

**Dams Safety Committee**

**Annual Report**

**2004/2005**



# NSW DAMS SAFETY COMMITTEE

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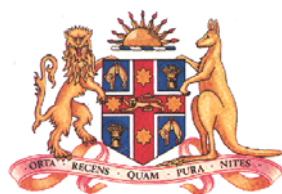
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**BUSINESS AND SERVICE HOURS ARE NORMALLY**

**9.30 am to 4.00 pm MONDAY to FRIDAY**

Please note that the NSW Dams Safety Committee (DSC) only has a small number of technical staff who are often away from the office on inspections. Accordingly, technical questions may not be able to be answered immediately, although every effort will be made to pass on messages to ensure a prompt response.



**Cover Picture:** Sooley Dam is a 13m high, post tensioned, concrete gravity dam near Goulburn, which is being raised to provide additional water supply, and buttressed to withstand modern-day extreme flood design loadings.

NOTE: The DSC has prepared 200 copies of this report for distribution to Parliament, relevant organizations, and the public, at a cost of \$2,950.00 (ie \$14.75 per copy).

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The Hon Ian Macdonald, MLC  
Minister for Natural Resources, Minister for Primary Industries  
and Minister for Mineral Resources  
Parliament House  
SYDNEY NSW 2000

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In reply please quote:  
Our Ref: 10.102.007

Dear Mr Macdonald,

We have pleasure in submitting to you, for presentation to Parliament, the NSW Dams Safety Committee's Annual Report for the year ended 30th June 2005.

This Annual Report has been prepared in accordance with the Annual Reports (Statutory Bodies) Act 1984 and the Annual Reports (Statutory Bodies) Regulation, 2000.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Len McDonald'.

Len McDonald  
Chairman

A handwritten signature in black ink, appearing to read 'Adrian Williams'.

Adrian Williams  
Deputy Chairman

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## Overview by Chairman

### Our Objectives

*The NSW Dams Safety Committee's mission is to develop and implement effective policies and procedures for:*

- *regulation of dams safety; and*
- *regulation of mining that could affect dams or stored waters.*

The main objectives are that risks to community interests from dams are tolerable, that the risks are kept under review and that they are further reduced where such reduction is reasonably practicable. In deciding on tolerable risks from dams, the Dams Safety Committee (DSC) takes into account modern principles of safety regulation across all industries, as well as relevant international dam safety practices and those recommended by the Australian National Committee on Large Dams (ANCOLD). A dam is classified as safe if it meets the DSC's requirements.

That no prescribed dam has failed does not demonstrate an adequate dam safety management program. International experience has shown the need for systematic programs, involving consequence rating, responsible operations, maintenance and emergency preparedness practices, regular surveillance reporting, periodic safety reviews and implementation of necessary risk reduction measures. The DSC's requirements for dam safety management programs are aligned with the ANCOLD *Guidelines on Dam Safety Management 2003*. Most owners have such programs.

In managing the threats of mining effects on stored waters, or dam structures, there is not the same degree of guidance from international practice. When formed in 1979, the DSC initially adopted a cautious approach in regulating mining activities near dams, based on existing scientific knowledge of the effects of mining. Monitoring of these effects continues to provide new knowledge enabling the DSC to update its requirements so as to allow the safe extraction of coal and mineral resources from more extensive and challenging mining operations. The result has been significant economic benefit to the State, whilst maintaining the security of stored waters and the safety of the dams.

### Targets

The DSC has adopted the targets given in Sub-section 5.2, Table 2, of this report. During the year, the DSC's main focus continued to be on the key target requiring that dam owners have provided programs agreed with the DSC for activities leading to safety improvements on dams identified as having significant deficiencies. These programs enable the DSC to monitor progress with the activities and to follow-up any issues in a timely manner. Identification of safety deficiencies and implementation of risk reduction measures for a dam usually requires a period of several years. The DSC must monitor progress, assist the process as needed, and be prompt in stating its requirements.

### Highlights

The DSC continued with its review of safety policies, to bring them into line with modern principles of safety management and good regulation. Drafts of a position paper on the proposed policies were reviewed by leading safety management specialists, an owner's manager, a legal practitioner and Treasury before finalisation in mid-2005. The paper is due for submission for Government approval in the latter half of 2005. The policy review involved complex considerations of public safety policy analysis and imposed heavy demands on the DSC's members and small staff.

Internal policies were developed and adopted to meet modern expectations for good governance of the Committee.

Safety improvements were effectively completed during the year on Grahamstown Dam, and were substantially advanced on Sooley Dam and Jindabyne Dam. Investigations continued into long-term options for upgrading the flood capacity of Hume, Chaffey and Keepit Dams. The owners of these dams are to be commended for committing substantial funds to the safety improvement of their dams. Starts were made in upgrading deficient Council dams, according to revised priorities identified in a portfolio risk assessment completed in 2002. Progress was made with planning of the risk reduction measures for other dams.

There were no significant dam safety incidents, floods or damaging earthquakes in NSW during the year, although there were several damaging floods and earthquakes, and dam failures with loss of life, overseas.

Work continued on updating of detailed technical policies and the preparation of new Information Sheets dealing with tailings dams, spillway gates and fusible elements, and community consultation.

Mining, under and near to stored waters continued at an unprecedented level throughout the year, without any significant adverse effects. The major new Dendrobium Mine, with potential for affecting the reservoir of Cordeaux Dam, commenced longwall operation in April 2005 after significant investigation and review by the DSC.



All targets were substantially met, except that site inspections were slightly reduced in the short term, while maintaining monitoring oversight, because of priority tasks on mining applications and policy development. Plans are in hand to address these matters in 2005/06 with submissions to restructure funding arrangements to meet essential dam safety regulatory requirements. Submission of dam Surveillance Reports is returning to an acceptable rate following letters that were sent to owners with a view to redressing the back-log situation that had developed.

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## Our People

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The Chairman, Deputy Chairman and members remained active and updated in their respective dam and mining related fields by their normal technical activities external to the DSC. The DSC is represented on the Board of the Mine Subsidence Technological Society and Engineers Australia. Most DSC members and technical staff attended the 2004 ANCOLD Conference on Dams. Other training for members and staff included attendance at various relevant seminars and refresher courses.

The DSC greatly appreciates the dedication of all staff in their efforts to improve the efficiency of the DSC's operations.

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## Our Stakeholders

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Dam owners, mining companies, and their consultants, have the most contact with the DSC, which seeks to work closely with these people in order to achieve mutually satisfactory outcomes to dam safety and mining issues. Most dam owners and mining companies understand their responsibilities and liability, and are committed to safe practices. The DSC takes a flexible approach and considers proposals on their merits, provided they will achieve tolerable risks.

The DSC monitors the satisfaction of dam owners, mining companies and other stakeholders by feedback at meetings and training courses. To assist with proper management of dams, the DSC places considerable importance on providing technical information to owners and their consultants. Updated Technical Information Sheets and relevant technical papers are available on CD-ROM and at the DSC's Internet site. Dam operator training courses were conducted jointly with the Department of Energy, Utilities and Sustainability (DEUS) in December 2004 and March 2005.

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## The Future

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Following approval of its overall policy framework, the DSC will proceed with the comprehensive updating of its detailed safety policies, initially on acceptable flood capacity for dams, since this is the main area of safety deficiency and has the most immediate and significant effects on dam owners.

The DSC will continue to refine its requirements in relation to mining near dams in the light of developments in international practice and the knowledge gained from monitoring the effects of mining.

New Technical Information Sheets on tailings dams, spillway gates, and community consultation are planned to be finalised and circulated in the coming year. A key Information Sheet on *Demonstration of Safety* will be commenced during 2005 and will cover detailed aspects of such topics as failure modes analysis, risk assessment and tolerability of risks in relation to dams. The DSC will continue with its support of research on piping risks and slope stability.

The steady increase in the number of prescribed dams, markedly increased and more complex mining activities near dams, and the increasing demands of policy development, are placing a strain on the DSC's resources which will need to be redressed in 2005/6.

The DSC aims to keep New South Wales at the forefront of good regulation for dam safety by world standards. An extensive network of international contacts, both within the dams' community and among regulators of industrial safety generally, is yielding benefits in continual improvements to DSC policies.

The risks posed by dams are being continually reduced, with priority normally given to early elimination of the most unacceptable risks. Risks are kept under review through the owner's regime of routine monitoring, surveillance, safety review, staff training and dam safety documentation procedures. Safety policies are being modernized, with proposals for a further shift to less prescriptive and more goals-based regulation. The safety risks of most concern are now eliminated. The risk reductions to be achieved over coming years are necessary and important safety measures but are generally of lower urgency than was the case for the safety improvements that have been made so far.



Len McDonald, Chairman

## 1. Charter

*The DSC is required to “formulate measures to ensure the safety of dams in NSW”*



**Coeypolly No. 2 Dam**

*Inspection in 2004 of this 21m high earthfill dam by Committee members and staff with Council owner personnel.*

### 1.1. Why do we have a Dams Safety Committee (DSC) in NSW?

In the 1970's, international concern at several major overseas dam failures led to the Australian National Committee on Large Dams (ANCOLD) raising the need for dam safety regulation in Australian states. There was also significant consideration by the NSW Government as to the extent of mining that should be permitted adjacent to Sydney's major water storages. Against this background, the NSW Government constituted the NSW Dams Safety Committee (DSC) under the NSW *Dams Safety Act, 1978*.

*“It is the nature of risk that, frequently, those who create the risk do not bear its consequences or the wider costs. So the market does not function properly as a distributive mechanism. The State must intervene to regulate risk”- [Jenny Bacon, then Director-General of the United Kingdom Health and Safety Executive, 1999].*

### 1.2. What Legislation defines our Function?

The DSC has statutory functions under the *Dams Safety Act 1978*, the *Mining Act 1992* and the *Coal Mine Health and Safety Act 2002*.

### 1.3. What is the Function of the DSC?

The DSC is required to “formulate measures to ensure the safety of dams” in NSW. It “prescribes” those dams with a potential for failure that could threaten downstream life, cause extensive property or environmental damage, or have a severe impact on the public welfare.

Currently there are 314 prescribed dams (see Appendix B and centre pull-out map) with an enviable safety record internationally compared with countries like the USA which has had over 500 significant dam failures in the last ten years.

For prescribed dams, the DSC adopts a regulatory ongoing watchdog role to ensure the owners of those dams, and organizations (eg mining companies) undertaking significant activities near their storages, conform to appropriate safety requirements.

The aim of regulation is that the risks of failures, with consequent community and environmental effects, will be tolerably low. In this context, a “safe” dam, or associated activity, is taken to be one that complies with the DSC's current requirements.

## 2. Access

The DSC's access details are outlined in the inside front cover of this report.

## 3. Aims and Objectives

In interpreting its legislative charter, the DSC has adopted the following mission statement.

*The NSW Dams Safety Committee's mission is to develop and implement effective policies and procedures for:*

- *regulation of dams safety; and*
- *regulation of mining that could affect dams or their stored waters.*

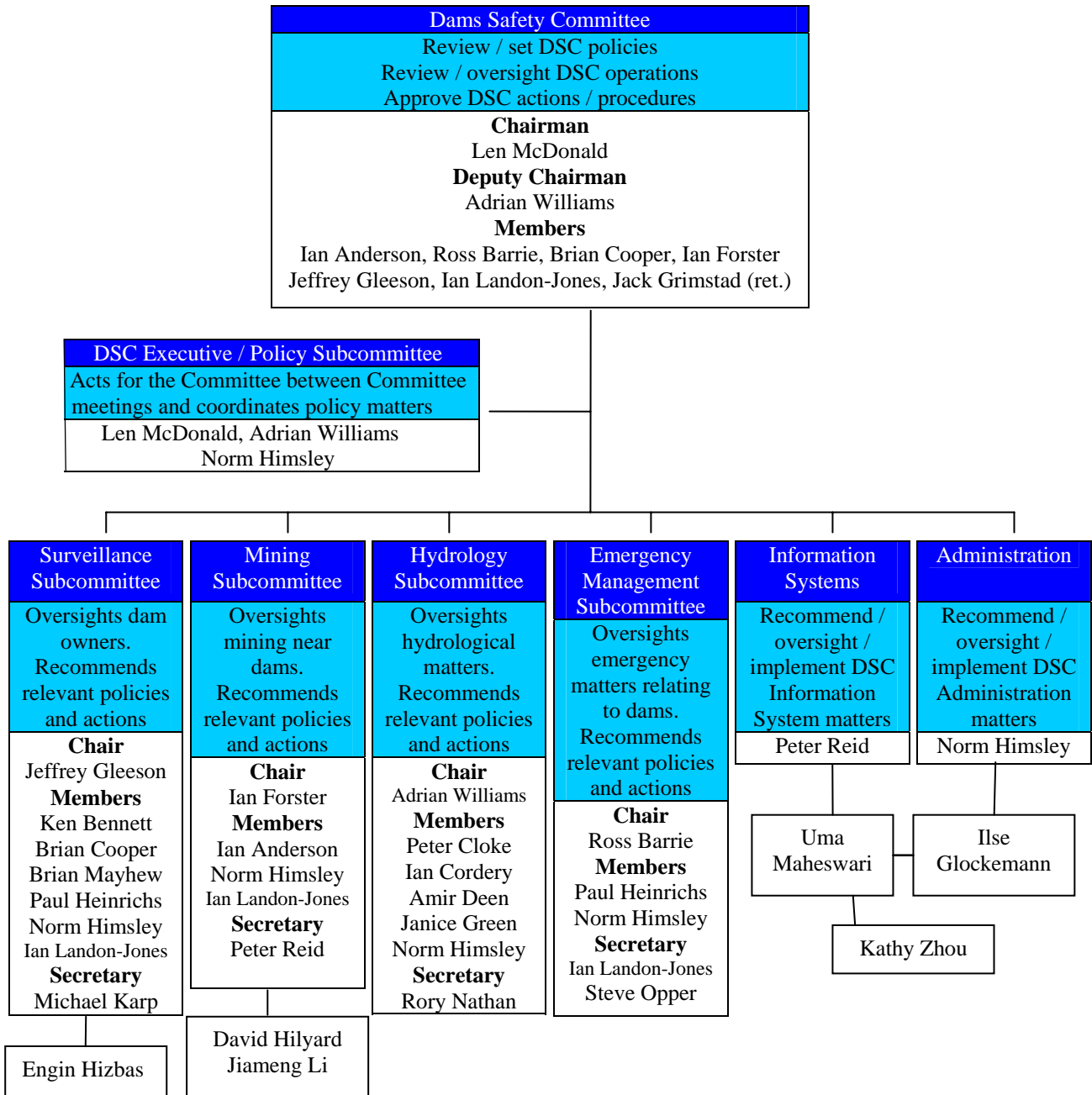
Relevant to this mission statement, the objectives of the DSC are to:

- Protect the safety, welfare and interests of the community from dam failure by ensuring that risks from prescribed dams are tolerable;
- Ensure that risks from prescribed dams remain tolerable over the long-term, by requiring that the risks are regularly reviewed, and further reduced if need be; and
- Protect the security of dams and their stored waters from the effects of mining or other activities.

## 4. Management and Structure

The DSC is a small statutory body with negligible assets; it owns no real estate and uses seconded staff from member organizations, and hires contract staff when required. It operates through two Standing Sub-committees, responsible for Dam Surveillance and for Mining matters, along with ad hoc Advisory Sub-committees on Policy, Hydrology and Emergency Management matters. Its functional organisation is outlined in the following chart with most business dealt with initially by the Sub-committees, which report to Committee meetings.

**Dams Safety Committee Organisation Chart**



### 4.1. Committee Members

The DSC's nine part time members are appointed by its Minister for four-year terms and usually re-appointed for continuity of Committee experience. Eight members are nominated for their experience in dams engineering and one for experience in coal mining. In routine matters, the Executive Engineer and standing Sub-committees act for the DSC. Between Committee meetings, its Executive deals with urgent important business or emergencies on behalf of the DSC. Policy initiatives originate at any level, but are coordinated by the Policy Sub-committee before submission for Committee approval.





**Len  
McDonald**



**Adrian  
Williams**



**Ian  
Anderson**



**Ross  
Barrie**



**Brian  
Cooper**



**Ian  
Forster**



**Jeffery  
Gleeson**



**Ian  
Landon-Jones**



**Jack  
Grimstad**

Committee membership during 2004/2005, with brief member biographies, is as follows:

**Leonard McDonald**, BE, MEngSc, MIEAust, CPEng, LGE (appointed to June 2009). Chairman, Nominee of Institution of Engineers, Australia. Initially appointed 1987. Len has practised as a private dams' consultant since his retirement as Assistant Principal Engineer, Dams & Civil section, of the then NSW Department of Public Works and Services. He took over the Chairmanship of the DSC in mid-1997. Until late 2003, he was the Assistant Secretary to ANCOLD and a member of the ICOLD Committee on Dam Safety. Len has more than thirty years experience in the water industry and has developed a wide background in all aspects of dam engineering with his involvement as a full time specialist in the design and safety evaluation of many dams.

