



Brian Cooper

Dams Engineer

Qualifications & Affiliations

Short courses on finite element analysis, embankment dam engineering, earthquake engineering. Published technical papers – ICOLD, ANCOLD and I.E. Aust. Attended dam safety course at USBR (Denver, USA) in 2002

Bachelor of Engineering (B.E. Hons), 1968 and Master of Engineering Science (M.Eng.Sc.), 1971

University of New South Wales

Graduate Diploma of Engineering Management, 1994 Deakin University

F.I.E. Aust., C.P.Eng. RPEQ

Expertise

Brian has approximately 40 years experience in investigation and design of major dams, weirs and hydraulic structures, having started his career designing farm dams and small irrigation schemes. He retired from NSW Department of Commerce in 2005. Brian now works as a private consultant specialising in dams engineering and fish passage at dams and weirs. He has a special interest in risk assessment and computer modelling in general and the seismic analysis of dams in particular. Engineering software (concrete dam stability analysis and flood routing) written by Brian is still used extensively in the Dams & Civil Group of the Department of Commerce. He also has particular experience with concrete dams and the use of post tensioned ground anchors for strengthening those dams. He was a member of the Australian National Committee on Large Dams (ANCOLD) Working Group that developed guidelines for 'Design of Dams for Earthquakes' and a member of the Working Group that revised the guidelines for 'Risk Assessment for Dams'. He has been a guest lecturer for a number of years (most recently in 2009) on concrete dam engineering for the University of NSW post graduate Embankment Dam Engineering Course, and on the history of dams in NSW at Sydney University.

He has been the project director and project manager for a number of feasibility studies, design reviews, site investigations and detail design consultancies for major dams and weirs including the direction and co-ordination of all specialist services including dambreak studies, preparation of dam safety emergency plans and risk assessments. He is currently an expert reviewer for a number of Australian water authorities and consultants (State Water Corporation (NSW), Hydro Tasmania, SunWater (Queensland), Brisbane City Council, Goulburn-Murray Water, Goulburn Valley Water, WA Water Corporation, Southern Rural Water (Victoria), URS, GHD, Hobart Water, NT PowerWater, and TrustPower (NZ)). He has also worked as a sub-consultant for a number of consulting firms (URS, MWH, GHD).

Brian is the Engineers Australia representative for the NSW Dams Safety Committee (the dam safety regulator in NSW) and is currently the Chairman of that organisation. He has been a member of the Murray Darling Basin Authority's Fish Passage Task Force which advises inter alia on the installation of fishways on the Murray River as part of the Living Murray Program.

Brian is a registered engineer in Queensland (RPEQ No. 6819). He started his own consulting business in 2008, advising on dam safety, dam design and analysis, dam risk assessments and dam upgrades as well as fish passage for dams. He is providing specialist advice through *Brian Cooper Consulting* as a sole trader.

