue ensures their continued performance. There is concern, however, that proposed construction of a nearby cricket oval and Criterium cycling track will have adverse effects on the endangered vegetation in Louisa Reserve
- ? the water quality control pond seems a good start to protect down-stream ecosystems, but as almost the whole Velodrome site has been made impervious, the question remains whether this will be adequate. It is unclear whether any monitoring of water quality has been implemented. It is unfortunate that water from the huge roof could not have been taken out of the equation altogether, by storage and reuse within the building
- ✗ the site is poorly served by public transport, in contravention of the Environmental Guidelines, and provision of a large car park is a virtual invitation to drive to the facility
- ✗ an all electric water heating system appears the worst choice for greenhouse gas emissions and will burden the operator with unnecessarily high running costs - in a facility which already has some uncertainty hanging over its long-term financial viability

the central rooflight is impressive and attractive: it could provide a useful model for future development if its performance is monitored, to demonstrate that it provides the desired light levels, glare-free, throughout the year

natural ventilation of the main arena bowl could similarly be useful to the wider design/development community if its performance is monitored and disseminated

omission of roofwater collection for toilet flushing and washdown represents one of the major lost opportunities of the Green Games as run-off from the roof could now cause adverse environmental impacts. Roofwater storage should have been included in the budget. (The claim that it was omitted because of excessive cost is a commonly used pretext, to disguise a lack of commitment on behalf of either the design team or client (or both).

despite 'in principle' commitment to select materials to minimise environmental impact, the process seems to have been applied less systematically for the Velodrome than at other venues

APPENDIX 1: ENVIRONMENTAL BENCHMARKS

Athletes' Village (Newington)

The MLLVC ESD Strategy included specific commitments and quantifiable targets which could provide useful benchmarks for the assessment of the Village itself and for future developments. These included:

- a generic outline Environmental Management System (EMS) that can be used as part of the 'greening industry' initiative
- 100% of management and site workers to receive environmental skills and due diligence awareness training;
- to provide a new benchmark for recycled water use in a residential development;
- 50% reduction in consumption of potable water against conventional designs;
- total annual average residential water consumption of less than 275 l/person/day;
- energy demand in permanent dwellings reduced 50% compared with standard project homes;
- 90% of permanent dwellings (excluding units) oriented with living areas 20°W-30°E of north;
- 90% of permanent dwellings (excluding units) meet 80MJ/m^2/yr for heating energy to 20°C;
- no air conditioning to residential buildings;
- 100% of permanent dwellings in 2000 (excluding units) to generate their own household energy demands (1600kWh/yr) by rooftop PV;
- 100% of major building materials/systems to be assessed using LCA techniques;
- in the order of 40% reduction in PVC use;
- zero irrigation demand in public areas after a three-year establishment period;
- 90% of landscape planting in public areas from native species;
- to provide a new benchmark in the environmental management of construction projects;
- importation of topsoil eliminated by reconstituting existing soil;
- CO_2 emissions reduced by 2000 tonnes/yr;
- no increase in lux levels in Newington Woodlands as a result of the Village;
- no increase in nitrogen, phosphorus, potassium and gross pollutants entering Homebush Bay as a result of the Village;
- infiltration to groundwater equivalent to 40% of rainfall runoff volume;
- project construction waste: 90% recycling of hard waste, 60% of soft waste;
- per capita residential waste to landfill reduced 50% and 50% increased recycling.

APPENDIX 2: GREEN GAMES WATCH 2000 ENVIRONMENTAL TARGETS AND GUIDELINES FOR DEVELOPMENT

Conservation of species

Flora and fauna

- ☐ no harm to threatened species, populations, ecological communities, critical habitat or areas of ecological sensitivity, including wetlands and remnant vegetation;
- ☐ minimum 30% increase in area of locally indigenous vegetation, and native wildlife corridors and habitat, compared to existing condition.

People and social environment

- ☐ increase in employment opportunities compared to existing situation.

Conservation of resources

Water

- ☐ minimum 50% reduction in demand for potable water from Sydney's mains supply for any new development compared to a similar development

Energy

- ☐ maximum energy consumption of 100MJ/psqm/a for any new multi-unit residential development
- ☐ 5 star energy rating under SEDA Energy Smart Homes Policy for any new individual lot residential development;
- ☐ maximum energy consumption of 350MJ/psqm/a for any new commercial/office development;
- ☐ maximum energy consumption of 900MJ/psqm/a for any new retail development
- ☐ minimum 50% reduction in demand for energy from non-renewable sources for any other new development compared to a similar development.