**Adrian Williams**, BE, FIEAust, CPEng (appointed to December 2008). Deputy Chairman, Nominee of Sydney Catchment Authority (SCA) until end 2000 and then the Institution of Engineers. Initially appointed 1986. Adrian was General Manager, Dam Safety in the SCA until retiring in December 2000. He has over thirty years investigation, design and construction experience with dams, through work with AWT/Sydney Water and the former Water Conservation and Irrigation Commission. He is a past Chairman of ANCOLD, past Vice-President of ICOLD and is Chairman of the DSC's Hydrology Sub-committee.

**Ian Anderson**, BE (Hons.1), ME (Mining), Certificated Coal Mine Manager, Undermanager & Mines Rescueman, Qualified Mine Ventilation Officer (appointed to June 2006). Nominee of the Minister for Mineral Resources. Initially appointed 1994. Ian is a Senior Inspector of Coal Mines with the Department of Primary Industries. He has over thirty years experience in underground, and open-cut, coal mining and is a member of the DSC's Mining Sub-committee.

**Ross Barrie**, BE, MEngSc, MBA, MIE Aust, CPEng (appointed to March 2007). Nominee of the Water Administration Ministerial Corporation. Initially appointed 1999. Ross is the Assets Services Manager of State Water. He has over thirty years water industry experience and is Chairman of the DSC's Emergency Management Sub-committee.

**Brian Cooper**, BE, MEngSc, Grad Dip Eng Mgt, MIEAust, CPEng (appointed to June 2009). Nominee of the Minister for Commerce. Initially appointed 1997. Brian is Principal Engineer, Dam Safety, with the Department of Commerce, Water Technologies Branch. He has over thirty years water industry experience including extensive dam design experience working with the Department of Public Works and Services and the former Water Resources Commission. He is a member of the DSC's Surveillance Sub-committee.

**Ian Forster**, BSc, MAIG, RPGeo (appointed to October 2007). Nominee of the State owned Electricity Generators. Initially appointed 1989. Ian is a specialist dam safety consultant with Connell Wagner Pty. Ltd. He is currently responsible for the safety management of dams owned by the NSW State-owned power generators. Ian has over thirty years experience in dam safety management and geotechnical engineering and hydrogeology related to dams, power stations, tunnels and coal mining. He is Chairman of the DSC's Mining Sub-committee and a board member of the Mine Subsidence Technological Society.

**Jeffery Gleeson**, BE, FIEAust, CPEng (appointed to December 2005). Nominee of Hunter Water Corporation. Initially appointed 1990. Jeff is Manager, Engineering, Hunter Water Australia, the consultancy division of the Hunter Water Corporation. He has over twenty-five years experience in the water and waste-water field with involvement in various aspects of dam engineering and structural design. He is Chairman of the DSC's Surveillance Sub-committee.

**Ian Landon-Jones**, BE (Hons), MEngSc, MIEAust, CPEng (appointed to December 2008). Nominee of Sydney Catchment Authority (SCA). Appointed in January 2001. Ian is Executive Director, Dam Safety with the SCA. He has over twenty-five years experience in the water and waste-water fields, through his work with the SCA and previously with Sydney Water, with involvement in various aspects of dam engineering and structural design. He is a member of the DSC's Surveillance, Mining and Emergency Management Sub-committees.

**Jack Grimstad**, BE, MBA, MIEAust, CPEng (retired March 2005). Nominee of Snowy Hydro Ltd. Initially appointed 2003. Jack was Manager, Dams & Civil Engineering with Snowy Hydro Ltd. with over thirty years experience in dam safety and hydro management related to dams, power station and tunnels. He was a member of the DSC's Surveillance Sub-committee until his retirement and will be replaced by Graeme Bell in July 2005.

## 4.2. Committee Staff

The Committee is assisted by a full time staff of six, seconded from authorities nominating Committee members, with temporary staff assistance where required. Given the extensive workload of the DSC's activities, this small staff provides an effective and efficient service to the DSC's functions. During the year the DSC staff comprised:

**Executive Engineer: Norman Himsley**, BE, MEngSc, Grad Dip Bus, FIEAust, CPEng. Norm was seconded to DSC in 1986 from a position currently aligned with the Department of Infrastructure, Planning & Natural Resources (DIPNR). He has over thirty year's investigation, design and construction experience in dams and engineering services.

**Surveillance Engineer: Michael Karp**, BE (Seconded 1999-DIPNR position). Michael has over twenty year's design, construction and surveillance experience in water and dams engineering.

**Engineering Geologist and Information Systems Coordinator: Peter Reid**, BSc BA (Seconded 1987-State Water position). Peter has over fifteen year's experience in geological/mining fields and extensive computer / information technology experience.

**Dams Engineer: Engin Hizbas**, BE (Seconded 2003-DIPNR position).

**Administrative Officer: Ilse Glockemann**, (Seconded 1995-DIPNR position).

**Information Systems Support Officer: Uma Maheswari**, (Seconded 2001-DIPNR pos.).

**Mining Regulation Officers: David Hilyard**, BA, MAppSc (temp. from June 2003).

**Jiameng Li**, B.E. (temporary from March 2005).

**Information Systems Support Officer: Kathy Zhou** (5 month temporary-2004/5).

## 4.3. Sub-committees

There are two standing Sub-committees, one on Dam Surveillance and one on Mining. There are three ad hoc Sub-committees, the Policy Sub-committee, the Emergency Management Sub-committee and the Hydrology Sub-committee, that meet as required. Membership of the Sub-committees is outlined in the DSC's organization chart (see page 8).

Mr Himsley has been appointed to each of the Sub-committees for his technical input, and to provide effective liaison between the Sub-committees and the Committee. He also provides an important role of liaison with dam owner personnel and other stakeholders.

## 4.4. Meetings

The Committee held eight normal meetings and one special policy meeting during the year, of which seven were in Sydney and one each at Parkes, and at Cooma, in association with dam inspections. Attendance at Committee meetings was as follows:-

- |                      |  |
|----------------------|--|
| • Mr L.A. McDonald   | attended 9 out of 9                    |
| • Mr A.C. Williams   | attended 8 out of 9                    |
| • Mr I. Forster      | attended 9 out of 9                    |
| • Mr I. Anderson     | attended 7 out of 9                    |
| • Mr J. Gleeson      | attended 8 out of 9                    |
| • Mr R. Barrie       | attended 8 out of 9                    |
| • Mr B. Cooper       | attended 9 out of 9                    |
| • Mr I. Landon-Jones | attended 8 out of 9.                   |
| • Mr J.Grimstad      | attended 6 out of 6. (ret. March 2005) |



**Norm Himsley**



**Michael Karp**



**Peter Reid**



**Ilse Glockemann**



**Uma Maheswari**



**Engin Hizbas**



**David Hilyard**

## 5. Summary Review of Operations

*“Substantial progress on producing a policy paper recommending new safety policies, including the incorporation of risk assessment practices into dam safety management”*

*“Two deficient dams significantly upgraded in 2004/5”*

*“DSC updated its records system and procedures”*

### 5.1. Major Achievements for 2004/2005

During the year the following milestones and deliverables were attained:

- Substantial progress on producing a policy paper recommending new safety policies, including the incorporation of risk assessment practices into dam safety management in NSW;
- Adoption of additional policies for the good governance of the DSC;
- Further progress in reducing the risks posed by deficient dams in NSW with the upgrading of Grahamstown Dam, substantial progress with upgrading works at Sooley Dam and commencement of upgrading at Jindabyne Dam;
- Substantial compliance with core business activities, as in Table 2 following;
- Investigation and approvals for an unprecedented number of technically challenging applications for coal mining near dam storages;
- Running of two training courses for dam operators;
- Upgrading and networking of the DSC computer systems;
- Upgrading and documentation of DSC procedures;
- Expansion and refurbishment of DSC office facilities;
- Substantial progress on production of new Information Sheets on tailings dams, gated spillways and community consultation.
- Production of updated DSC public information materials; and
- Upgrading of the DSC record system, including scanning and archiving of old records.

### 5.2. Performance Indicators

During the year the DSC monitored performance indicators, which reflect the objectives of its mission statement, as shown in Table 2 on the following page. Because of the nature of the DSC's work, and the relatively small size of its organization, quantitative indicators are often not entirely appropriate and some of its significant indicators are therefore qualitative.

### 5.3. Budget Highlights

A summary of the DSC's financial performance is shown in Table 1 with full details given in Section 10 of the Report. Budgeted expenditure is used as DSC expenses were included within DIPNR's funding allocation while new funding strategies are being explored with Treasury.

**Table 1 – 2004/5 Budget Highlights**

Item	\$
<b>Budget</b>	829,000
<b>Expenditure</b>	826,000

**Table 2 - DSC Performance Indicators**

#	PERFORMANCE TARGET	PERFORMANCE INDICATOR	RATING
1	Programs provided by owners, and agreed with DSC, for activities leading to safety improvements to dams with significant known deficiencies	Percentage of significantly deficient dams with agreed programs	90% (Good)
2	Follow up action taken within three months of due date	Percentage performance	80% (Satisfactory)
3	Reports and programs reviewed and response sent within three months of receipt	Percentage performance	100% (Good)
4	Significant risk dams (18) inspected yearly	Number inspected this year	14 (Good)
5	Medium risk dams (32) inspected every two years (average of 16 per year)	Number inspected this year	11 (Marginal)
6	Low risk dams (264) inspected every five years (average of 53 per year)	Number inspected this year	78 (Very Good)
7	Request programs for preparation of dam safety documentation for each dam	Percentage of dams with documentation requested	100% (Good)
8	Update dam safety education material every two years	Time since last update issued	Updated in 2005
9	Annual involvement in providing at least one dam safety education course in NSW	Number of courses this year	2
10	Compliance with approved Committee budget	Percentage deviation	<1% under budget (Good)
11	Surveillance Sub-committee	Subjective based on policy progression, reports received and reviewed (average 70 reports/yr) and matters followed up	Satisfactory. 59 reports reviewed
12	Mining Sub-committee	Subjective based on compliance with monitoring programs, matters followed up and mining impacts as predicted	Satisfactory given unprecedented workload
13	Hydrology Sub-committee	Subjective based on policy progression, research oversight and updating of procedures	Good
14	Emergency Management Sub-committee	Subjective based on policy progression, coordination of matters and implementation of emergency plans for dams	Good
15	Compliance with Records Management Standards	Subjective based on progression in updating procedures and systems, and programs achieved	Good
16	Administration	Subjective, based on meeting HR, accounting and logistical needs of the DSC	Good

## 6. The Future

*“DSC requires NSW dams to present a tolerably low risk to downstream residents, property, the environment and associated community interests”*



**Drayton Mine Water Supply Dam**

*Committee staff carried out an audit inspection of the dam in April 2005 to confirm Surveillance Report recommendations and a dam failure consequence assessment.*

*“The DSC will continue to monitor progress of activities for safety improvements of NSW dams”*

*“DSC will further develop the integration of the traditional dam safety standards into a risk management framework”*

### 6.1. Regulation of Dams Safety

The DSC sees that the number of dams in NSW will continue to grow and existing dams will be improved to meet community expectations. The DSC's main objective is to ensure that all prescribed dams present a tolerably low risk to downstream residents, property, the environment and associated community interests.

In particular, the DSC will:

- Continue with its dam safety policy development, with a view to having a revised overall policy framework and updated policies in place on key aspects, such as flood capacity for dams and tailings dam management, by mid-2006;
- Develop further Information Sheets to assist dam owners on such subjects as tailings dams (DSC19), gated spillways (DSC20), demonstration of safety (DSC21), embankment dam safety (DSC22), community and other stakeholder consultation (DSC23), and dam security (DSC24);
- Continue to monitor activity programs for safety improvements to dams, especially those identified as having significant deficiencies;
- Continue to develop the risk indexing of dams, as a basis for assessing the priority and urgency of safety improvements and activities, in order to achieve the optimum risk reduction with the available resources;
- Develop the integration of traditional dam safety standards into the risk management framework of AS/NZS 4360:2004 *Risk Management*;
- Continue support of research into dam safety risks, such as the risks of piping (internal embankment erosion) and slope instability;
- Work with NSW dam owners to ensure appropriate dam emergency and security arrangements are in place. Liaise with the State Emergency Management Committee and the State Emergency Service (SES) to facilitate these arrangements;
- Pursue a program to ensure dam owners have in place, and regularly update, Operation and Maintenance Manuals for their dams;
- Maintain liaison with NSW dam owners by continuing its emphasis on education, and by arranging training courses for dam's personnel. The DSC will also arrange staff presentations at meetings and conferences on relevant dam matters, and will provide input to ANCOLD Guidelines;
- Continue to advise dam owners of the value of installing rainfall and flow monitoring equipment to enhance catchment/storage management and flood warning, and to assist in flood analysis, safety review and design. The DSC will continue to promote research into extreme flood estimation and probability;
- Support expansion of the earthquake monitoring network in NSW and collaborate with other agencies in the development of improved seismic analysis of dams, relevant to the characteristics of Australian earthquakes;
- Continue its program to determine the condition of unprotected pressure pipelines through dams and ensure appropriate remedial actions are implemented;
- Maintain liaison with the Department of Environment and Conservation (DEC) and DIPNR to ensure that DSC dam safety requirements are compatible with environmental protection and planning policies; and
- Hold further forums with agencies responsible for nuclear safety and land planning regulation, to update thinking and practices on risk management.



## 6.2. Regulation of Mining near Dams

In the Southern Coalfield, the Dendrobium Mine proposes to longwall mine adjacent to Cordeaux and Avon Reservoirs and Upper Cordeaux Dam for at least five years. NRE No.1 Colliery plans further mining under Cataract Reservoir. In 2005/6, Westcliff Colliery will continue to mine away from Westcliff Dam, Avon Colliery will continue to mine away from Broughtons Pass Weir and a major application from Metropolitan Colliery to mine under Woronora Reservoir is likely to be made.

To the north of Sydney, United Colliery will continue to mine longwalls under Wambo Tailings Dam although the possible stabilisation and decommissioning of this dam may remove long-term dam safety issues. Duralie Colliery will continue open-cut mining near its two surface mine water dams. Applications are also expected in 2005/6 from Wambo Mine (near Wambo Tailings Dam) and Newpac No. 1 Colliery (near Ravensworth Void 3 Ash Dam).

The DSC's objective is to regulate mining so as not to restrict extraction of these coal resources, within the constraint that risks to dams, and their stored waters, are tolerable. It continues to urge mine owners to develop a more scientific approach to prediction of the effects of mining, utilizing results from a growing database of monitoring information, allied with more sophisticated computer simulation techniques. There is an increasing sophistication of mining applications reviewed by the DSC. Improved knowledge has resulted, over time, in the DSC being able to approve the extraction of some coal from under NSW storages, where mining would have not been approved in earlier years.

The DSC's proposed initiatives to achieve its objective are to:

- Ensure adequate protection of dam walls and stored waters by reviewing the maximum extent of ground movements induced by coal mining and, if necessary, increasing the size of Notification Areas;
- Ensure adequate security deposits are held by the State to allow for the timely implementation of dam safety mitigation works in the event that the safety of a prescribed dam or its storage is threatened by mining;
- Promote compliance within the mining industry, and promote an understanding within other Government agencies, of the DSC's mining regulation requirements.
- Work closely with the recently instituted Subsidence Management Plan Review Committee to facilitate a combined Government approach to mining regulation;
- Develop a revised basis for providing funding needs for mining regulation to cover significantly varying workloads each year;
- Investigate applications of risk management to various aspects of mining developments, and monitor practice and update guidelines accordingly; and
- Explore use of new equipment and techniques for prediction and monitoring to provide a clearer picture of mining induced ground behaviour.

## 6.3. Administration and Information Systems

The DSC will maintain a commitment in 2005/6 to ongoing implementation of Total Quality Management principles. Procedures and practices will be formalised and updated progressively, records management will continue to be updated, and the DSC's database on dam information will be extended and consolidated to assure the timely provision of dam safety information. Training of DSC staff will be kept up-to-date with appropriate requirements to facilitate effective and safe work practices.

The DSC will keep dam owners informed of its current requirements by regularly releasing updated Information Sheets in paper format, as well as on CD-ROM, and on its Internet site.

*“The DSC will investigate applications of risk management to various aspects of mining developments”*



### **Upper Cordeaux No 2 Dam**

*The DSC has approved underground coal mining adjacent to this dam and is closely monitoring the mining operations, by Dendrobium Colliery, as they progress towards the dam.*

*“The DSC continues to urge mine owners to develop a more scientific approach to prediction of the effects of mining”*

*“The DSC aims to keep dam owners informed by regularly releasing updated Information Sheets”*

## 7. Review of Operations

### 7.1. Regulation of Dams Safety

#### 7.1.1. What Dams are Regulated?

The DSC is required to formulate measures to ensure the safety of dams in NSW. The total number of dams in the state is estimated at many tens of thousands, predominantly farm dams. However, the charter of the DSC is to protect life and significant property, environmental and community interests from the effects of dam failure. That is why the DSC only “prescribes” and regulates the safety of those 314 dams with significant failure consequences as detailed in Appendix B.