Professional Experience

2008 to Present: *Principal of Brian Cooper Consulting*

- 2010
- Five yearly comprehensive dam safety inspection of Carcoar Dam (double curvature arch dam).
 - Internal reviewer to URS (Melbourne) on concept design of regulator structures and associated fishways for the Hipwell Road project for watering the Gunbower Forest
 - Specialist adviser to Melbourne Water – valve behaviour on Sugarloaf Dam pipeline, structural behaviour of pumping station floor slab and pump bases at Cardinia Dam Pumping Station
 - Commenced work as member of ANCOLD working group re-writing the Earthquake Guidelines – responsible for re-writing sections relating to concrete dams.
 - Continuing involvement with Alluvium in the design of the weir upgrade and the new fishway for Booligal Weir.
 - Continuing external peer review services to State Water Corporation for the detail design of new auxiliary fuse plug spillways for Copeton and Chaffey Dams, detail design of raising and post tensioned strengthening of Keepit Dam, detail design of upgrade works for Wyangala Dam, finite element analysis of Carcoar Dam (double curvature arch dam).
 - Further work with GHD (Perth) on risk assessment for Serpentine Dam.
 - Continuing involvement with Hydro Tasmania, as Chair of external review panel for Catagunya Dam.
- 2009
- Part of URS' comprehensive inspection team for Melbourne Water's Maroondah Dam.
 - Part of URS' business risk assessment team for Southern Rural Water's Cowwarr and Maffra Weirs.
 - Part of Alluvium's design team upgrading Booligal Weir and providing a fishway at the weir, for State Water Corporation.
 - Part of GHD's design team for Lower Fitzroy River Infrastructure Project designing fishways for Rookwood and Eden Bann Weirs near Rockhampton in Queensland.
 - Project Manager on behalf of SA Water and reviewer for study into vibration of a crane rail beam at Lock 5 on the River Murray.
 - Expert reviewer for State Water Corporation for 3D finite element analysis of Carcoar Dam (double curvature arch dam).
 - Internal reviewer for URS on Laanecoorie Dam Upgrade.
 - Expert reviewer for State Water Corporation for risk assessments for Oberon and Rydal Dams.
 - Member of GHD's Serpentine Dam risk assessment team for WA WaterCorp.
 - Expert reviewer for SunWater in Queensland for the comprehensive risk assessment undertaken for Fairbairn Dam and Coolmunda Dam.
 - Expert reviewer for State Water Corporation for major upgrade works at Keepit, Copeton, Chaffey and Wyangala Dams.
 - Appointed as Chairman of the NSW Dams Safety Committee (the dam safety regulator in NSW).
 - Provided external peer review for Goulburn Valley Water, on Nine Mile Creek Dam Upgrade.
 - Internal reviewer for URS (Adelaide) for Lake Victoria Outlet Regulator options studies.
 - Provided advice to URS (Melbourne) on the Mildura Weir Fishway design.
 - Member of expert panel advising State Water Corporation on revised dam surveillance regime.
 - Part of Ecosmart bid team - prepared concept designs for fish passage facility at proposed Wyaralong Dam in Queensland.
 - Continuing expert review role for Catagunya Dam upgrade.
- 2008
- Started as a private specialist dams consultant - *Brian Cooper Consulting*.
 - Worked through the URS Corporation for the USBR and the USACE in developing a risk toolbox for lined spillways.
 - Advised TrustPower in New Zealand on replacement of post tensioned anchors at Mahinerangi No. 1 Dam.
 - Adviser to State Water Corporation and to URS on further upgrade works for Hume Dam.
 - Provided specialist advice to WA Water Corporation on Wellington Dam post tensioning.
 - Peer reviewer on behalf of URS for Warren Dam in South Australia.
 - Part of URS team carrying out portfolio risk assessment of Melbourne Water's dams.
 - Member of Expert Review Panel for Darwin River and Manton Dams for NT PowerWater.

1987 to 2008: Dams & Civil Section of NSW Department of Public Works and Services/NSW Department of Commerce.

- 2008 Carried out detailed 3D finite element analysis of radial gate at Wyangala Dam spillway for State Water Corporation.
Continuing review role for Tillegra Dam.
Continuing review role for Hinze and Lake Manchester Dams in Queensland and Catagunya Dam in Tasmania.
Prepared options report on Burrendong Dam spillway modifications for State Water Corporation.
- 2007 Continuing roles on Lake Manchester, Hinze, Catagunya and Redbank Ck. Dams.
Internal peer reviewer for NSW Dept. of Commerce regarding design of Tillegra Dam.
Advised State Water on feasibility of fish passage facilities at a number of their major irrigation dams.
Expert reviewer for GHD on a flood retarding basin in south west Sydney.
Part of expert panel for River Murray Water risk assessments for Hume and Dartmouth Dams, Torrumbarry and Yarrawonga Weirs and Lake Victoria.
Re-elected as Deputy Chairman of the Dams Safety Committee
- 2006 Project director for 3D finite element analysis of Bendora Dam (double curvature arch dam)
Chair of external peer review panel for upgrading of Lake Manchester Dam (concrete gravity dam) in Queensland
Internal peer reviewer and senior consultant for the raising of Hinze Dam (earth and rockfill embankment) in Queensland
Project director for preliminary and detailed design of Redbank Creek Dam (single curvature arch dam) upgrading
Project director for Keepit Dam fish passage investigations
Part of expert panel for URS undertaking portfolio risk assessment for dams owned by River Murray Water
External peer reviewer for Hydro Tasmania for Catagunya Dam (concrete gravity dam) upgrading;
Project director for 3D finite element analysis of Upper Cordeaux No. 2 Dam (single curvature arch dam owned by SCA) for BHP Billiton
- 2005 Project design engineer for dam related aspects of Nepean Dam Deepwater Access Project:
Pipeline crossing end of spillway; outlet works for end of pipeline
Project design engineer for Avon Dam Deepwater Access Project: tunnel design through rockfill buttressing; new low level outlet works
- 2004 Internal reviewer to URS Australia for Pykes Ck Dam Investigations (Southern Rural Water, Victoria)
Internal reviewer to URS Australia for Lower Reservoir Dam (Hobart Water, Tasmania)
Member of expert review panel for the Melton Dam upgrade design (Southern Rural Water, Victoria)
- 2003/04 Designer for retrofitting multi-level offtake for Tallowa Dam (Sydney Catchment Authority).
Member of the Independent Technical Expert Panel for the Eildon Dam Upgrading in Victoria for Goulburn-Murray Water.
Currently the design director for the Wivenhoe Dam Alliance carrying out the flood capacity upgrading for Wivenhoe Dam in Queensland – included directing major computational fluid dynamics modelling investigations of existing spillway
- 2003 Carried out options study for environmental upgrading works at Keepit Dam (selective withdrawal facility, additional outlet works and fish passage)
Carried out assessment of spillway capacity for Hume Dam using computational fluid dynamics modelling (by a sub-consultant)
Carried out detail design for anchoring Bellfield Dam (Victoria) Intake Tower
Carried out detailed finite element analysis of Keepit Dam radial gates
- 2002 Carried out review of large farm dam with seepage problems. Directed computational fluid dynamics modelling of drum gate and radial gates at Warragamba Dam together with structural analysis of gates (modelling carried out by sub-consultant) to ensure gates can handle more

