

Dr Robert A. Patterson
Soil Scientist and Environmental Engineer

Professional Certifications

- Certified Professional Soil Scientist (CPSS – Stage 3)
- Certified Agricultural Scientist (CPAg)

Professional Affiliations

- Adjunct Associate Professor, School of Environmental and Rural Science, University of New England (expires 2016)
- Fellow, Institution of Engineers Australia (FIEAust) - outgoing Chair of Northern Group Newcastle Division of Engineers Australia (2005-2006)
- Member Australian Society of Soil Science Inc.
- Member Australasian Soil and Plant Analysis Council
- Member Australian Institute of Agricultural Science and Technology

Professional Panel Memberships

- Member Accreditation Board, Soil Science Australia
- Member, Newcastle Divisional Committee, Engineers Australia

Awards

- Engineers Australia Medal 2012

Qualifications

- Bachelor of Natural Resources First Class Honours (Uni. of New England) major - soil and water resources (1982)
- Postgraduate Certificate of Engineering (Deakin University) major - water engineering (1994)
- Doctor of Philosophy (University of New England) jointly resource engineering and soil science (1994)
- Postgraduate Diploma of Engineering (Deakin University) major - environmental engineering (1996)
- Master of Engineering (Deakin University) (1998)

Major Academic Theses

- B. Nat. Res. Honours thesis examined surface water, groundwater and rain water collection and use by rural residential developments in the Armidale area.
- Doctoral thesis "On-site treatment and disposal of septic tank effluent" examined wastewater chemical properties and the effects of effluent disposal on the hydraulic conductivity of soils.
- Master of Engineering project on "Environmental Indicators of Effective Sewage Effluent Re-use" examining re-use at the Armidale Sewage Treatment Works.

Key Responsibilities and Achievements**Specific Expertise****Certified Professional Soil Scientist (Leading Professional Stage 3) (CPSS)**

Specific expertise in landscape analysis, soil survey and soil description, soil physical and chemical analysis, salinity and sodicity issues and soil phosphorus cycling. Key

achievements include technical advice to local government and private developers in soil survey, landscape assessment and wastewater management on soils.

Certified Agricultural Scientist (CPAg)

Specific expertise in soil management in agricultural land use planning, salinity and sodicity issues and fertiliser requirements. Key achievements include recognition by agriculturalists of technical competence in measuring soil chemical properties and recommending ameliorating strategies.

Environmental Engineer

Practical and technical expertise in water and wastewater management, soil resource management and environmental issues related to development site assessments, effluent re-use projects and biosolids management. Key achievements in current projects with Armidale Dumaresq Council in relation to effluent and biosolids re-use and annual monitoring of large effluent re-use project; providing ongoing assessment for Guyra Shire Council for conformance to licence conditions; and numerous re-use projects for small packaged treatment works for coastal developments including The Byron Resort at Byron and the Byron Bay Golf Club re-use project.

Recent – role as one of three supervisors for a PhD candidate for a engineering thesis on the measurement of bridge health in short span timber bridges (University of New England), PhD awarded to candidate August 2013.

Recent - Prepared Statement of Environmental Effects for the upgrading of the wastewater treatment and irrigation for a piggery in the Sydney Basin. Project part of a Land & Environment case in which I act as expert witness for the piggery owners, having prepared a Statement of Evidence on the operation of the piggery and it environmental footprint.

Recent – prepared On-site Wastewater Policy for Armidale Dumaresq Council to update with current legislation and standards.

Continuing: Provide assistance and supervision of Engineering students at University of New England, as Adjunct Associate Professor.

Continuing - Prepare annual return for Armidale Dumaresq Council for the Environmental Protection Licence for the effluent re-use at the sewage treatment works, including annual soil sampling, analysis and reporting of Annual Soil Report.

Continuing -Maintain wastewater and effluent monitoring programs for Armidale Dumaresq Council, Guyra Shire Council and Uralla Shire Council, providing analysis and assessment of monthly water quality.

Continuing -prepare degraded-site investigations, air and water quality monitoring and assessments, storm water runoff effects on groundwater and surface waters, surface water quality relationships and potable water supply investigations. Key achievement is recognition of expertise in irrigation projects in relation to salinity, sodicity and nutrient relationships.