#### 7.1.2. Policies and Procedures that Apply to the Regulation of Dams Safety

After being informed of a proposed dam, the initial DSC decision is on the need, or otherwise, for prescription of the dam and its safety regulation by the DSC. These matters are outlined in the DSC’s Information Sheet DSC1. Then for prescribed dams, as shown in the chart below, the Committee has a range of policies and procedures that facilitate its interactions with dam owners and other affected organizations at all stages of the life of that dam.

#### Interaction of DSC Over Dam Life Cycle

Phase	Interaction
<b>Investigation</b>	Owners provide proposed dam details DSC decides on prescription and provides ongoing requirements (see DSC14)
<b>Design</b>	DSC reviews suitability of designers DSC requires design report and reviews major design standards (does not review details)
<b>Construction</b>	DSC requires designer oversight of construction DSC requires Construction Report and Construction Certificate on completion
<b>Commissioning</b>	DSC requires Surveillance Report one year after construction DSC requires Operation & Maintenance Manual DSC requires Dam Safety Emergency Plan if downstream lives at risk
<b>Operation</b>	DSC requires regular surveillance and reporting DSC conducts random audits DSC requires submission of Surveillance Reports at regular intervals (usually 5 yearly) DSC requires Safety Reviews at regular intervals (usually 10 yearly)
<b>Modifications</b>	DSC requirements similar to that for new dam
<b>Decommissioning</b>	DSC reviews proposal DSC requires decommissioning report

For further information on the policies that apply to the regulation of dam safety, refer to the Information Sheets listed in the table below. These are available on-line on our web page ([www.damsafety.nsw.gov.au](http://www.damsafety.nsw.gov.au)).

**Table 3 - Information Sheets for Dams Safety**

Document	Description	Update Date
DSC 01	General Information	April 1998
DSC 02	Role, Policies and Procedures	August 1999
DSC 03	Glossary of Terms	April 1998
DSC 05	Advice on Legal Matters for Dam Owners	August 1996
DSC 11	Acceptable Flood Capacity for Dams	August 1992
DSC 12	Operation, Maintenance and Emergency Management Requirements for Dams	April 2003
DSC 13	Consequence Categories for Dams	March 2002 (b)
DSC 14	Requirements for Submission of Information by Dam Owners	August 2000(b)
DSC 15	Requirements for Surveillance Reports	January 2003
DSC 16	Requirements for Earthquake Assessment of Dams	February 2000(b)
DSC 17	Requirements for Assessment of Flood Retarding Basins	August 2000(a)
DSC 18	Dam Design and Construction Issues requiring Particular Consideration	June 2003
DSC 19	Tailings Dams	Draft-June 2005

Note: (a), (b) indicate revisions of initial Information Sheets. Date changes only when there is a Policy change.

### 7.1.3. Changes introduced in 2004/2005

During 2004/5 the DSC:

- Finalised, for submission for Government approval in late 2005, its overarching policy paper, which consolidates and extends the DSC's policies and proposes a staged implementation of risk assessment methodologies into dam safety regulation;
- Implemented protocols with State emergency authorities (eg SES, police) for emergency arrangements relating to dams (see DSC12-1 addendum);
- Implemented a new Information Sheet DSC18 on "Dam Design and Construction Issues requiring Particular Consideration"; and put a draft of a new Information Sheet DSC19 on "Tailings Dams" on the DSC's Internet site for community comment before finalisation; and
- Initiated new Information Sheets on "Gated Spillways", "Demonstration of Safety", "Embankment Dam Safety", "Community Consultation" and "Dam Security".

*"Staged implementation of risk assessment proposed for dam safety regulation"*



**Clarrie Hall Dam**

*Tweed Shire Council is currently investigating options to increase the storage capacity and flood capability of this 43m high decked rockfill dam near Murwillumbah.*

### 7.1.4. 2004/2005 Dams Surveillance Matters

The DSC continually reviews its list of prescribed dams in the light of new proposals, changed conditions, staff inspections and information supplied, to ensure that only dams with the potential for significant failure consequences are prescribed. During the year four dams were prescribed, and one dam was de-prescribed, giving a total of 314 prescribed dams at June 2005 (see Appendix B and centre pull-out map).

For proposed dams and dam modifications, the DSC requires dam owners to provide design information for its review before construction. In all, 19 such submissions were processed during 2004/5. The DSC does not have, or require, the resources to examine designs in detail, but audits the design process to ensure major safety criteria (eg flood capacity, filter provisions) are addressed, and that the designers are competent. The DSC also requires the submission of copies of design reports.

The DSC requires designers' involvement in the dam construction process, to approve design changes and "sign-off" that the "as-built" design is sound. DSC staff also audit construction and maintain close contact with, and assistance to, the owner's personnel.

Upon completion of construction, the DSC requires dam owners to submit work-as-executed drawings and the "construction certificate" (certifying designer's approval) for the DSC's records. Some dam owners have been slow to comply with this requirement during the year and the DSC has issued follow-up letters requesting the information.

The DSC then requires Surveillance Reports to be regularly submitted, summarising the behaviour of the dam since construction. The first report is to be submitted usually after first filling of the dam, which is a critical phase in dam safety, but no later than one year after completion of construction. Thereafter, Surveillance Reports are required at not more than five yearly intervals (with annual update reports also required for most tailings dams).

These reports provide information on the safety status of existing dams and are checked in a staged process by DSC staff, its Surveillance Sub-committee and then the Committee. The reports enable the DSC to monitor whether dam owners are continuing with a responsible approach to their dams at all stages during their lives. The reporting extent varies, with comprehensive reporting required for extreme consequence category dams, down to brief reports for low consequence category dams (see DSC15).

During 2004/5, the DSC reviewed 59 dam Surveillance Reports (see Appendices A and B for details). This was slightly below the number that normally needs to be processed. Procedures are now in place to automatically send letters to dam owners when reports are due, stressing their liabilities and the importance of submitting these reports on time. Surveillance Reports are stored in the DSC's record system and progressively incorporated into the DSC database. This has been simplified by requiring owners to provide electronic copies of each report. The DSC considers that the content and presentation of Surveillance Reports is now of a generally high standard and that owners are responding in a positive and responsible manner to its requirements.

*"4 dams prescribed, 1 dam de-prescribed and 19 dam designs processed in 2004/5"*

*"59 dam surveillance reports reviewed in 2004/5"*

*“104 dams inspected during 2004/5”*



#### **Emigrant Creek Dam**

*Committee staff audited the surveillance inspection of this 12m high concrete gravity dam, near Ballina, one year after safety augmentation of the dam.*

*“The DSC provides regular updated Information Sheets to dam owners on relevant dam safety matters”*



#### **Woolgoolga Dam**

*Committee staff undertaking a surveillance audit inspection, with Coffs Harbour Council staff, of this 14m high earthfill dam.*

In addition to the Surveillance Report review procedures, the DSC continued with regular staff inspection of dams, and discussion with owners, throughout the State. There were also inspections by DSC members in conjunction with country meetings. Overall 104 prescribed dams were inspected during the year (see Appendices A and B for details). This number was satisfactory in light of priority tasks on mining applications and policy development. Such inspections and meetings are essential to audit the general safety standard of each dam, its consequence category, and the actual performance of each dam owner in complying with DSC requirements. At the same time, any deficiencies detected are brought to the attention of the owner's representative, and any concerns discussed on site. The inspections also provide useful background knowledge and photographs, against which Surveillance Reports can be evaluated and assessed by the DSC.

#### **7.1.5. Status of Dams Safety Assessment**

Effective safety management of dams requires continual updating by drawing on the results of operational experience and the latest techniques for design, construction and asset management. Each dam is site specific and uncertainties exist in the many areas related to dam safety assessment and risks and society's expectations can change with time.

Dam owners (and their agents) are legally responsible for assessment of all these factors, and to make informed judgments, to ensure the risks associated with their dams continue to be tolerable. As a regulator, the DSC ensures that dam owners discharge this responsibility and that community interests are adequately protected.

To assist owners in this regard, the DSC provides regular updated Information Sheets on relevant dam safety matters. These sheets set out the normal requirements of the DSC. However, the policy of the DSC is to judge each case on its merits. It will consider any dam safety proposals from dam owners provided they are soundly researched, within the bounds of accepted practice, and tolerable risks.

To adequately assess these proposals, the DSC needs to keep itself updated in all areas of dam safety regulation and management through the continuing education of staff and members. For this purpose, staff and members attend relevant technical symposia, along with meetings with representatives of various dams' organizations, and of hazardous industries generally.

To provide background data needed for safety assessment studies, and the estimation of design loadings for rare, but credible, extreme floods and earthquakes, the DSC has continued to encourage dam owners and Government agencies to install and maintain rainfall/runoff and seismic monitoring equipment.

A process of risk assessment, used to better clarify the safety of dams, is now considered desirable to assist in evaluating the relative safety of each dam, to assess risk reduction options, and to assign priority and urgency. During the year, the DSC has continued to assess developments in risk assessment as applied to dams and has fostered discussion in this developing field. It has also supported research into the estimation of risk associated with piping in embankments and foundations, the derivation of extreme rainfall estimates, and the risk assessment of slopes.

The DSC sees that the risk assessment approach of the national standard AS/NZS 4360:2004 *Risk Management* provides a framework for comprehensive assessment of dam safety over the whole range of potential failure situations and provides a better understanding of relative risks and consequences. Risk assessment will better clarify safety and thus provide for more informed decision-making. Risk assessment requires that the analysis team work with the decision-maker, and communicate appropriately with the affected community, to formulate an informed overall judgment of the safety requirements for a dam.



A factor in determining that risks are acceptable is the effectiveness of emergency response actions. Effectiveness is difficult to determine before the emergency occurs. To maximize effectiveness, the DSC, through its Emergency Management Sub-committee, has developed a protocol with the SES for the development of appropriate interim emergency procedures for deficient dams in NSW. The Sub-committee is also examining the feasibility of developing acceptable "long-term" flood emergency plans to minimise the risk to life from dam failure events.

From information received on dams, the DSC identifies those with possible safety deficiencies and reaches agreements with owners on needed safety improvements, or the activities needed to clarify safety, and a timetable for actions. Once it has been established that a dam has a significant safety deficiency, the owner is to submit a program for safety improvement. To focus the attention of the DSC across owners, it regularly updates its provisional risk index ranking of dams and the SES is informed to guide them with interim flood planning downstream of deficient dams.

The DSC then monitors activities against the safety improvement program, which can necessarily extend over many years to allow for detailed investigations and community consultation, financing and implementation.

This process continued throughout the year. Forty one deficient dams have now been modified for safety improvement following the DSC's establishment, as shown in Table 4. For some of these dams, there has been a series of improvements made. In 2004/5 flood upgrading works were completed on Grahamstown Dam, were substantially advanced on Sooley Dam and were initiated on Jindabyne Dam.

**Table 4 - Dams Modified for Safety Upgrading**

Dam	Upgrade Cost Orders (\$M)	Deficiency	Year Upgrading Completed	Nature Of Upgrading
Ben Chifley	10-100	Flood	2001	Dam raised and spillway post-tensioned
Burrinjuck	10-100	Flood	1996	Dam raised 15m and post-tensioned
Blackbutt	<1	Flood	1995	Spillway upgraded
Bonalbo	<1	Flood	1989	Spillway upgraded
Captains Flat	1-10	Flood/Stability	1993	Dam post-tensioned
Cataract	10-100	Flood/Stability	1987	Dam post-tensioned
Chichester	1-10	Flood/Stability	1995,2003	Dam post-tensioned, abutment stabilised
Coalcliff	<1	Flood/Stability	1999	Spillway enlarged, embankment upgraded
Cordeaux	<1	Flood	1988	Internal drainage improved
Dungowan	1-10	Flood	1992	Spillway augmentation, dam raising
Dunn Swamp	<1	O&M	1995	New outlet, wall repair
Emigrant Creek	1-10	Flood	2001	Dam post-tensioned, abutments raised
Foothills Rd	<1	Flood	1997	Embankment stabilised, new spillway
Glenbawn	10-100	Flood	1986	Dam raised, storage augmented, new spillway
Googong	10-100	Flood	1992	Dam raised, spillway stabilized
Grahamstown	10-100	Flood	2001,2005	Dam core raised, face armoured, spillway upgraded
Green Meadows Basin	<1	Flood	2003	Embankment & crest stabilised, new spillway
Honeysuckle Ck	<1	Flood	1991	Post-tensioned and raised
Hume	10-100	Stability/ Earthquake	1973,2003	Embankments stabilised, gates/outlets upgraded
Killara	1-10	Stability	1994	Embankment walls stabilized
Lyell	10-100	Flood	1996	Dam raised, spillway and storage augmented
Manly	1-10	Flood	1984	Dam post-tensioned
Mardi	1-10	Earthquake	1991	Embankment stabilized
Moolarben	<1	Flood	1993	Spillway augmented
Nepean	10-100	Flood/Stability	1992	Spillway augmented, dam post-tensioned
Northmead Basin	<1	Flood	1994	Embankment raised, strengthened
Oberon	10-100	Flood	1996	Dam raised, additional spillway
Orange Agricultural	<1	Flood	1997	Spillway augmented
Palm Tree Grove	<1	Flood	1990	Embankment raised, strengthened
Pindari	10-100	Flood	1993	Dam raised, storage augmented, new spillway
Prospect	10-100	Earthquake	1997	Upstream dam embankment stabilised
Rydal	1-10	Stability/Flood	1993	Dam wall stabilised, spillway augmented
Rylstone	<1	Flood	1995,2003	Auxiliary embankments removed.
St Joseph Sch. Basin	<1	Flood	2001	Bank stabilisation and new spillway
Tilba	<1	Flood/Stability	1997,2003	Dam wall raised, toe drained
Tumbarumba	<1	Stability	1999	Embankment drainage installed
Warragamba	>100	Flood	2001	Dam post-tensioned, raised 5m, new spillway
Wentworth Falls	<1	Flood	1993,2003	Dam raised, spillway augmented
Wellington	<1	Flood/Stability	1996,2002	Dam demolished
Wollondilly Washery	<1	Flood	1998	Dam raised, emergency spillway installed
Woronora	<1	Flood	1988	Internal drainage improved



The dams currently identified as posing significant safety risks are ranked in Table 5, together with the year in which the deficiency was determined, and the status of the safety improvement program for each dam. Dam owners have commenced remedial studies or design of improvement works for all of these deficient dams, and the DSC monitors their progress. If owners fail to achieve satisfactory progress, the DSC works with the owners to ensure an improved outcome. Should owners not respond positively, the DSC could issue a notice under Section 18 of the *Dams Safety Act*. It was not necessary to issue any Section 18 notice during the year. In addition, the DSC is monitoring owners' progress in developing action programs for dams with minor deficiencies, and owners' investigations of several other dams to confirm their safety status (see Appendix B for details).

As mentioned in previous DSC Annual Reports, significant upgrading works at Hume Dam have been completed at a cost of over \$80 million. In addition, a Dam Safety Emergency Plan (DSEP) by the owner, and a downstream flood plan by the relevant emergency agencies, has been instituted and tested several times to minimise the risks to downstream residents. The remaining safety evaluation area for the dam, the dam's flood capacity, is currently nearing the end of its investigations as a prelude to development of improvement options.

The DSC has been observing closely the work of State Water on its risk assessments for its portfolio of dams, in particular, the need for the early reduction of risks at Keepit, Chaffey and Bethungra Dams. At Keepit and Chaffey Dams, interim safety improvements have been implemented and community consultations continued to facilitate planning for long-term safety improvements. An interim flood warning system has been implemented at Bethungra Dam to minimise the risks to downstream residents while investigations continue into long-term options.

During the year, Snowy Hydro Ltd commenced construction of a major flood capacity and environmental flow upgrading of Jindabyne Dam at a cost of over \$50million. These works are programmed for completion in 2005/6.

Work continued, during the year, on the implementation of a prioritised program to improve the safety of 20 deficient dams in the portfolio of dams owned by local government councils. This portfolio is under the jurisdiction of the Department of Energy, Utilities and Sustainability. Rylstone and Wentworth Falls Lake Dams were improved in 2003, Sooley Dam is being upgraded and construction works are planned in 2005/6 for Company and Spring Creek Dams.