- rigorous operating conditions
 Adviser to the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) on civil engineering matters related to the replacement reactor project at Lucas Heights
 Expert reviewer for Goulburn-Murray Water for remedial works at Cairn Curran Dam in Victoria
 Project Director for Lerderderg Weir safety review and risk assessment for Southern Rural Water (Victoria). Carried out finite element analysis of radial gate
- 2001
- Project Director for design of further remedial works at Hume Dam.
 Technical director on behalf of NPWS for quantitative risk assessment for Snowy Mountains roads
 Chairman of the committee producing a geotechnical response plan for the Alpine Way in the Snowy Region for NPWS
 Carried out non-linear finite element analysis (earthquake loading) for outlet tower at Bellfield Dam for Wimmera-Mallee Water (Victoria)
 Joined the MDBC's Fish Passage Reference Group and reviewed fishway designs
 Consultant to DLWC for their portfolio risk assessment of thirty dams
 Provided advice on the post tensioning system at Waitakere Dam in New Zealand.
- Director of Dam Surveillance Group responsible for the surveillance of DLWC dams and participant of a number of 5 yearly surveillance inspections
 Project Director of review of DLWC Intake Towers Earthquake Stability Review
 Directed DPWS input into the Earthquake Stability of the structural elements of Yarrawonga Weir as sub-consultant to URS Australia – included detail design of anchoring system for the weir.
 Also provided design advice on design of stone columns to provide protection against liquefaction of alluvial foundations.
 Member of the expert panel for the risk assessment studies being undertaken for Goulburn-Murray Water
 Project Director for safety review and preliminary design of remedial options for Blowering Dam (DLWC)
 Acted as reviewer for a number of projects carried out by URS (incl. Cardinia Dam outlet tower, Bellfield Dam embankment/spillway)
 Directed functionality study (including business risk assessment) for Yallourn Weir for Southern Rural Water (Victoria)
- 2000
- Project Director for design of further investigations and remedial works at Hume Dam.
 Safety reviews for Bamarang and Flat Rock Dams
 Director of Dam Surveillance Group responsible for the surveillance of DLWC dams and participant of a number of 5 yearly surveillance inspections
 Project Director for earthquake studies on intake towers and appurtenant works at DLWC dams
 Consultant to DLWC to manage their portfolio risk assessment
 Project Director for a number of dambreak studies and preparation of dam safety emergency plans
 Member of the consulting team carrying out risk assessments for Goulburn-Murray Water (Victoria) for Eppalock Dam
 Carried out review of Earthquake Stability Review of the Outlet Tower at Eppalock Dam in Victoria for G-MW.
 Reviewed URS Australia designs for Alpine Way remedial works
- 1999
- Project Director of earthquake studies on Wyangala Dam
 Project Director for design of further remedial works at Hume Dam. Included design of ground improvement works (stone columns) for protecting alluvial foundations against liquefaction
 Peer reviewer of Leslie Dam (Queensland) Safety Report.
 Peer reviewer of DLWC's Screening Level Risk Assessment
- 1998
- Project Director for portfolio risk assessment for six dams owned by a Southern Rural Water in Victoria.
 Directed structural analysis of spillway gates on Narracan Dam for Southern Rural Water
 Project Director for concept design and DD&C contract documentation for Warragamba Dam auxiliary spillway. Dam to be upgraded the dam to cater for increased inflow flood estimates. Upgrading works estimated to cost \$135M. An auxiliary spillway is to be constructed adjacent to the existing dam - involves excavating some 2,000,000m³ of rock and constructing concrete lining, training walls, fuse plug embankments, large scale cement stabilised sandstone fill, a multi