Construction materials

- ☐ reduction in use of materials which deplete natural resources or create toxic pollution in manufacture, use or disposal for any new development compared to a similar development

Open space

- ☐ significant allocation of public open space in the development for community use

Topsoil

- ☐ no importation of topsoil

Pollution prevention

Air & transport

- ☐ minimum 25% decrease in greenhouse gas emissions compared to existing situation
- ☐ no use of ozone depleting substances
- ☐ no increase in ambient levels of air toxics listed under the National Pollutant Inventory measured at the boundary of any new industrial development
- ☐ maximum of 0.08 ppm ozone measured over 1 hour
- ☐ maximum of 0.105 ppm nitrogen dioxide over 1 hour

- ☐ maximum of 30 micrograms per cubic metre particulate matter (PM10) over 1 year
- ☐ maximum of 90 micrograms per cubic metre of total suspended particulates over 1 year
- ☐ significant decrease in number of car parking spaces per capita
- ☐ significant increase in VKT by public transport compared to existing situation
- ☐ maximum indoor levels of carbon monoxide, formaldehyde, lead, ozone, radon, sulfates, sulfur dioxide, total suspended particulates and total VOC as specified in NHMRC interim national indoor air quality goals for any new development.

Water

- ☐ significant improvement in quality of stormwater compared to existing situation
- ☐ significant reduction in pollutant load from licensed discharge for any new development compared to similar development
- ☐ no adverse impact on water flows from any new development
- ☐ groundwater quality to meet ANZECC 1992 Australian Water

  Quality Guidelines for Fresh and Marine Waters

Soil

- ☐ maximum levels of heavy metals, mineral pollutants, phenolic compounds, aromatic hydrocarbons, chlorinated hydrocarbons, pesticides, sulfate and pH to be levels specified as environmental investigation levels in ANZECC 1992 Guidelines for the Assessment and Management of Contaminated Sites

Waste

- ☐ minimum 60% reduction in waste to landfill from operation of any new development compared to a similar development
- ☐ 90% reduction in construction hard waste from any new development compared to a similar development

Noise

- ☐ significant reduction in noise level for any new development compared to a similar development

Light

- ☐ significant reduction in light spill for any new development compared to a similar development

  no adverse light impact on environmentally sensitive or existing residential areas

Design and construction

- ☐ developments incorporate or adapt existing facilities as far as possible;
- ☐ building and infrastructure design minimises adverse environmental impacts and impacts on surrounding communities;
- ☐ building material selection is subject to life cycle assessment, considering environmental implications during manufacture, use and disposal;
- ☐ development takes into account the findings of social and health impact assessments
- ☐ development minimises the amount of land used while not compromising good urban design
- ☐ site selection and design avoids native bushland, threatened species, populations and ecological communities, critical habitat, and ecologically sensitive areas including wetlands and wildlife corridors;
- ☐ site selection and design avoids areas of Aboriginal or European archaeological significance
- ☐ site selection and design encourages the use of public transport

- ☐ environmental management plans are prepared and implemented during design, construction and operational stages of development;
- ☐ independent environmental audits are conducted during design, construction and operational stages of development

Energy conservation

- ☐ the development incorporates passive solar building design;
- ☐ insulation and natural ventilation are used;
- ☐ life cycle assessment of materials considers thermal performance
- ☐ renewable sources of energy are widely used
- ☐ use of natural light is maximised
- ☐ energy efficient appliances and lighting systems are used;
- ☐ sophisticated building management and control systems assist management of engineering services to minimise energy requirements
- ☐ mechanical ventilation is zoned to allow ventilation flow to be switched off when spaces are unoccupied

Water conservation

- ☐ the development is consistent with any relevant catchment management plan
- ☐ a water cycle management plan is incorporated
- ☐ buildings and infrastructure are designed to collect wastewater for recycling
- ☐ life cycle assessment of materials considers water used
- ☐ treated stormwater and sewage effluent are recycled
- ☐ the recycled water system is supported by public information and education
- ☐ landscape design uses locally indigenous species which decrease water requirements
- ☐ water conservation devices are used such as dual flush toilet systems, roof-fed water tanks, water-saving shower roses, and appropriate irrigation devices
- ☐ AAA rated low-water use appliances are used

Waste avoidance and minimisation

- ☐ a waste minimisation plan covering design, construction and operation is prepared and implemented
- ☐ the waste minimisation plan is supported by user information and education
- ☐ life cycle assessment of materials considers waste issues, including recycled content
- ☐ packaging is avoided wherever possible during construction and operation of the development
- ☐ waste separation and composting facilities are incorporated in design
- ☐ colour coded recycling bins with signage are used
- ☐ compost from organic waste is used in landscaping
- ☐ regular waste audits are conducted
- ☐ recycled, non-chlorine bleached paper is used in all project documentation.