**Table 5 - Status of Dams with Significant Safety Risks**

Dam	Deficiency		2004/2005 Upgrading Progress
	Type	Identified	
Company	F	1992	Upgrading construction programmed in 2005 (FWS).
Sooley	F	1992	Safety improvements in progress (FWS).
Hume	F	1994	Stability/seismic works completed, studies of flood requirements continuing (FWS).
Redbank Creek	F,E,S	1996	Design of improvements in progress (FWS).
Lake Endeavour	F,E,S	1995	Upgrading options being investigated.(FWS).
Spring Creek	F,S	1994	Safety improvements about to commence (FWS).
Coey Polly Ck 2	F	1993	Upgrading options being investigated (FWS).
Bethungra	F,E	2000	Upgrading options being finalized for construction in 2005/6 (FWS).
Dumaresq	F,S	2000	Upgrading design programmed for 2006 (FWS).
Keepit	F	1995	Interim works completed. Finalising long-term options (FWS).
Chaffey	F	1995	Interim works completed. Finalising long-term options (FWS).
Burrendong	F,S	2003	Investigating long-term options (FWS).
Imperial Lake	F	2000	Upgrading options being investigated.
Jindabyne	F	2001	Upgrading commenced in May 2004 for completion in 2005/6 (FWS).
Lake Rowlands	F,S	2003	Consultant engaged for detailed safety review.
Khancoban	F,S	2001	Upgrading options being investigated (FWS).
Winburndale	F	1995	Revised dambreak studies commissioned (FWS).
Lake Canobolas	F	2002	Surveillance Report recommendations being reviewed.
Blowering	F	1996	Staged upgrading works programmed to commence in 2006/7 (FWS).
F - Inadequate Flood Capacity			E - Inadequate Earthquake Structural Resistance
S - Structural Inadequacy under Normal Operating Conditions			FWS - Flood Warning Systems installed

*“A record storm at Dapto in 1984 dumped 515 mm of rain in 6 hours” – a near PMP event*



**Grahamstown Dam**

*Raising of the dam's storage capacity and complementary flood handling capacity is currently being finalised by Hunter Water Corporation.*

*“Seismologists indicate that major earthquakes up to Magnitude 7.5 could occur anywhere in NSW”*

### 7.1.6. Flood Capacity and Hydrology

The current record drought in NSW is focussing dam owners on drought security. However, the drought will break at some time, and long-term planning for the safety of dams from flooding effects still needs to be implemented.

In line with world-wide experience, inadequate flood capacity continues to be the most serious dam safety problem faced by NSW dam owners, as reflected in the deficient dams listing (Table 5). These deficiencies have become apparent as meteorologists and hydrologists have gained better data and a clearer understanding of extreme climatic events. To keep pace with this increasing knowledge, the DSC requires NSW dam owners to undertake regular reviews of the flood capacity of their dams and to determine the need for safety improvements.

Initially, generalised Probable Maximum Precipitation (PMP) estimates are required to define extreme storm rainfalls for each dam. The Bureau of Meteorology sets the procedures for this work. These PMP events, while very rare, are plausible and several near PMP events have occurred (ie a record storm at Dapto in 1984 dumped 515mm of rain in 6 hours). Generalised procedures are now available in NSW for PMP storms of any duration and area, following the Bureau's completion of its review of long duration tropical storm estimates for northern NSW in early 2004. The DSC was involved in the project's Steering Committee since its inception in 1999 and in co-ordinating financial support from the NSW dams' industry.

Rainfall estimates then need to be converted to flood predictions by the dam owner's hydrologists, using approaches outlined in *Australian Rainfall and Runoff*, produced and currently being updated by Engineers Australia. The DSC continues to monitor research into estimation of rare storm events for input into dam risk assessments, including current work to develop the FORGE method for estimating storms up to an annual exceedance probability (AEP) of 1 in 5,000.

The DSC has put on its Internet site a draft of its updated flood requirements (Information Sheet DSC11), which it plans to finalise in 2005. In setting its requirements, the DSC has been guided by the advice of its Hydrology Subcommittee, which maintains a close liaison with ANCOLD, Engineers Australia, and with hydrologists from various authorities, and academia, throughout Australia.

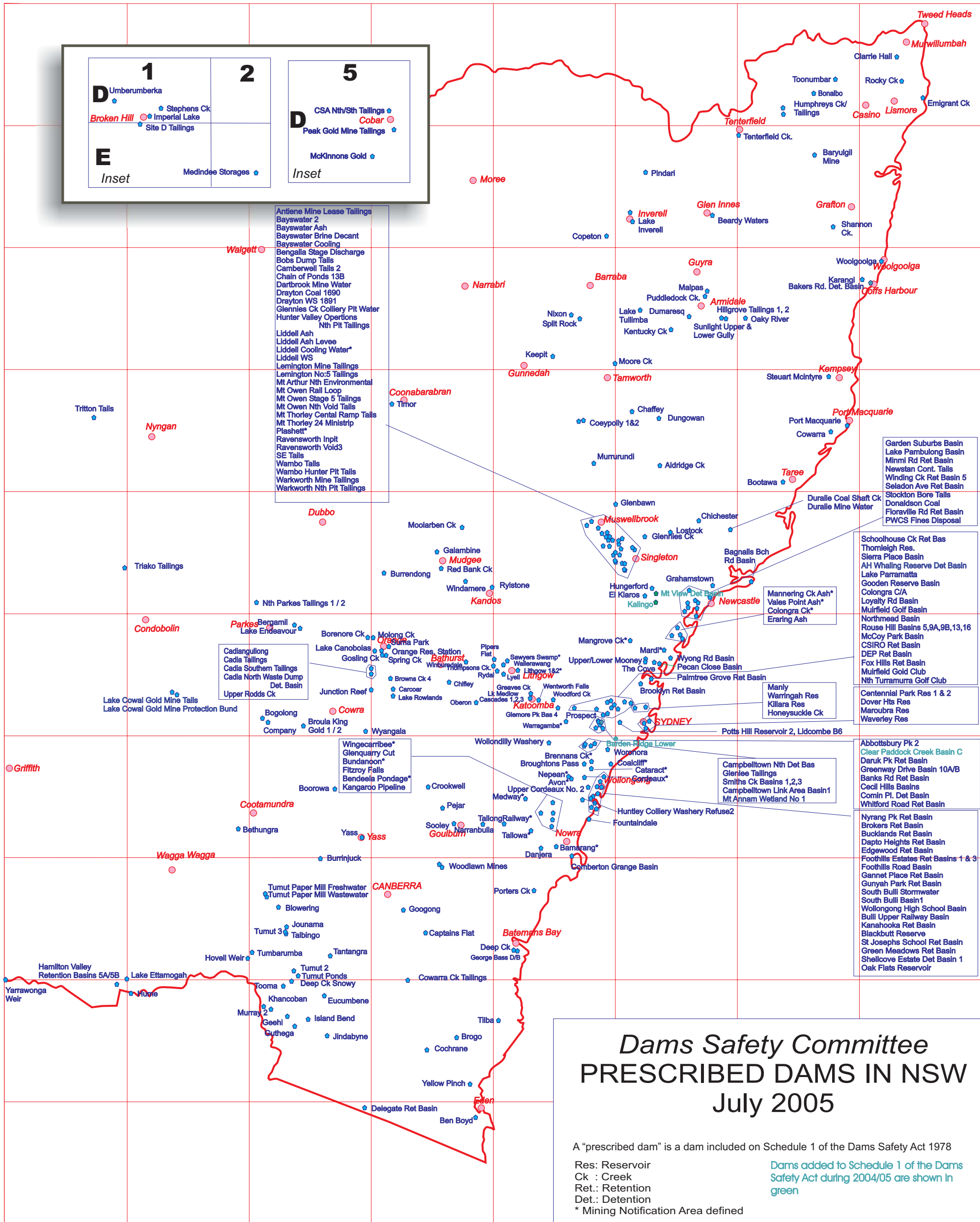
As rainfall and flow data are very limited in Australia, the DSC has continued to encourage dam owners to install hydrologic instrumentation around their dams to assist in calibration of hydrologic models, and to contribute to the improvement of knowledge of rainfall/runoff processes within the industry. The data will also assist in estimating available yield for water supply, as well as providing valuable input to planning and warning for flood conditions.

### 7.1.7. Earthquake Structural Capacity

Historically, several earthquakes of around Magnitude 7 have occurred in Australia and the 1989 Newcastle earthquake (Magnitude 5.6) provided a reminder that large damaging earthquakes can occur. Seismologists indicate that major earthquakes (ie up to Magnitude 7.5) could occur anywhere in NSW and that a Magnitude 7.5 earthquake has about 1,000 times the destructive power of the Newcastle earthquake.

Many overseas dams have survived nearby earthquakes up to Magnitude 8 and current knowledge indicates that well-constructed concrete, and compacted earth/rockfill, dams on good foundations are inherently stable during earthquake events. Fortunately these types form the bulk of NSW prescribed dams.

The DSC initially directed its earthquake stability concerns to the owners of the few vulnerable dams and, following investigations by their owners, earthquake stability remedial works have been completed at Mardi, Prospect and Hume Dams. In addition, stability reviews are required to be included in the regular safety reviews of NSW prescribed dams. To provide current guidance for designers and reviewers, the DSC issued, in 2000, its revised earthquake safety requirements in a new Technical Information Sheet (DSC16), which replaced its 1993 interim requirements.



<b>D</b>	<b>1</b>	<b>2</b>	<b>5</b>
	Umberumberka Broken Hill Imperial Lake Site D Tailings	Stephens Ck Imperial Lake Site D Tailings	
<b>E</b>	Medindie Storages		<b>Inset</b>

- Antione Mine Lease Tailings
- Bayswater 2
- Bayswater Ash
- Bayswater Brine Decant
- Bayswater Cooling
- Bengalla Stage Discharge
- Bobs Dump Tails
- Camberwell Tails 2
- Chain of Ponds 13B
- Dartbrook Mine Water
- Drayton Coal 1690
- Drayton WS 1891
- Glennies Ck Colliery Pit Water
- Hunter Valley Operations
- Nth Pit Tailings
- Liddell Ash
- Liddell Ash Levee
- Liddell Cooling Water\*
- Liddell WS
- Lemington Mine Tailings
- Lemington No:5 Tailings
- Mt Owen Rail Loop
- Mt Owen Stage 5 Tailings
- Mt Owen Nth Void Tails
- Mt Thorley Central Ramp Tails
- Mt Thorley 24 Minstrip
- Plashett\*
- Ravensworth Inpit
- Ravensworth Void3
- SE Tails
- Wambo Tails
- Wambo Hunter Pit Tails
- Warkworth Mine Tailings
- Warkworth Nth Pit Tailings

- Garden Suburbs Basin
- Lake Pambulong Basin
- Minmi Rd Ret Basin
- Newstan Cont. Tails
- Winding Ck Ret Basin 5
- Seladon Ave Ret Basin
- Stockton Bore Tails
- Donaldson Coal
- Floraville Rd Ret Basin
- PWCS Fines Disposal
- Schoolhouse Ck Ret Bas
- Thornleigh Res.
- Sierra Place Basin
- AH Whalling Reserve Det Basin
- Lake Parramatta
- Gooden Reserve Basin
- Colongra C/A
- Loyalty Rd Basin
- Muirfield Golf Basin
- Northmead Basin
- Rouse Hill Basins 5,9A,9B,13,16
- McCoy Park Basin
- CSIRO Ret Basin
- DEP Ret Basin
- Fox Hills Ret Basin
- Muirfield Golf Club
- Nth Turramurra Golf Club
- Centennial Park Res 1 & 2
- Dover Hts Res
- Maroubra Res
- Waverley Res
- Abbottsburry Pk 2
- Clear Paddock Creek Basin C
- Daruk Pk Ret Basin
- Greenway Drive Basin 10A/B
- Banks Rd Ret Basin
- Cecil Hills Basins
- Comin Pl. Det Basin
- Whitford Road Ret Basin
- Nyrang Pk Ret Basin
- Brokers Ret Basin
- Bucklands Ret Basin
- Dapto Heights Ret Basin
- Edgewood Ret Basin
- Footihills Estates Ret Basins 1 & 3
- Footihills Road Basin
- Gannet Place Ret Basin
- Gunyah Park Ret Basin
- South Bulli Stormwater
- South Bulli Basin 1
- Wollongong High School Basin
- Bull Upper Railway Basin
- Kanahooka Ret Basin
- Blackbutt Reserve
- St Josephs School Ret Basin
- Green Meadows Ret Basin
- Shellcove Estate Det Basin 1
- Oak Flats Reservoir



In 2004/5 the largest seismic event in NSW was a Magnitude 3.7 earthquake near West Wyalong in January 2005 and the largest national events were Magnitude 4.6 earthquakes near Ernabella in South Australia in March 2005 and Port Hedland in Western Australia in June 2005.

Scarcity of long-term seismic data in NSW to use as a basis for determining the earthquake design loadings for dams remains a concern for the DSC.

The seismic monitoring network, installed on Sydney Catchment Authority (SCA) dams in the early 1990s, has already recorded evidence of minor seismicity in the area and provided data for future design use on dams and other structures in the Sydney area.

The SCA network complements the Newcastle network installed after the 1989 earthquake, along with some seismic stations at State Water and Snowy Hydro dams, and the national grid installations of Geoscience Australia. The DSC will continue to support expansion of this seismic network throughout NSW to provide valuable design data and insight into earthquake activity in NSW.

### 7.1.8. Structural Safety under Normal Operating Conditions

Dams are long life structures, with the oldest dam in Europe some three thousand years old, and the oldest prescribed dam in NSW, Lake Parramatta Dam, being nearly 150 years old. Given that the average age of major NSW dams is over 40 years, the structural safety of these dams under normal operating conditions is considered to be generally satisfactory when checked using current methodology. Where deficiencies have been revealed, the DSC has required owners to undertake safety reviews and to implement any consequent improvement action.

Particular areas of concern to the DSC include:

- The safety of older earth dams, without intercepting filters to control piping and seepage, which may require buttressing and/or supplementary drainage. Hume, Mardi, Tilba, Rydal and Tumberumba Dams have been upgraded in this regard. In addition, there appears to be no clearly recognized established international practice on piping safety for such dams. The DSC has plans for an Information Sheet (DSC22) to assist owners to address this problem.
- The deterioration, with time, of unencased pressure conduits through embankments could lead to uncontrolled high-pressure leakage through the embankment, leading to washout and dam failure. The DSC requires dam owners to investigate and monitor their conduits on a priority basis.
- The need to better understand piping and slope instability risks of embankment dams. A research program, initiated in 1996 by the University of NSW and sponsored by the DSC and several major dam owning organizations has developed valuable new understanding in this area. The DSC will continue to sponsor further research in this area.
- The reliability of spillway gates, given several serious incidents and dam failures world-wide involving gate failures. The DSC requires NSW dam owners to regularly review their gates' safety and to ensure high reliability through systems upgrades and proper operation and maintenance procedures. The DSC has initiated the production of a DSC Information Sheet (DSC20) for guidance on this aspect of dam safety.
- The safety of tailings dams usually associated with mining. Several incidents on prescribed dams have highlighted the special vulnerability of these types of dams. The DSC has concluded that there is a need to develop safety policies specific to tailings dams and, to assist in this area, a draft Information Sheet (DSC19) has been formulated and placed on the DSC's Internet site for dam owner and community comment before finalisation by the DSC.

*“In 2004/2005 the largest seismic event in NSW was a Magnitude 3.7 earthquake near West Wyalong in January 2005 and the largest national events were Magnitude 4.6 earthquakes near Ernabella in South Australia in March 2005 and Port Hedland in Western Australia in June 2005”*



#### **Lake Parramatta Dam**

*Surveillance of this 14m high sandstone arch dam, the oldest prescribed dam in NSW, has indicated the dam is in good condition due to regular ongoing maintenance.*

*“The average age of major NSW dams is over 40 years with the oldest nearly 150 years old”*



**Pejar Dam**

*This dam near Goulburn, like many other dams in NSW, is currently at its lowest level since first filling, due to the record drought. The low levels of these dams however provide an opportunity to carry out surveillance and maintenance of low level structures in the dams.*

*“The DSC continually promotes the need to develop and maintain basic operations and maintenance programs and manuals for NSW dams”*



**Redbank Creek Dam**

*A dam safety emergency plan has been prepared for this 16m high concrete arch dam, and the dam is being kept empty to maximize protection to downstream residents in Mudgee while safety improvements are designed.*

### 7.1.9. Operation, Maintenance and Surveillance

Dam materials, components and machinery deteriorate with time. Ongoing operation, maintenance and surveillance is essential and cost-effective, otherwise reduced life expectancy or failure could result (eg a near piping failure of a Hunter Valley tailings dam in 2003 was averted by timely detection). The rehabilitation works (eg Bethungra Dam, Redbank Creek Dam), or decommissioning (eg Wellington Dam), found necessary for some older NSW dams illustrate the deterioration that can occur as dams age.

The DSC requires dam owners to develop and maintain operation and maintenance (O&M) manuals, based on organized programs and systematic inspections. The DSC maintains an active education program in this area and audits performance through the owner's five yearly Surveillance Reports and by regular inspections of dams by DSC members and staff.

The drought over the past few years in NSW has had some positive benefits for dam owners who have been able to carry out maintenance work on low-level outlets in their dams without the need for costly diving operations.