span bridge across the spillway, post tensioned ground anchors for dissipator/training walls, modifications of existing spillway gates. Design involved extensive physical hydraulic model testing.

- 1997 Feasibility options study for remediation of Redbank Ck. Dam near Mudgee (NSW) Karapiro Dam, New Zealand - Part of international consulting team reviewing this concrete arch dam's security and determining appropriate remedial options (mass concrete buttressing). Director of risk assessment studies for Tenterfield Dam
- 1993-1997 Hume Dam Investigations - Project Manager of Investigation and Design Studies for the embankments at the dam. Work involves:
- review of the stability of the embankments under static and earthquake loadings
 - investigation of liquefaction
 - potential of embankments' foundations
 - development of stabilising options
 - development of options to provide increased flood security including provision of new auxiliary spillways and modifications to existing works
- detail design and documentation of stabilising works for the embankments including a key trench into the dam's foundations, stabilising berms, slurry wall cut-offs, drainage/filter curtains and strengthening of critical gravity training walls with both horizontal and vertical post tensioning.
- part of advisory and review team for the risk assessment of the dam and its components.
- 1990-1996 Warragamba Dam Upgrading for Sydney Water Corporation - Project Manager of Investigation Concept Design Studies for upgrading the dam to cater for increased inflow flood estimates and provide substantial flood mitigation. Upgrading works estimated to cost \$280M. The existing dam was to be strengthened with mass concrete buttressing – some 600,000m³.
- 1996 Project Director for Safety Review (including Finite Element Analysis) of Wellington Dam
- 1993-1996 Hume Dam Gates for Department of Water Resources - Project Manager for the design of new maintenance baulks and emergency closure gates. Involves development of proposals for underwater installation.
- 1995 Redbank Creek Dam and Lithgow No. 2 Dam for NSW Public Works Dams Surveillance - Project Manager for safety reviews and finite element analysis of two 15m high arch dams. Clarrie Hall Dam for NSW Public Works Dams Surveillance - Project Manager for dambreak studies.
- 1994 Burrinjuck Dam Gates for NSW Department of Water Resources - Project Manager for the design of new control and emergency closure gates. Involves underwater installation. Karangi Dam for Coffs Harbour City Water Project - Project Manager for dambreak studies.
- 1993 Mardi Dam for Wyong Council - Project Manager for safety review of earth embankment.
- 1988-1990 Nepean Dam Remedial Works for Sydney Water Corporation - Project Manager for investigation studies, design development and detail design. Work involved:
- initial flood security studies and development of options
 - co-ordination of hydraulic model studies
 - detail design and contract documentation for modified spillway, large size post-tensioned ground anchors and rockfill buttressing.
- 1987-1989 Boggabilla Weir for NSW Department of Water Resources - Project Manager for detail design and contract documentation of a large gated re-regulation weir with fishway. Involved liaison with fisheries expert in developing optimum geometry for fish ladder.

Chaffey Dam for NSW Department of Water Resources - Project Manager for upgrading of dam.
Work involved:

- development of options and preliminary design
- finite element analyses for raised morning glory spillway
- stability analyses for raised earth/rockfill embankment
- co-ordination of hydraulic model studies for raised spillway.

1969-1987: *Water Resources Commission of NSW (WRC) (now Department of Land and Water Conservation).*

1986-1987 Flood Security studies for WRC - Project Design Engineer for investigation into flood security of Chaffey and Glennies Creek Dams. Involved co-ordinating dambreak studies, development of remedial options, economic risk studies.

1985-1987

Hume Dam Strengthening for WRC - Project Design Engineer for detail design and contract documentation. Work included:

- design of large size post-tensioned ground anchors including development of appropriate grouting procedures
- design of structural modifications to the concrete gravity dam
- design of a new road bridge over the dam.
- establishing the rationale for replacing the existing post tensioning system

Contact

Tel:
Mob
Ema