Improving air, water and soil quality

- ☐ an air quality management plan covering design, construction and operation is prepared and implemented;
- ☐ public transport access is facilitated;
- ☐ provision of car parking spaces is limited;
- ☐ carpooling is encouraged;
- ☐ cycle ways and pedestrian walk ways which link to existing routes are provided;
- ☐ new plantings are provided to fully offset greenhouse gas emissions;
- ☐ CFC, HFC, HCFC-free refrigerants and processes only are used;
- ☐ building design maximises indoor air circulation, without compromising energy saving features;
- ☐ integrated pest management is adopted during design, construction and operation to minimise use of chemical pesticides;
- ☐ indoor air quality is protected by selecting building materials, finishes and furnishing with the lowest emissions of pollutants and radiation;
- ☐ plant species known to produce common human allergens are avoided in landscaping near buildings;
- ☐ use of chlorine based products (organochlorines) such as PCBs and PVC is avoided or minimised;
- ☐ an erosion and sedimentation control plan is prepared and implemented;
- ☐ paved surfaces are minimised and permeable pavement systems are used where appropriate
- ☐ constructed wetlands and gross pollutant traps are used to remove pollutants from stormwater;
- ☐ cleaner production practices and best practice technology are implemented to minimise licensed pollution discharges;
- ☐ a land-use history of the site is prepared to identify potential soil contamination;
- ☐ comprehensive soil and groundwater contamination testing are undertaken for potentially contaminated sites;
- ☐ an ecological risk assessment and remedial action plan are prepared and implemented for contaminated sites;
- ☐ bioassays are used in testing, validation and monitoring of contaminated and remediated sites;
- ☐ life cycle assessment of materials considers emissions to air, water and soil

Protecting significant natural and cultural environments

- ☐ flora and fauna impacts are assessed and minimised
- ☐ design avoids damage to native bushland, threatened species, populations and ecological communities, critical habitat, and ecologically sensitive areas including wetlands and wildlife corridors
- ☐ landscape and habitat management plans are prepared and implemented to enhance locally indigenous communities
- ☐ extensive indigenous plantings, including corridor plantings, are used to attract locally indigenous birds and other animals
- ☐ buffer zones are provided between sensitive natural areas and human use areas
- ☐ integrated pest management is used to manage feral animals and weed invasion
- ☐ impacts on Aboriginal or European heritage are assessed and minimised

- ☐ existing landscape features, such as ridges and lookouts, are protected, and visual amenity is assessed and enhanced
- ☐ a management plan is prepared and implemented to manage natural, landscaped and cultural features;

Event management

- ☐ an event public transport strategy is prepared and implemented
- ☐ public transport is the primary means by which spectators can directly access the event
- ☐ where appropriate, satellite car-parking venues are established so people can transfer to trains, buses and ferries for event access
- ☐ the event transport strategy facilitates access for people with disabilities
- ☐ event tickets integrate event admission with public transport
- ☐ integrated ticket prices encourage the use of public transport
- ☐ tickets are printed on recycled paper using non-toxic ink
- ☐ an event waste minimisation strategy is prepared and implemented
- ☐ waste minimisation and recycling are applied at both "back of house" and "front of house"
- ☐ event organisers minimise the amounts and types of waste entering venues;
- ☐ foodstuffs from event outlets have minimal packaging subject to health requirements
- ☐ non-disposable cutlery and crockery are used at food outlets wherever possible
- ☐ a standardised, colour-coded recycling bin system is applied throughout event venues;
- ☐ recycling bin stations carry simple information to assist users to correctly separate waste
- ☐ the event waste strategy is supported by education of participants, including suppliers, waste contractors, venue employees and spectators
- ☐ event information is carried electronically where possible to reduce unnecessary use of paper, supplemented by effective paper recycling procedures
- ☐ procedures are implemented to identify, minimise and safely manage special wastes such as medical waste, photographic waste, batteries, cooking oil;
- ☐ noise abatement techniques minimise disturbance for nearby residents from the event;
- ☐ event merchandise with a short useful life is avoided
- ☐ selection of event fitout material and official merchandise is subject to life cycle assessment considering environmental implications during manufacture, use and disposal
- ☐ use of recycled materials in fitout and merchandising is maximised
- ☐ packaging of merchandise is avoided or minimised
- ☐ official merchandise embodies environmental messages