The ANCOLD *Guidelines on Dam Safety Management-2003* set out contemporary requirements in this area, based on industry best practice. They provide a basis for a more uniform national approach to proper dam safety management, and the DSC has adopted them as its requirements for use in NSW. The DSC's Executive Engineer was the Convenor of the working group, which produced these guidelines.

### 7.1.10. Dams Safety Emergency Management

The DSC's primary objective is to protect the public from the uncontrolled release of water from dam storages and it requires that dam owners prepare Dam Safety Emergency Plans (DSEP) for dams posing a risk to downstream residents. During the year work continued on these plans, which are now in place for the majority of deficient, and extreme and high consequence category, dams. This planning covers monitoring procedures, actions to be taken by the owner's personnel, pertinent advice to emergency management agencies, and relevant information concerning the nature of dambreak flooding. These plans also take into account the general increase in security required world-wide for strategic assets such as dams.

Responsibility for developing and maintaining flood plans in NSW rests with the State Emergency Service (SES). The DSC looks to dam owners to assist the SES in developing Flood Plans to protect residents against the impacts of major floods that pass through their dams, including a potential dam failure. The value of these plans, even for dams that meet normal safety requirements, was demonstrated in 1999 with activation of the Lyell Dam DSEP, facilitating the timely evacuation of campers after the unexpected failure of the dam's inflatable spillway section. Also, further demonstration was provided during the late 2000 Tamworth floods, with the timely evacuation of residents downstream of Chaffey Dam.

The SES has continued to prepare and update flood emergency plans for communities downstream of deficient NSW dams during the year. The DSC is pleased with the public response to implementation of this planning, and continues to press for early and comprehensive public awareness campaigns to inform affected residents of the details of these flood emergency plans.

To mesh the responsibilities of dam owners and the SES, the DSC's Emergency Management Sub-committee meets, as necessary, to review and monitor the procedures used by the agencies concerned. As a result, an amendment has been made to the State Disaster Plan recognising the responsibilities of the DSC in the area of dam emergencies. Also dam incident warning protocols have recently been developed, and are being implemented, with all of the emergency agencies. The Sub-committee also provides a channel for information exchange between the DSC and the SES, giving the SES regular updates on the safety status of dams in NSW.



### 7.1.11. Flood Retarding Basins

Flood retarding basins, and some pollution control basins, are holding ponds normally constructed in urban areas to temporarily store stormwater runoff, and reduce downstream flood levels. They are usually designed to mitigate small, frequent, floods, but may also have considerable community benefits (eg recreational areas, scenic ponds). They vary in size from commercial/industrial on-site storages up to large basins several hectares in area, such as the Loyalty Road Retarding Basin, upstream of Parramatta, which is formed by a concrete dam over 20m high.

When these basins store water they act as dams, and the DSC prescribes those that would pose a significant threat to downstream communities or the environment in the event of failure. Although basins are generally small, their potential threat to a community can be as significant as that from a major dam due to their location within residential areas. They thus need to be designed and constructed in accordance with good dams engineering practice.

The DSC's requirements for prescribed basin flood capacity extend past the usual design standards, such as the 1% Annual Exceedance Probability (AEP) flood often used for urban drainage design. The community generally does not appreciate the potential for larger floods to occur. Recent examples, of events exceeding the 1% AEP mitigation limit, were the storm events in Wollongong in August 1998, in the southern Newcastle area in April 2001 and in Mudgee in February 2003. These floods caused severe damage to urban areas, except for those properties downstream of prescribed flood retarding basins and dams.

It should be noted that with several hundred basins in NSW, there is a strong possibility that one or more basins could be tested annually by an extreme storm.

The DSC's requirements aim to ensure that basins will withstand appropriately large floods, or that basin failure does not involve a significant risk to life. The design needs to allow for the effects of future development in the area and the "domino effect" of basin failure if there are multiple basins in a cascade arrangement.

The DSC requires that prescribed retarding basins are subject to relevant procedures regarding surveillance, inspection, operation and maintenance but continues to be concerned with the poor maintenance some basins receive in the long-term. Inspections still reveal basins with partially blocked outlets which can significantly reduce the basins' flood capacity. This reinforces the need for basins to be inspected monthly, as part of their maintenance schedule, as well as after significant flood events.

The DSC continues to maintain close liaison with basin owners during the design stage, particularly to oversight urban drainage designers whose experience of dams engineering is often limited to small structures. DSC staff carry out regular basin inspections and the DSC has prepared an Information Sheet on retarding basins (DSC17-updated in 2000).

*"The DSC requires that flood retarding basins are designed and constructed in accordance with good dams engineering practice"*

*"The DSC is concerned with the poor degree of maintenance of some flood retarding basins"*



**Cecil Hills Basin 100**

*The basin owner completed upgrading this basin during the year to maximize its recreational potential and flood retarding features.*

*“The DSC sets Notification Areas around dams to provide a minimum buffer zone to unrestricted mining”*



*Longwall mining of an underground coal seam, with hydraulic jacks providing roof support and personnel protection.*

*“During 2004/5 some four million tonnes of coal were extracted from under and adjacent to NSW storages”*

*“Dendrobium Colliery commenced longwall mining adjacent to Cordeaux reservoir in April 2005”*

## 7.2. Regulation of Mining near Dams

### 7.2.1. Background

Under the *NSW Dams Safety Act 1978*, any activity that may impact on the safety of a prescribed dam, or its stored waters, may be regulated by the DSC. The most common activity that could result in a “dam safety” impact is mining, and the DSC uses powers under the *Dams Safety Act 1978*, the *Mining Act 1992* and the *Coal Mine Health and Safety Act 2002* to ensure that mining risks around dams are acceptably low.

The DSC sets Notification Areas around selected prescribed dams (see Appendix B) on the basis of mining experience to provide a minimum buffer area, outside of which mining would be unlikely to prejudice the integrity of the dam or its storage. Details of these Notification Areas are published in the Government Gazette. The DSC requires mining companies to advise it of any proposed mining within those Notification Areas so it can recommend to the Minister administering the *Mining Act* appropriate conditions to be put on the proposed mining.

### 7.2.2. 2004/5 Overview

There has been a marked resurgence of interest in coal mining near dams and storages during the year primarily due to the strong upsurge in coal market prices. Thirteen new applications were processed, mainly for mining by the new large Dendrobium Colliery near Cordeaux Reservoir. Discussions regarding future applications were held with seven collieries (Dendrobium, NRE No. 1, Wambo Mine, United Colliery, Duralie Mine, Newpac No. 1 and Metropolitan Colliery). This is an unprecedented level of interest (see details-Tables 7 and 8) and the DSC had to re-prioritise its review and processing of applications while minimising delays on mining operations.

During 2004/2005, under the DSC's guidelines, some four million tonnes of coal were extracted from mine workings within the Notification Areas of prescribed dams in NSW, without jeopardising the integrity of these dams or their storages. Prior to the formation of the DSC, much of these coal deposits would not have been mined, due to the safety concerns of dam owners.

### 7.2.3. Details of New Applications and Currently Monitored Mines

**Westcliff Colliery** continued to longwall mine over 3km from Brennans Creek Dam with negligible effects on the dam. The DSC is finalising monitoring of this situation.

**Appin Colliery** continued to longwall mine over 2km from Broughtons Pass Weir. Initially, nearby mining caused some cracking of the weir but its safety is still acceptable. Weir movements are tapering off as mining moves further away, with monitoring to continue until the movements become negligible. The colliery has advised the DSC that it is considering further mining adjacent to completed workings near the weir.

**Dendrobium Colliery** commenced longwall mining adjacent to Cordeaux Reservoir in April 2005. An application for longwall mining in Area 2 is still being considered.

The DSC had expressed concern to the colliery over a number of aspects relating to the application but significant liaison and high level discussions have been positive to clarify the process for assessment of mining proposals and to achieve their timely approval. Compliance with mining approvals has improved throughout the year and the colliery is working with the DSC to achieve 100% compliance.

The Committee will continue its efforts to minimise the risk to Cordeaux Reservoir by requiring the applicant to fully investigate the impact of mining in further applications, and by continuing to ensure that an adequate monitoring program is maintained.



### Wambo NE Tailings Dam

*Filling of this 26m high tailings dam is almost completed and the owner is investigating decommissioning options in parallel to proposed coal mining under the dam.*

*“In late 2004, United Colliery commenced mining a series of longwalls under Wambo NE Tailings Dam”*

**NRE No. 1 (formerly Bellpac No. 1) Colliery** is programming to recommence mining of two pillar extraction panels and more extensive first workings under, and adjacent to, Cataract Reservoir. There has been a history of regular changing of ownership of this mining application and a five point plan aimed at protecting the stored waters and allowing some mining to proceed was put to the new owners. Each point was satisfied and the Committee endorsed the proposal.

**Duralie Colliery** continued open cut mining near its two surface water dams with monitoring of effects on the dam wall.

**United Colliery** commenced mining a series of longwalls under Wambo Tailings Dam with careful monitoring of effects on the dam wall and surrounding features.

**Cooranbong Colliery** maintained a monitoring program near Dora Creek Effluent Pond. Mining has now ceased in this area and the impact of mining on the structure appears to have been negligible.

### 7.2.4. Policies, Procedures and Organizational Updates

The DSC has a range of policies and procedures, which vary through the life of a mine, to facilitate the safety of dams and reservoirs from mining operations. There was no significant policy or procedural change during the year and information on mining policies is given in the Information Sheets listed in Table 6 below and available on-line on our web page ([www.damsafety.nsw.gov.au](http://www.damsafety.nsw.gov.au)).

The Committee's geologist, Peter Reid went on long service leave during 2005 and David Hilyard acted in his position while a contract employee, Jiameng Li, was engaged to facilitate handling the high mining workload during the year.

The Committee's representatives attended several Department of Mineral Resources' Subsidence Management Plan Review Committee (SMPRC) meetings during the year. Although the DSC will continue to manage the dam safety aspects of mine subsidence around major dams independently of the Department, the SMPRC is considered to be a worthwhile forum for fostering inter-Departmental cooperation.

**Table 6 - Information Sheets for Mining near Dams**

Document	Title	Date
DSC 32	Notes on the Administrative Role of the Dams Safety Committee in the Granting of Mining Leases and Approval of Mining Applications	June 1998
DSC 33	Mining in Notification Areas of Prescribed Dams	June 1998
DSC 34	Typical Monitoring Program Requirements for Mining near Prescribed Dams	August 2000
DSC 35	Mining Contingency Plans to Minimise Loss of Stored Waters from Dams	June 1998

## 7.2.5. Mining Statistics

**Table 7 - Mining in Notification Areas**

Item	2002/3	2003/4	2004/5
Coal Removed from Notification Areas (million tonnes)	0.3	0.4	4
First Workings (km length)		13.5	34
Current Approvals:			
Actively Mining	4	2	11
Actively Monitoring	6	7	18
Applications Processed	1	9	13
Variations to Existing Approvals	1	0	2
Coal Titles Processed	2	3	2
New Proposals Discussed	4	7	6
Site Inspections (person days)	2	15	20

**Table 8 - Monitored Approved Mining 2004/2005**

Approval	Colliery	Dam	Mining Type	Possible Effect on			Currently Monitoring
				Active Mining	Dam Storage	Dam Structure	
Bellambi-6/11	Bellpac	Cataract	Longwall	No	Yes	Yes	Yes
Bellambi-13/15	Gujurat NRE	Cataract	Pillar Extract.	Yes	Yes	No	Yes
Westcliff-2	Westcliff	Brennans Ck	Longwall	Yes*	Yes	Yes	Yes
Appin-2	Appin	Broughtons Pass Weir	Longwall	Yes*	Yes	Yes	Yes
Dendrobium-1	Dendrobium	Cordeaux	1 <sup>st</sup> workings	Yes	Yes	No	Yes
Dendrobium-2	Dendrobium	Cordeaux	Longwall	Yes	Yes	No	Yes
United-2/3	United	Wambo Tails	Longwall	Yes	Yes	Yes	Yes
Mannering-1	Mannering	Mannering Ck Ash	Pillar Extraction	Yes	Yes	Yes	Yes
Newpac-1	Newpac	Ravensworth Inpit Storage	Pillar extraction	Yes	Yes	Yes	Yes
Cooranbong-1	Cooranbong	Dora Ck	Pillar Extract.	No	Yes	No	Yes

\*-Mining outside Notification Area is still having minor influences on dam

## 7.3. Information Systems

During 2004/5 the DSC information systems personnel:

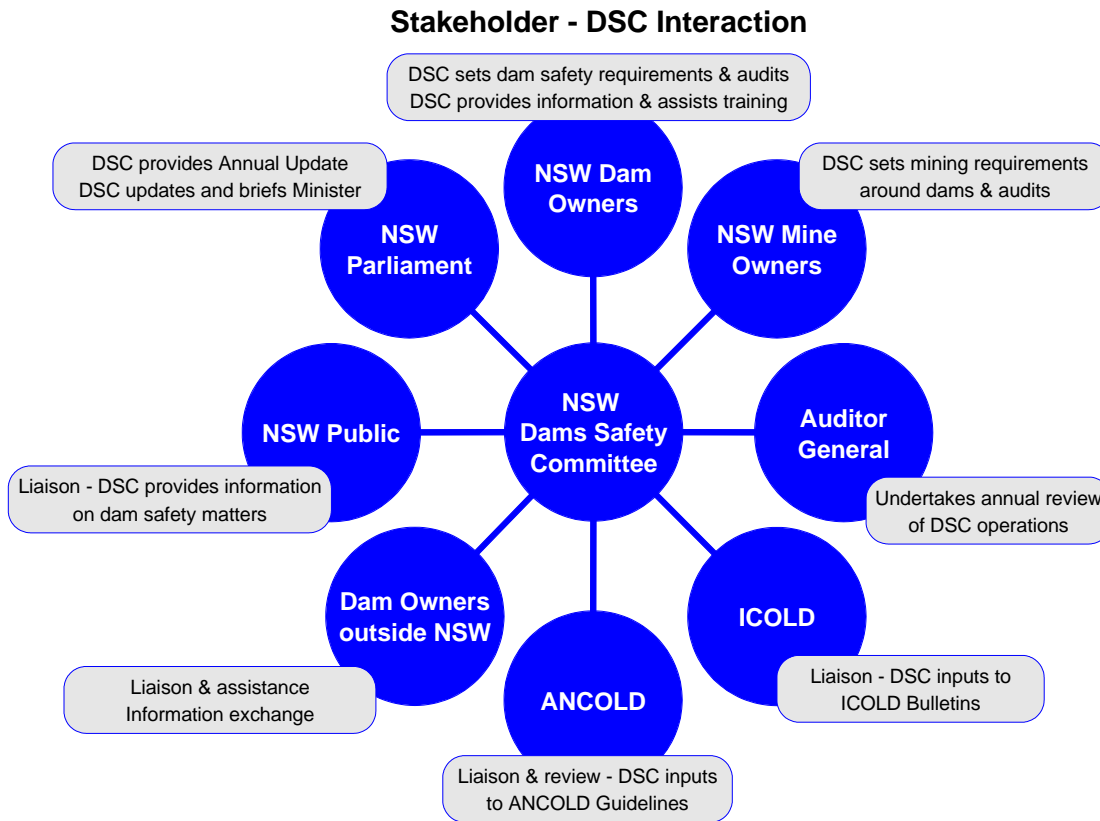
- Updated the DSC's public documents, Information Sheets, Annual Report and Website (<http://www.damsafety.nsw.gov.au>) ;
- Updated a full text searchable database of DSC minutes;
- Produced a range of internal reports for use by the Committee and staff;
- Continued to digitise critical technical information on dams to improve access and create a backup (ie GIS dam mapping, updated mining approval plans);
- Consolidated and maintained computer facilities for staff and members including implementing new server and upgrading computer hardware and software;
- Continued to upgrade and document DSC procedures; and
- Continued to maintain and upgrade the DSC's record system (eg correspondence lists, automatic requests for Surveillance Reports).

*“In 2004/5 the DSC updated its existing databases and computer facilities”*



## 8. Stakeholders

The DSC's role as a regulator of dam safety in NSW requires interaction with a wide range of stakeholders as summarized in the following diagram:



### 8.1. Liaison with Stakeholders

In line with modern principles of good regulation, the DSC has adopted a goal of full “transparency”. During the year, it continued to work toward having all its safety policies accessible to all stakeholders, by their incorporation into Information Sheets, available on the DSC Internet site.

The DSC recognizes that to be effective as a dam safety regulator, it needs to give all stakeholders an opportunity to comment on its policies. During the year, policy proposals were placed on the DSC’s Internet site and comments were invited.

The DSC has a role to educate dam owners on their responsibilities and on international standards, practice and technology. It communicates its objectives and concerns to dam owners and their representatives through various avenues, including its Internet site. The DSC has assembled a considerable library of publications and videotapes on various aspects of dams and their management. This material is freely loaned to dam owners to assist in staff training.

Close contact is maintained by the DSC with the major NSW dam owning authorities, through their nominees on the DSC, and through meetings held during the year to discuss specific dam requirements and general procedures.

*“The DSC considers it essential to give all stakeholders an opportunity to comment on its policies”*

*“DSC staff were involved in running two dam safety training courses for NSW dam operators in 2004/5”*



**Port Macquarie Dam**

*DSC personnel instructing dam operators on dam surveillance techniques during a dam safety training course in December 2004.*

*“DSC members and staff attended relevant conferences and courses during the year to keep abreast of modern developments”*

The dam safety education of local government authorities, mining companies and private dam owners is of particular interest to the DSC, because their staff do not usually have specialist engineering knowledge of dams. Education of these owners is assisted by regular site visits by the DSC and/or its staff to meet owners' representatives to discuss relevant issues. Such meetings are invaluable in reaching a common understanding of the problems facing these owners in regard to asset management and responsibilities to the community, and obtaining feedback for enhancing the Committee's education role.

The DSC ran its first training course in 1991 for Local Government and private dam owners. As a result of the positive feedback, regular training courses for dam operators are now run in NSW with the assistance of DSC staff. Three-day courses for dam operators were run by the Department of Energy, Utilities and Sustainability in December 2004 and March 2005 at Port Macquarie as part of this program. This work is seen as a key part of the DSC's educational role for dam owners in NSW and accordingly DSC cost recovery was limited to expenses associated with attending or running these sessions.

DSC members and staff addressed Council and community meetings on a number of occasions during the year.

The increasing emphasis by the DSC on owner education in NSW has been reflected in numerous requests from dam owners outside NSW for educational assistance. Such involvement is of value to the DSC in broadening its experience of dam safety management issues and in benchmarking its own performance against the procedures and practices of similar authorities.

## **8.2. Education and Training of Members and Staff**

The DSC's members and staff have extensive and varied experience in dams' engineering and mining. However, it is essential in any organization to keep abreast of modern developments in all the technical and societal fields related to its functions. This is particularly important in the case of the DSC, because of the diverse technical knowledge required from its small staff. Accordingly, the DSC's members and staff attended relevant conferences and courses during the year.

In November 2004, the Chairman, Executive Engineer, Surveillance Engineer, Dams Engineer and Geologist attended the ANCOLD Conference on Dams, held in Melbourne. Several other DSC members also attended, as representatives of their own organizations. Papers were presented on community, legal and environmental concerns with dams, along with recent developments in dam engineering.

During the year, DSC staff attended relevant local technical seminars to update their proficiencies.

In May 2005, Mr Ian Landon-Jones attended the ICOLD 73<sup>rd</sup> Annual Meeting and associated technical committee meetings, held in Tehran, Iran. Whilst this attendance was not arranged or funded by the DSC, the knowledge gained benefits the development of the DSC's policies.

## 9. Administration and Human Resources

DSC members are subject to the Premier's Department Conduct Guidelines and the DSC staff is subject to the Department of Infrastructure, Planning and Natural Resources' (DIPNR) Code of Ethics and Conduct. As an extension of those requirements, the DSC adopted during the year policies on Managing Conflicts of Interest and on Interactions with Stakeholders and the Public. Under its existing policy of Delegated Authority, the DSC adopted a revised Schedule of Delegations.

The DSC rents office space with the DIPNR in Parramatta and, to maximize the effectiveness of DSC staff, reimburses the DIPNR for its administration and human resources assistance, accounting, insurance scheme and legal services. Other authorities, that nominate members to the DSC, continue to provide technical assistance in specialised areas and the DSC wishes to acknowledge their assistance.

As part of the DSC's administrative, and ministerial alignment with the DIPNR the DSC's Freedom of Information (FOI) statistics are published in that Department's Annual Report. A supplement, pursuant to the Annual Reporting Requirements issued by the Premier's Department on 27 June 1991, will accompany the DSC's statistics. There were no requests for information under FOI legislation during the year.

The DSC has adopted DIPNR's Occupational Health, Safety and Rehabilitation (OHS&R) practices, with necessary minor adaptations, to ensure the maintenance of appropriate standards of work practice in the DSC. In relation to OHS&R there were no work injuries to DSC staff during the year and DSC staff regularly update their first aid training to facilitate safe inspection practices.

As part of its contracted administration assistance to the DSC, the DIPNR implement Equal Employment Opportunity (EEO) and Ethnic Affairs matters (including Ethnic Affairs Priorities Statement program) for, and with, the DSC. The DSC is aware of, and committed to, the principles of multi-culturalism, but all policies relating to this area are programmed under the DIPNR's overarching banner. However, the DSC again provided technical training of a new migrant professional, Kathy Zhou, for five months as a follow on to a scheme organized by the Office of Employment, Equity and Diversity of the NSW Premier's Department. Feedback at the conclusion of the training period indicated that the scheme was extremely beneficial to both Kathy Zhou and the DSC. The DSC's Internet site provides initial information about the DSC in several languages.

The DSC is progressively implementing the Government's Waste Reduction and Purchasing Policy by implementing more electronic storage of information and use of recycled paper.

## 10. Finance

### 10.1. Dams Safety Committee Certificate

DAMS SAFETY COMMITTEE  
FINANCIAL STATEMENTS FOR THE FINANCIAL YEAR ENDED 30 JUNE 2005  
CERTIFICATE UNDER SECTION 41C (1B) AND 1(C) OF THE  
PUBLIC FINANCE AND AUDIT ACT, 1983

In our opinion the financial statements consisting of the Statement of Financial Performance, Statement of Financial Position, Statement of Cash Flows and Notes attached thereto for the year ended 30 June 2005 exhibit a true and fair view of the financial position and transactions of the Dams Safety Committee.

The financial statements have been prepared in accordance with the provisions of the Public Finance and Audit Act 1983, and the Public Finance and Audit Regulation, 2000 and the Treasurer's Directions as they relate to the preparation of accounts.

We are not aware at this time of any circumstances, which would render any particulars in the financial statements to be misleading or inaccurate.

This certificate is given for and on behalf of the Committee.



L A McDONALD  
CHAIRMAN



A C WILLIAMS  
DEPUTY CHAIRMAN

## 10.2 Auditor General's Certificate



GPO BOX 12  
Sydney NSW 2001

### INDEPENDENT AUDIT REPORT

#### Dams Safety Committee

To Members of the New South Wales Parliament

#### Audit Opinion

In my opinion, the financial report of the Dams Safety Committee:

- (a) presents fairly the Dams Safety Committee's financial position as at 30 June 2005 and its financial performance and cash flows for the year ended on that date, in accordance with applicable Accounting Standards and other mandatory professional reporting requirements in Australia, and
- (b) complies with section 41B of the *Public Finance and Audit Act 1983* (the Act).

My opinion should be read in conjunction with the rest of this report.

#### The Committee's Role

The financial report is the responsibility of the members of the Dams Safety Committee. It consists of the statement of financial position, the statement of financial performance, the statement of cash flows and the accompanying notes.

#### The Auditor's Role and the Audit Scope

As required by the Act, I carried out an independent audit to enable me to express an opinion on the financial report. My audit provides *reasonable assurance* to Members of the New South Wales Parliament that the financial report is free of *material* misstatement.

My audit accorded with Australian Auditing and Assurance Standards and statutory requirements, and I:

- evaluated the accounting policies and significant accounting estimates used by the Committee in preparing the financial report, and
- examined a sample of the evidence that supports the amounts and other disclosures in the financial report.

An audit does *not* guarantee that every amount and disclosure in the financial report is error free. The terms 'reasonable assurance' and 'material' recognise that an audit does not examine all evidence and transactions. However, the audit procedures used should identify errors or omissions significant enough to adversely affect decisions made by users of the financial report or indicate that members had not fulfilled their reporting obligations.

My opinion does *not* provide assurance:

- about the future viability of the Dams Safety Committee,
- that it has carried out its activities effectively, efficiently and economically, or
- about the effectiveness of its internal controls.

#### Audit Independence

The Audit Office complies with all applicable independence requirements of Australian professional ethical pronouncements. The Act further promotes independence by:

- providing that only Parliament, and not the executive government, can remove an Auditor-General, and
- mandating the Auditor-General as auditor of public sector agencies but precluding the provision of non-audit services, thus ensuring the Auditor-General and the Audit Office are not compromised in their role by the possibility of losing clients or income.

*P.K. Brown*

P K Brown, FCPA  
Director, Financial Audit Services



### 10.3. Audited Financial Report

#### STATEMENT OF FINANCIAL PERFORMANCE FOR THE FINANCIAL YEAR ENDED 30 JUNE 2005

	Note	2005 \$'000	2004 \$'000
<b>Revenues from ordinary activities</b>	3	946	853
Administration Expenses		(771)	(712)
Lease expenses		(55)	(58)
Other Expenses		(133)	(110)
<b>Expenses from ordinary activities</b>	4	<u>(959)</u>	<u>(880)</u>
Deficit from Ordinary Activities		<u>(13)</u>	<u>(27)</u>
<b>Total revenues, expenses and valuation adjustments recognised directly in equity</b>		<u>-</u>	<u>-</u>
<b>Total changes in equity other than resulting from transactions with owners as owners</b>	7	<u>(13)</u>	<u>(27)</u>

#### STATEMENT OF FINANCIAL POSITION AS AT 30 JUNE 2005

<b>Current Assets</b>			
Cash Assets		54	25
Receivables	5	<u>78</u>	<u>10</u>
<b>Total Assets</b>		<u>132</u>	<u>35</u>
<b>Current Liabilities</b>			
Payables	6	<u>163</u>	<u>53</u>
<b>Total Current Liabilities</b>		<u>163</u>	<u>53</u>
<b>Total Liabilities</b>		<u>163</u>	<u>53</u>
<b>Net Liabilities</b>		<u>(31)</u>	<u>(18)</u>
<b>Equity</b>			
Accumulated deficit	7	<u>(31)</u>	<u>(18)</u>
		<u>(31)</u>	<u>(18)</u>

#### STATEMENT OF CASH FLOWS FOR THE FINANCIAL YEAR ENDED 30 JUNE 2005

<b>Cash Flows From Operating Activities</b>			
Payment to Suppliers		(730)	(760)
Recurrent Government Contribution Received		735	700
Interest Received		7	8
Other Income		17	45
Net cash flows from / (used in) operating activities	11	<u>29</u>	<u>(7)</u>
Net increase / (decrease) in cash held		29	(7)
Cash at the beginning of the financial year		<u>25</u>	<u>32</u>
<b>Cash at the end of the financial year</b>		<u>54</u>	<u>25</u>

#### NOTES TO AND FORMING PART OF THE ACCOUNTS FOR THE FINANCIAL YEAR ENDED 30 JUNE 2005

##### 1. Reporting Entity

The Dams Safety Committee was constituted in 1979, under the *Dams Safety Act 1978* to ensure the owners of the State's major dams conform to appropriate safety requirements in order to prevent uncontrolled loss of their storages with consequent effects on the community, environment and water supply.

The Committee operates in New South Wales, Australia. The office is located on Level 3, 10 Valentine Avenue, Parramatta, NSW 2150.

##### 2. Summary of Significant Accounting Policies

###### a. Basis of Accounting

The Committee's financial report is a general purpose financial report, and has been prepared in accordance with:

- applicable Australian Accounting Standards;
- other authoritative pronouncements of the Australian Accounting Standards Board (AASB);
- Urgent Issues Group (UIG) Consensus Views;
- the requirements of the Public Finance and Audit Act and Regulations.

Where there are inconsistencies between the above requirements, the legislative provisions have prevailed.

In the absence of a specific Accounting Standard, other authoritative pronouncement of the AASB or UIG Consensus View, the hierarchy of the pronouncements as outlined in AAS 6 "Accounting Policies" is considered.

The financial report has been prepared on an accrual basis and in accordance with the historical cost convention except where stated.

###### b. Revenue Recognition

Revenue is recognised to the extent that it is probable that the economic benefits will flow to the entity and the revenue can be reliably measured. The following specific criteria must also be met before revenue is recognised:

## 2. Summary of Significant Accounting Policies (continued)

### (i) Rendering of services

Revenue from a contract to provide services is recognised by reference to the stage of completion of the contract. When the contract outcome cannot be reliably measured, revenue is recognised only to the extent that costs have been incurred.

### (ii) Rendering of services

Revenue from a contract to provide services is recognised by reference to the stage of completion of the contract. When the contract outcome cannot be reliably measured, revenue is recognised only to the extent that costs have been incurred.

### (iii) Interest

Interest revenue is recognised as it accrues.

### (iv) Contributions of assets including grants and subsidies

Contributions and grants from other bodies are recognised as revenue when the agency obtains control over the relevant assets or receipt of cash.

### c. Significant Government Subsidies

Dams Safety Committee obtains the major portion of its funding from the State Government through a budget allocation. Other expenditure incurred by government departments and other statutory authorities in direct support of the Committee is now accounted as revenue and expense in the financial report.

### d. Financial Instrument

A financial instrument is any contract that gives rise to both a financial asset of one entity and a financial liability or equity instrument of another entity. For the Dams Safety Committee financial instruments range from cash at bank and accounts receivable to creditors. Financial instruments are carried in the accounts at net fair value.

### (i) Interest Rate Risk

Interest rate risk is the risk that the value of the instruments will fluctuate due to changes in market interest rates. The entity's exposure to interest rate risk and the effective interest rates of financial assets and liabilities at the balance date are in Note 13.

### (ii) Credit Risk

Credit risk is the risk of financial loss arising from another party to a contract/or financial position failing to discharge a financial obligation thereunder. The entity's maximum exposure to credit risk is represented by the carrying amounts of the financial assets included in the Statement of Financial Position.

### e. Accounting for the Goods and Services Tax (GST)

Revenues, expenses and assets are recognised net of the amount of GST, except:

- The amount of GST incurred by the agency as a purchaser that is not recoverable from the Australian Taxation Office is recognised as part of the cost of acquisition of an asset or as part of an item of expense.
- Receivables and payables are stated inclusive of GST.

### f. Employee Entitlements

Dams Safety Committee has no employees and accordingly there are no employee entitlements. Employees are on secondment from the Department of Natural Resources and State Water Corporation. Fees for Services represents the cost of the seconded employees.

### g. Non-Current Assets

Accounting control of assets is maintained by way of an asset register. The Committee has reviewed all the assets and it is considered that assets shown in the asset register / general ledger are at Fair Value as at 30 June 05. Depreciation is provided for on a straight-line basis for all depreciable assets so as to write off the depreciable amount of each depreciable asset as it is consumed over its useful life to the Committee.

Plant and equipment costing \$5,000 and above individually are capitalised.

The normal life expectancies of the asset categories are as follows:

Asset Class	Number of years
Office Equipment	4
Scientific Instruments	5-8

### h. Receivables

Trade receivables are required to be settled within thirty days. A provision for doubtful debts has not been established as it is considered by the Committee that all debt owing is recoverable.

### i. Payables

Trade accounts payable is generally settled within thirty days. The Committee considers the carrying amounts of creditors approximate to their net fair value.

### j. Impact of adopting Australian Equivalents to International Financial Reporting Standards (IFRS)

The Committee will apply the Australian Equivalents to International Financial Reporting Standards (AEIFRS) from 1 July 2005.

The Committee has determined the key areas where changes in accounting policies are likely to impact the financial report. Some of these impacts arise because AEIFRS requirements are different from existing AASB requirements (AGAAP). Other impacts are likely to arise from options in AEIFRS. To ensure consistency at the whole of government level, NSW Treasury has advised agencies of options it is likely to mandate for the NSW Public Sector. The impacts disclosed below reflect Treasury's likely mandates (referred to as "indicative mandates").

The Committee does not anticipate any material impacts on its financial position. The actual effects of the transition is depending on changes to the AEIFRS, including the UIG Interpretations and / or emerging accepted practice in their interpretation and application. The Committee's accounting policies may also be affected by a proposed standard to harmonise accounting standards with Government Finance Statistics (GFS). However, the impact is uncertain because it depends on when this standard is finalised and whether it can be adopted in the financial year ended June 2006.

## 2. Summary of Significant Accounting Policies (continued)

### (i) Financial Instruments

In accordance with NSW Treasury's indicative mandates, the Committee will apply the exemption provided in AASB 1 *First-time Adoption of Australian Equivalents to International Financial Reporting Standards* not to apply the requirements of AASB 132 *Financial Instruments: Presentation and Disclosures* and AASB 139 *Financial Instruments: Recognition and Measurement* for the financial year ended 30 June 2005. These Standards will apply from 1 July 2005. None of the information provided above includes any impacts for financial instruments. However, when these Standards are applied, they may impact on retained earnings (on first adoption) and the amount and volatility of result for the year. Further, the impact of these Standards will in part depend on whether the fair value option can or will be mandated consistent with Government Finance Statistics.

### (ii) Grant recognition for *not-for-profit* entities

The Committee will apply the requirements of AASB 1004 *Contributions* regarding contributions of assets (including grants) and forgiveness of liabilities. There are no differences in the recognition requirements between the new AASB 1004 and the current AASB 1004. However, the new ASB 1004 may be amended by proposals in Exposure Draft (ED) 125 *Financial Reporting by Local Governments*. If the ED 125 approach is applied, revenue and / or expense recognition will not occur until either the recipient of the contribution supplies the related goods and services (where grants are in-substance agreements for the provision of goods and services) or until conditions are satisfied. ED 125 may therefore delay revenue or expense recognition compared with current AASB 1004, where grants are recognised when controlled. However, at this stage, the timing and dollar impact of these amendments is uncertain.

### k. Going Concern

The Committee is a going concern despite accumulated losses as the Department of Natural Resources will be providing sufficient funds to cover the above losses and the future operating costs of the Committee. A letter of financial support has been provided by the Department of Natural Resources for the period to 20 October 2006.

## 3. Revenue from ordinary activities

	2005 \$'000	2004 \$'000
Committee Support Contribution	133	110
Other Income	5	33
Interest Income	3	10
Recurrent Government contribution from Treasury	805	700
	<u>946</u>	<u>853</u>

## 4. Expenses from ordinary activities

<b>Administration Expenses</b>		
Auditor's remuneration - audit of the financial report	6	6
Fees for services rendered	743	675
Members' Expenses	22	31
	<u>771</u>	<u>712</u>
<b>Lease expenses</b>		
Minimum lease payments	55	58
<b>Other Expenses</b>		
Committee Support costs	133	110
	<u>959</u>	<u>880</u>

Members' expenses include Board Members' fees of \$21,799. Board Members received no other benefits.

## 5. Current Assets - Receivables

Interest Income receivable	1	5
Input Tax recoverable from Taxation Office	4	3
Prepayments	1	2
Other	72	-
	<u>78</u>	<u>10</u>

## 6. Current Liabilities - Payables

Accrued Expenses	156	29
Payables	7	24
	<u>163</u>	<u>53</u>

## 7. Equity

Accumulated surplus / (deficit) at the beginning of the financial year	(18)	9
Deficit from ordinary activities	(13)	(27)
Accumulated deficit at the end of the financial year	<u>(31)</u>	<u>(18)</u>

## 8. Contingent liabilities

The Committees' contingent liability was \$Nil at 30 June 2005 (30 June 2004 - \$Nil)

## 9. Consultancies

Consultancy expenditure during the year amounted to \$Nil (30 June 2004 - \$Nil).

**10. Lease commitments**

Lease commitments represent property, photocopier and motor vehicle leases.

	2005 \$'000	2004 \$'000
Not later than 1 year	74	79
Later than 1 year but not later than 5 years	69	84
<b>Total (inclusive of GST)</b>	<b>143</b>	<b>163</b>

The total commitments above include input tax credits of \$13,009 (30 June 2004 - \$14,806) that is expected to be recoverable from the Australian Taxation Office.

**11. Note to the Statement of Cash Flows**

For the purposes of the statement of cash flows, cash includes cash on hand and in the bank.

**Reconciliation of loss from Ordinary Activities to Net Cash (Used In) / Provided by Operating Activities**

Deficit from ordinary activities	(13)	(27)
	(13)	(27)
<b>Changes in Operating Assets and Liabilities</b>		
(Increase) in Receivables	(67)	(3)
Increase in Payables	109	23
<b>Net Cash Flow from / (used in) Operating Activities</b>	<b>29</b>	<b>(7)</b>

**12. Additional Financial Instruments Disclosure**

	Fixed Interest Rate Maturities					Non Interest Bearing \$000	Total Carrying amount as per the Statement of Financial Position \$000
	Weighted average effective interest rate %	Floating Interest Rate \$000	1 year or less \$000	1 to 5 Years \$000	> 5 Years \$000		
<b>30 June 2005</b>							
Financial Assets							
Cash	4.33	54	-	-	-	-	54
Receivables	-	-	-	-	-	78	78
<b>Total Financial Assets</b>		<b>54</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>78</b>	<b>132</b>
Financial Liabilities							
Payables	-	-	-	-	-	163	163
<b>Total Financial Liabilities</b>		<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>163</b>	<b>163</b>
<b>Net Financial Assets / (Liabilities)</b>		<b>54</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>(85)</b>	<b>(31)</b>
<b>30 June 2004</b>							
Financial Assets							
Cash	4.06	25	-	-	-	-	25
Receivables	-	-	-	-	-	10	10
<b>Total Financial Assets</b>		<b>25</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>10</b>	<b>35</b>
Financial Liabilities							
Payables	-	-	-	-	-	53	53
<b>Total Financial Liabilities</b>		<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>53</b>	<b>53</b>
<b>Net Financial Assets / (Liabilities)</b>		<b>25</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>(43)</b>	<b>(18)</b>

End of Audited Financial Statements



## 10.4 Dams Safety Committee 2004/2005 – Budgetary Information

	2004/5 Budget (\$)	2004/5 Actual (\$)	2005/6 Budget (\$)
<b>Income</b>			
Consolidated Fund	825,000	805,000	888,000
Interest Income	-	3,000	3,000
Miscellaneous (eg Training courses, rebate)	4,000	5,000	4,000
<b>Total</b>	<b>829,000</b>	<b>813,000</b>	<b>895,000</b>
<b>Expenditure</b>			
Administration (incl Audit-\$6,000)	220,000	198,000	239,000
Dam Surveillance	337,000	356,000	365,000
Mining Investigations	272,000	272,000	291,000
<b>Total</b>	<b>829,000</b>	<b>826,000</b>	<b>895,000</b>
<b>Operating Surplus / (Deficiency)</b>	<b>0</b>	<b>(13,000)</b>	<b>0</b>

## Appendix A – Dam Owner Summary 30 June 2005

Dam Owner	Prescribed Dams	Surveillance Reports Received 04/05	Dams Inspected by DSC in 04/05
Councils	121	19	42
Sydney Water / Catchment Authority	37	4	10
Delta, Macquarie Generation, Eraring Energy	17	2	3
State Water	22	5	8
Other State Authorities	8	2	4
Snowy Hydro	15	3	1
Non State Authorities	3	0	0
Mining Companies	71	23	29
Other Ownership	20	1	7
<b>TOTAL</b>	<b>314</b>	<b>59</b>	<b>104</b>

## Appendix B – 2005-Current Prescribed Dams in NSW

Dam	Map Ref	Presc. 2004/5	Surv. Report	Safety	Built	Type	Height (m)	Storage (ML)	Owner
Abbotsbury Park Pond 2*	F10		S		2004	TE	6	18	RTA
AH Whaling Reserve Basin*	F10				-	TE	2	7	Baulkham Hills Council
Aldriges Creek*	D11				1994	TE	24	1200	Hunter Pastoral
Antiene Mine Lease Tails	E11		S		2000	TE/ER	15	3000	Rio Tinto Coal
Avon	G10				1927/71	PG/ER	72	214400	SCA
Bagnalls Beach Rd Basin*	E12				1998	TE	2	5	Port Stephens Council
Bakers Road Basin	C13				-	TE	7	200	Coffs Harbour Council
Bamarang	G10		S		1983	TE	26	3800	Shoalhaven Council
Banks Rd Basin	F10				1997	TE	4	40	Liverpool Council
Barden Ridge Lower	F10	P			-	TE	18	35	Sutherland Council
Baryulgil Mine*	B12		S		1996	TE	8	70	Dept. of Mineral Resources
Bayswater Ash	E10				1985	TE	39	22000	Macquarie Generation
Bayswater Brine Decant	E10				1986	TE	21.5	650	Macquarie Generation
Bayswater Cooling Makeup	E10				1984	TE	16	460	Macquarie Generation
Bayswater 2 Main	E10				1979	TE	27	1200	Bayswater Colliery
Beardy Waters	B11				1932/60	PG	8.5	500	Glen Innes Municipal Ccl
Beargamil*	F8				1914	TE	16	480	Parkes Council
Ben Boyd*	J9		S		1978	TE	29	800	Bega Valley Council
Ben Chiffley	F9				1957/2001	TE	27	30000	Bathurst Council
Bendeela Pondage*	G10		S		1973	TE/ER	18	1200	SCA
Bengalla Mine Raw Water	E10				2000	TE	11	270	Bengalla Mining Co P/L
Bethungra*	G7			R	1895	PG	13	580	State Water

Dam	Map Ref	Presc. 2004/5	Surv. Report	Safety	Built	Type	Height (m)	Storage (ML)	Owner
Blackbutt Reserve*	G10				1957/95	TE	6	25	Shellharbour City Council
Blowering*	H8			R	1968	TE/ER	112	1628000	State Water
Bobs Dump Tails*	E10		S		-	TE/ER	25	2100	Coal & Allied
Bogolong	F8			M	1932	TE	11	360	Central Tablelands Cnty Cncl
Bonalbo*	A12			M	1969/89	TE	13	55	Kyogle Council
Boorowa*	G8		S		?	PG/TE	8	180	Boorowa Council
Bootawa	D12			I	1967	TE	25	2270	North Power
Borenore Creek	F8			I	1928	VA	17	230	Cabonne Council
Brennans Creek*	G10				1976	DR	17	320	Coal Cliff Collieries Pty Ltd
Brogo	I9				1976	DR	43	9800	State Water
Brokers Rd Retarding Basin	G10				2000	TE	5	70	Wollongong Council
Brooklyn Retarding Basin*	F11		S		1995	ER	5	5	State Rail Authority
Broughton Pass Weir*	G10				1888	PG	6	50	SCA
Broula King Tails 1*	F8				-	TE/ER	18	138	Broula King Joint Venture
Broula King Tails 2*	F8				-	TE/ER	18	25	Broula King Joint Venture
Browns Creek Tails 4	F9				1991	TE/ER	32	1400	Hargraves Resources NL
Buckland's Retarding Basin	G10				1991	TE	5	2	P. Buckland
Bundanoon	G10				1960	VA	35	2040	Wingecarribee Council
Burrendong*	E9		S	M	1967	TE/ER	76	1188000	State Water
Burrinjuck*	H8				1928/56/96	PG	93	1026000	State Water
Cadiangullong	F8				1997	PG	45	4200	Cadia Holdings Pty Ltd
Cadia Southern Tails	F8				2001	TE/RE	79	91000	Cadia Holdings Pty Ltd
Cadia Tails Stage 2	F8				1997/2000	TE/ER	56	40000	Cadia Holdings Pty Ltd
Cadia-Upper Rodds Ck	F8				2001	TE	31	3000	Cadia Holdings Pty Ltd
Cadia Waste Dump Basin	F8		S		2002	TE/ER	18	50	Cadia Holdings Pty Ltd
Camberwell Tails 2	E11		S		-	TE/ER	40	1660	Camberwell Coal P/L
Campbelltown Link Basin	G10				2003	ER	6	26	Landcom
Campbelltown Nth Basin	G10				2001	TE	3	30	Campbelltown Council
Captains Flat*	H9				1939/93	PG	16	820	Yarrowlumla Shire Council
Carcoar	F9				1970	VA	46	35800	State Water
Cascade 1	F10				1915	VA	15	160	SCA
Cascade 2	F10				1926	TE	26	320	SCA
Cascade 3	F10				1938	TE	30	1700	SCA
Cataract*	G10				1907/87	PG	56	94300	SCA
Cecil Hills Basin 100*	F10		S		2001	TE	4	30	Liverpool Council
Cecil Park Basin 3A*	F10			R	1992	TE	6	52	Liverpool Council
Centennial Pk Res No. 1	F11				1899	PG	7	82	Sydney Water
Centennial Pk Res No. 2	F11				1925	PG/TE	11	89	Sydney Water
Chaffey*	D11			R	1976	TE/ER	54	61800	State Water
Chain of Ponds 13B	E11				-	TE	18	4000	Liddell Coal operations
Chichester*	E11				1923/84/95	PG	41	21000	Hunter Water Corporation
Clarrie Hall*	A13		S	M	1982	DR	43	16000	Tweed Council
Clear Paddock Ck Basin*	F11	P			2005	PG/TE	6	70	Fairfield Council
Coalcliff	G10				1971	TE	7	130	Illawarra Coke Co Pty Ltd
Cochrane	I9				1958	TE	29	3085	Eraring Energy
Coepolly Ck 1*	D10				1932	VA	19	860	Liverpool Plains Council
Coepolly Ck 2*	D10			R	1955	TE	21	5435	Liverpool Plains Council
Colongra Ck Ash	F11		S		1965	TE	6	5550	Delta Electricity
Comberton Grange Basin	G10		S		1990	TE	15	65	Shoalhaven Council
Comin Place Basin	F10		S		2000	TE	5	20	Fairfield Council
Company*	F8			R	1867	TE	6	113	Weddin Council
Copeton	B11			M	1976	TE/ER	113	1364000	State Water
Cordeaux	G10				1926/77/88	PG	49	93600	SCA
Cowarra*	D12				2001	TE	40	10000	Hastings Council
Cowarra Creek Tails*	H9			M	1986	ER	23	52	Horizon Pacific Ltd
Crookwell	G9		S		1937	PG/VA	15	450	Crookwell Council
CSA Tails	D5		S		1960	TE	8	1932	Cobar Management / DMRes
CSIRO Retarding Basin	F10				1990	TE	6	58	Holroyd Council
Danjera	G10		S		1971	CB/ER	30	7700	Shoalhaven Council
Dapto Heights Basin	G10				1991	TE	7	16	Wollongong Council
Dartbrook Mine Water	E10				2000	TE	11	450	Dartbrook Mine
Daruk Park Basin*	F10				1987	TE	3	47	Liverpool Council
Deep Creek*	H10				1983	TE	31	4500	Eurobodalla Council
Deep Creek (Snowy)	I8				1961	PG	21	5	Snowy Hydro
Delegate Retarding Basin	J8			M	1984	TE	7	7	Bombala Council
DEP Retarding Basin	F10				1990	TE	9	110	Blacktown Council
Dover Heights Reservoir*	F11				1929	PG/TE	8	85	Sydney Water
Drayton 1690*	E10				1993	TE	16	440	Drayton Coal Pty Ltd
Drayton W.S.*	E10		S		1980	TE/ER	18	390	Drayton Coal Pty Ltd
Dumaresq	C11			R	1896	PG	12	440	Armidale Council
Dungowan	D11				1957/92	TE	31	5900	Tamworth Council
Duralie Coal Shaft Creek*	E11				2003	TE/ER	17	1400	Duralie Coal Pty Ltd
Duralie Mine Water*	E11		S		2003	TE/ER	18	1100	Duralie Coal Pty Ltd
Edgewood Retarding Basin	G10				2002	TE	7	19	Illawarra Land Development

Dam	Map Ref	Presc. Surv. 2004/5 Report	Safety	Built	Type	Height (m)	Storage (ML)	Owner
Elanora	C11		I	?	TE	7	100	Hillgrove Mine
El Klaros	E11			1995	TE	25	200	Mawpalivier P/L
Emigrant Creek	A13	S		1968/2001	TE/PG	12	820	Rous County Council
Eraring Ash	F11			1982	TE	25	20500	Eraring Energy
Eucumbene	I8			1961	TE/ER	116	4798000	Snowy Hydro
Fitzroy Falls*	G10	S		1974	TE/ER	14	22200	SCA
Floraville Road Basin	F11			1992	TE	4	20	Lake Macquarie Council
Foothills Estate Basin 1	G10			1994	TE	5	20	Wollongong Council
Foothills Estate Basin 3	G10			1995	TE	5	20	Wollongong Council
Foothills Rd Basin	G10			1982/97	TE	5	24	Wollongong Council
Fountaindale	G10		I	1915	VA	15	61	Kiama Council
Fox Hills Basin	F10			1990	TE	4	127	Blacktown Council
Galambine	E9			1982	TE	18	227	Gooree Pastoral Co
Gannet Place Basin	G10			1992	TE	10	5	Wollongong Council
Garden Suburbs Basin 2	E11			2000	TE	8	17	Lake Macquarie City Council
Geehi	I8	S		1966	ER	91	21100	Snowy Hydro
George Bass Drive Basin	H10			2000	TE	3	11	Eurobodalla Council
Glenbawn	E10			1958/86	TE/ER	100	750000	State Water
Glenlee Tails*	G10	S		U/C	ER	29	1500	Sada Pty Ltd
Glenmore Park Basin	F10	S		1997	TE	4	232	Penrith Council
Glennies Creek	E11	S	M	1983	DR	67	283000	State Water
Glennies Ck Mine Pit Water*	E11			2004	TE	14	1250	Glennies Ck Joint Venture
Glenquarry Cut*	G10	S		1974	PG	18	34510	SCA
Gooden Reserve Basin*	F10			1997	PG	5	380	Baulkham Hills Council
Googong	H9			1977/1992	ER	67	124000	ACT Electricity & Water
Gosling Creek*	F9		M	1890	PG	8	650	Orange Council
Grahamstown*	E11			1964/96/01	TE	11	132000	Hunter Water Corporation
Greaves Creek	F10			1942	VA	17	320	SCA
Green Meadows Basin	G10			1981/93	TE	4	165	Shellharbour Council
Greenway Dve Basin 10A/B*	F10			2000/3	TE	5	132	Landcom
Gunyah Park Basin	G10			1992	TE	4	5	Wollongong Council
Guthega	I8			1955	PG	34	1550	Snowy Hydro
Hamilton Valley Basin 5A	I6			1993	TE	4	135	Albury Council
Hamilton Valley Basin 5B	I6			1993	TE	3	62	Albury Council
Hillgrove Tails 1	C11		M	1982	TE/ER	40	700	Hillgrove Gold NL
Hillgrove Tails 2	C11			U/C	TE/ER	40	1280	Hillgrove Gold NL
Honeysuckle Creek*	F11			1962/91	PG	9	12	Killara Golf Club Ltd
Hovell Weir	H7		M	1986	TE	8	2000	Tumbarumba Council
Hume*	I7		R	1936/1967	PG/TE	51	3038000	MDBC
Humphreys Creek	A12	S		1988	TE	15	750	Norminco Ltd
Humphreys Creek Tails	A12		M	1989	TE/ER	15	1100	Norminco Ltd
Hungerford Hill*	E11			1970/2002	TE	8	545	Southcorp Wines P/L
Hunter Valley Nth Pit Tails	E10			U/C	TE/ER	50	20000	Coal & Allied Operations
Huntley Colliery 2	G10			U/C	TE	28	59	Powercoal
Imperial Lake	D1		R	1967	TE	8	700	Aust. Inland Energy & Water
Island Bend	I8			1965	PG	49	3020	Snowy Hydro
Jindabyne*	I8		R	1967	ER	72	690000	Snowy Hydro
Jounama	H8	S		1968	ER	44	43500	Snowy Hydro
Junction Reefs	F8			1898	MB	19	300	State Water
Kalingo	E11	P		1920	TE	9	81	Southland Mining Ltd
Kanahooka Basin*	G10			1993	TE	5	26	Forest Grove Estate
Kangaroo Pipeline*	G10			1974	ER/PG	20	23500	SCA
Karangi*	C13	S		1980/96	TE/ER	38	5600	Coffs Harbour Shire Council
Keepit*	C10		R	1960	PG/TE	55	423000	State Water
Kentucky Creek	C11			1944/84	PG	12	500	Uralla Shire Council
Khancoban	I8		R	1966	TE	18	21500	Snowy Hydro
Killara Reservoir*	F11			1931/94	PG/TE	11	166	Sydney Water
Lake Canobolas	F9		R	1918	VA	12	700	Orange City Council
Lake Cowal Gold Tails	F7			2004	TE	20	3600	Barrick Gold Australia
Lake Cowal Protection Bund	F7			2004	TE	5	194000	Barrick Gold Australia
Lake Endeavour*	F8		R	1940	TE	21	2400	Parkes Shire Council
Lake Ettamogah	H6			1993	TE	13	2100	ANM Mill
Lake Inverell	B11			1938	PG	13	1500	Inverell Shire Council
Lake Medlow	F10			1907	VA	20	290	SCA
Lake Pambulong Basin	E11			2002	TE	5	57	Hammersmith Mgt
Lake Parramatta*	F11			1857/98	VA	14	490	Parramatta Council
Lake Rowlands	F9		R	1953	CB/TE	20	4690	Central Tablelands Council
Lake Tullimba	C11			1982	TE	18	1200	New England Uni
Lemington Mine Tails*	E10			1991	TE/ER	12	2000	Lemington Mine
Lemington Mine Tails 5*	E10	S		2000	TE/ER	22	2000	Lemington Mine
Lidcombe Ret Basin 6	F11			2003	TE	4	11	Sydney Olympic Park Auth.
Liddell Ash*	E10			1971/82	TE	31	28500	Macquarie Generation
Liddell Ash Levee*	E10	S		U/C	TE/ER	21	Variable	Mac. Gen / Drayton Coal
Liddell Cooling Water*	E10			1968	TE	43	148000	Macquarie Generation
Liddell Water Supply	E10			1970	TE	31	4500	Macquarie Generation

Dam	Map Ref	Presc. 2004/5	Surv. Report	Safety	Built	Type	Height (m)	Storage (ML)	Owner
Lithgow 1	F10			M	1896	VA	11	69	Lithgow Council
Lithgow 2	F10			M	1907	VA	27	440	Lithgow Council
Lostock	E11		S		1971	TE/ER	38	20000	State Water
Loyalty Rd. Ret Basin	F11				1995	PG	27	1520	Upper Parramatta Trust
Lyell	F10				1983/96	DR	50.5	33500	Delta Electricity
Malpas*	C11			M	1968	TE/ER	31	13000	Armidale Council
Mangrove Creek*	F11			M	1983	DR	80	170000	Gosford Council
Manly*	F11				92/1922/84	PG	18	2000	Sydney Water
Mannerling Ck Ash	F11		S		1963	TE	12.5	20000	Delta Electricity
Mardi*	F11			M	1963/91	TE	26	7280	Wyong Council
Maroubra Reservoir	F11				1966	PG/TE	12	128	Sydney Water
McCoy Park. Basin	F11				1989	TE	6	500	Parramatta Council
McKinnons Gold Project	D5				1996	TE	17	3030	Burdekin Resources
Medway	G10				1964	VA	23	1270	Wingecarribee Council
Menindee Storages	E2			M	1960	TE	12	2287280	State Water
Minmi Rd Retarding Basin	E11				1995	TE	5	55	Newcastle City Council
Molong Creek	F9			M	1987	PG	16	1000	Cabonne Council
Moolarben Creek	E9				1957/93	ER	12	375	Ulan Coal Mines Ltd
Mooney Lower	F11			M	1937	VA	13	310	Gosford Council
Mooney Upper	F11		S		1961	VA	27	4630	Gosford Council
Moore Creek	C10		S		1898	VA	19	220	State Water
Mt Annan Wetlands 1	G10				-	TE	7	80	Landcom
Mt. Arthur Nth Environment*	E10		S		2002	TE	17	1260	Coal Operations Aust
Mt Owen Nth Void 2 Tails	E10		S		2003	TE/ER	14	2000	Hunter Valley Coal Corp.
Mt Owen Tails 4	E10				2003	TE/ER	12	5000	Hunter Valley Coal Corp.
Mt Owen Tails 5					-	TE	11	5000	Hunter Valley Coal Corp.
Mt Thorley Minstrip Tails*	E11				-	ER	50	2520	Mt Thorley Operations
Mt. Thorley Ramp Tails*	E11		S		U/C	TE	75	4700	Mt Thorley Operations
Mt View Basin	E11	P			1987	TE	4	247	Cessnock Council
Muirfield Golf Club*	F11				1969	TE	8	6	Muirfield Golf Club
Muirfields Golf Ret Basin*	F11			I	1993	TE	4	12	Baulkham Hills Council
Murray 2	I8				1968	VA	43	2310	Snowy Hydro
Murrurundi*	D10				1984	TE	11	170	Murrurundi Council
Narranbulla	G9				1966	TE	7	1445	Narranbulla Pastoral Co.
Nepean	G10				1935/92	PG	81	81400	SCA
Newstan Contingency Tails	E11				2003	TE/ER	20	78	Newstan Colliery
Nixon	C10				1971	TE	16	222	J. Nixon
Northmead Ret Basin	F10				1990/94	TE	6	30	Baulkham Hills Council
North Parkes Tails*	E8				1993	TE	20	25000	North Parkes Mines
Nth Turrumurra Golf	F11				2001	TE	5	10	Ku-ring-gai Council
Nyrang Park Basin	G10				1993	TE	4	21	Wollongong Council
Oak Flats Reservoir	G10				1978	TE	15	56	Sydney Water
Oaky River	C12				1956	PG/ER	18	2700	New England County Cncl
Oberon	F9				1949/96	CB	34	45400	State Water
Orange Research Station	F9		S		1993/97	TE	7	175	NSW Agriculture Dept
Palm Tree Grove Basin	F11				1975/90	TE/ER	3	3	Gosford Council
Pasminco Site D Tails	E1				1998	TE	26	6600	Pasminco Broken Hill Mine
Peak Gold Mine Tails	D5		S		1990?	TE	13	4200	Peak Gold Mines P/L
Pecan Close Basin	F11				1998/03	TE	5	100	Gosford Council
Pejar*	G9				1979	TE/ER	23	9000	Goulburn-Mulwaree Council
Pindari	B11			I	1969/93	DR	85	312000	State Water
Pipers Flat	F10			M	1920	TE	10	645	Centennial Coal Pty Ltd
Plashett	E10				1987	TE	46	70000	Macquarie Generation
Porters Creek	H10			M	1968	TE/PG	17	2541	Shoalhaven Council
Port Macquarie*	D12				1980	TE	19	2500	Hastings Council
Port Waratah Fines Disp	E11			I	1990	TE	5	1750	Port Waratah Coal
Potts Hill Res. 2	F11				1923	PG/TE	8	799	Sydney Water
Prospect	F10				88/1979/97	TE	26	50200	SCA
Puddledock Creek	C11			M	1928	VA	21	1730	Armidale Council
Ravensworth Mine Inpit*	E11				1994	TE	12	1000	Peabody Resources
Ravensworth Void 3 Ash*	E11				2001	TE	20	12000	Macquarie Generation
Redbank Creek*	E9			R	1899	VA	16	180	Mudgee Council
Rocky Creek*	A13			M	1953	TE	28	14000	Rous County Council
Rouse Hill Ret Basin 5	F10				1993	TE	4	72	Sydney Water
Rouse Hill Ret Basin 9	F10				1993	TE	5	46	Sydney Water
Rouse Hill Basin 9B	F10				2001	Te	7	55	Sydney Water
Rouse Hill Ret Basin 13	F10				1994	TE	5	99	Sydney Water
Rouse Hill Ret Basin 16	F10				2000	TE	4	13	Sydney Water
Rydal	F10				1957/96	TE	15	370	State Water
Rylstone*	E9				1953	VA	15	3210	Rylstone Council
Sawyers Swamp Creek Ash	F10				1979	TE	40	8500	Delta Electricity
School House Ck Ret Basin	F10		S		1989	TE	4.5	138	Penrith Council
Seladon Ave Ret Basin	E11				1993	TE	2	3	Newcastle Council
SE Tails*	E10		S		Prog	ER	35	1200	Coal & Allied



Dam	Map Ref	Presc. 2004/5	Surv. Report	Safety	Built	Type	Height (m)	Storage (ML)	Owner
Sheahan-Grants Tails	F8				1990	TE	26	1280	Climax Management Pty Ltd
Shellcove Estate Basin	G10				2003	TE	7	27	Shell Cove Estate
Sierra Place Basin	G10		S		1991/2001	TE/ER	9	213	Blacktown Council
Smiths Ck Ret Basin 1	G10				2001	TE	9	55	Campbelltown Council
Smiths Ck Ret Basin 2	G10				1996	TE	8	50	Campbelltown Council
Smiths Ck Ret Basin 3	F10				1996	TE	7	32	Campbelltown Council
Sooley*	G9				1930/1961	PG	13	4500	Goulburn-Mulwaree Council
South Bulli Stormwater Dam	G10				1992	TE	9	89	Bellambi Coal Company P/L
Split Rock	C10		S		1987	DR	66	397370	State Water
Spring Creek*	F9			R	1931/47/69	TE/VA	16	4700	Orange Council
Stephens Creek	D1			M	1892/1909	TE	15	20400	Aust. Inland Energy & Water
Steuart McIntyre*	D12		S		2000	TE	25	2500	Kempsey Council
St Josephs School Basin	G10				1990/2001	TE	5	17	Shellharbour Council
Stockton Borehole Tails	E11				1982/1985	TE/ER	21	360	Broken Hill Prop. Co Ltd
Suma Park*	F9			M	1962	VA	34	18000	Orange Council
Sunlight Gully Upper Dam	C11			I	1900?	TE	4	28	Hillgrove Gold NL / D Hanlan
Sunlight Gully Lower Dam	C11			I	1900?	TE	5	65	Hillgrove Gold NL / D Hanlan
Talbingo	H8			M	1970	ER	162	921400	Snowy Hydro
Tallong Railway*	G10				1883/1975	MB	7	318	State Rail Authority
Tallowa	G10				1976	PG	46	110200	SCA
Tantangara	H8				1960	PG	45	254000	Snowy Hydro
Tenterfield Creek	B12			M	1930/74	PG	11	1170	Tenterfield Shire Council
The Cove*	F11			M	1972	TE	7	140	Old Sydney Town
Thompsons Creek	F9				1992	TE/ER	53.5	27500	Delta Electricity
Thornleigh Reservoir	F11				1971	TE	9	409	Sydney Water
Tilba*	I10		S	I	1970/97	TE	17	135	Bega Valley Council
Timor	D9				1961	VA	19.5	1140	Coonabarabran Council
Tooma	I8				1961	TE	67	28100	Snowy Hydro
Toonumbar	A12				1971	TE/ER	44	11000	State Water
Triako Tails	E6		S		1989	TE	12.5	950	Triex Ltd
Tritton Tails	D6				2004	TE	14	5500	Tritton Resources Ltd
Tumbarumba	H8			M	1972	TE	6	68	Tumbarumba Council
Tumut Mill Freshwater	H8				2001	TE	11	190	Visy Pulp & Paper
Tumut Mill Winter Storage	H8				2001	TE	11	700	Visy Pulp & Paper
Tumut Pond	H8				1959	VA	86	52800	Snowy Hydro
Tumut 2	H8				1961	PG	46	2700	Snowy Hydro
Tumut 3 Inlet	H8		S		1971	PG	35	160000	Snowy Hydro
Umberumberka	D1				1914	PG	26	8180	Aust. Inland Energy & Water
Upper Cordeaux 2*	G10		S		1915	VA	19	1200	SCA
Vales Point Ash	F11				1984	TE	6	42000	Delta Electricity
Wallerawang	F10				1978	TE	14	4300	Delta Electricity
Wambo Hunter Pit Tails*	E11				-	ER	50	8300	Wambo Mining Corp.
Wambo NE Tails*	E11				U/C	TE	26	2060	Wambo Mining Corp
Warkworth Tails*	E11				1992/94	TE	24	3500	Warkworth Mining
Warkworth Nth Pit Tails*	E11		S		1997	TE	21	1900	Warkworth Mining
Warragamba*	F10				1960/92/02	PG	113	2091800	SCA
Warringah Reservoir	F11				1936/95	PG/TE	8	77	Sydney Water
Waverley Res. WS133	F11				1917	PG/TE	8	19	Sydney Water
Wentworth Falls Lake*	F10				1906/93	TE	10	300	Blue Mountains Council
Whitford Rd Basin	F10				1997	TE	4	44	Liverpool Council
Winburndale*	F9			R	1936	PG	25	1850	Bathurst Council
Windamere	E9				1984	TE/ER	67	368000	State Water
Winding Creek 5 Basin	E11				1993	TE	5	72	Hunter Water Corp
Wingecarribee*	G10			M	1974	TE/ER	20	34510	SCA
Wollondilly Washery*	G10				1968	ER	18	150	Sada Pty Ltd
Wollongong High Basin	G10				2001	TE	5	80	Wollongong Council
Woodford Creek	F10				1928/48	VA	18	850	SCA
Woodlawn Mine Evap*	H9		S		1989	TE	6	750	Woodlawn Mines
Woodlawn Mine Evap. 2*	H9		S		1989	TE	10	290	Woodlawn Mines
Woodlawn Nth Tails*	H9		S		1977	TE/ER	18	2100	Woodlawn Mines
Woodlawn Sth Tails*	H9		S		1982	TE/ER	25	2400	Woodlawn Mines
Woodlawn West Tails*	H9		S		1989	ER	35	2400	Woodlawn Mines
Woolgoolga*	C13		S		1967	TE	14	270	Coffs Harbour Council
Woronora	G10				1941/88	PG	63	71800	SCA
Wyangala	F8			M	1971	TE/ER	85	1220000	State Water
Wyong Road Basin	F11				1975	TE	3	50	Wyong Council
Yarrowonga Weir	I6				1939/2001	PG/TE	7	120000	MDBC
Yass*	G8				1927	VA/PG	12	1125	Yass Council
Yellow Pinch*	I9				1987	ER	40	3000	Bega Valley Council

**LEGEND:**

\*: DSC Inspected-2004/5

I: Dam under Investigation

ER: Rockfill dam

CB: Concrete buttress

R: Sig. Risk Dam

U/C: Under Construction

DR: Decked rockfill

VA: Concrete arch

M: Medium Risk Dam

TE: Earthfill dam

PG: Conc. gravity

MB: Masonry buttress



***North Parkes Mine Tailings Dam***

*Dams Safety Committee members and staff inspecting the filling operations for this tailings dam during a site inspection in 2004.*

***Jindabyne Dam***

*DSC members and staff inspecting the current upgrading of the spillway.*



***Woodlawn Mine Tailings Dam***

*DSC staff inspecting the ongoing rehabilitation works.*