Continuing - prepare on-site wastewater management plans to meet environmental constraints and comply with state and national guidelines for traditional septic tank systems, aerated wastewater treatment systems, composting toilets, sand filters, evaporation beds and other

treatment systems. Key achievement is recognition by local government and peers of specific expertise in on-site systems, these include preparing plans for individual dwellings as well as large subdivisions, represent clients as expert witness in Land & Environment Court.

Continuing - provide third party environmental review of wastewater treatment at International Byron at Byron Resort at Byron Bay and irrigation at Byron Bay Golf Club. Initially involved as expert witness in Land & Environment Court proceedings for same Resort application. Involved as part of team in developing management plans for effective re-use of the effluent, hydrogeological studies, nutrient budgeting and soil and water studies.

Continuing - provide training to professionals in on-site wastewater management in courses with others (1995 to present) and those run under the Lanfax Labs banner. These courses have been run in Sydney, Melbourne, Bendigo, Ballarat, Rosebud, Queanbeyan, Nowra, Darwin, Perth, Tasmania and New Zealand (Christchurch, Hamilton, Blenheim, Wellington, Nelson, Paraparamu, Auckland). For each area, I prepare special soils information and supervise a field exercise.

Monitor groundwater projects including assessments in relation to irrigation projects, protection of groundwater resources, nutrient monitoring programs and hydrogeological planning issues. Recognised by Land & Environment Court as expert in soil and water resource management. Undertaken numerous cases as expert in that area.

Provided third party review to effluent irrigation project at Gelita Australia's Beaudesert works, and continue to provide analytical soil services to them.

Previously provided technical advice to Parry Shire Council, Glen Innes Council and Bellingen Shire Council in relation to large scale effluent re-use projects in their areas

Court appointed expert (NSW Land & Environment Court) on several occasions (2005, 2006) in relation to water and wastewater disposal to land in proceedings before the court. Have been expert witness in more than 20 court cases and Commissions of Enquiry.

Provide advice to Local Government and industry in relation to soil nutrient balances. Key achievements have been projects with Armidale Dumaresq Council, Glen Innes Shire, Bellingen Shire and the cattle feedlot industry.

One of a four person team that reviewed the "Environment and Health Protection Guidelines: On-site sewage management for single household" for NSW Dept of Local Government.

Collaborative research with Australian Consumer Association (Choice) investigating environmental effects of greywater application from laundry detergents. Material published separately by Choice (2007, 2008, 2009 and 2010). Provided the review assessment for Choice in the 2011 investigation of laundry detergents.

Laboratory Management

Solely responsible for the management of the analytical services, proficiency testing participation, quality control programs of all aspects of the research and commercial operations. Key achievement has been the development of the laboratory, its technical procedures manual and its competitive role as provider of quality analytical services to Universities, Government and the private sector. Refer to Laboratory Competence document.

Responsible for the interpretation of all analytical results, liaison with the clients and development of strategies to meet their requirements. Responsible for the financial and regulatory aspects of the Laboratory.

Completed acid sulphate soils proficiency testing under the coordination of ASSMAC Technical Committee's (2002). In October 2012 upgraded personal skills with regards to acid sulphate soil by completing the course with Southern Cross University.

Maintain technical competence through proficiency testing programs with Australasian Soil and Plant Analysis Council (ASPAC) and National Association of Testing Authorities (NATA). Key achievement is maintaining high level of proficiency and competence in soil and water analysis.

Research activities

Adjunct Association Professor with Faculty of the Sciences at University of New England, Armidale extended to 2016. (Honorary Research Associate 1990 to 2007).

Undertake commercial research for university, government and private sector in areas of soil, water and wastewater research. Responsibilities in project design and implementation, including assessment of the results. Key achievements have been the development of peat applications for treatment of domestic and industrial wastewater through laboratory trials and commercial full-scale trials. Recent research into NZ peats for wastewater treatment (2006).

Research interests in chemical interactions in domestic wastewater generation and treatment. Key achievement has been recognition as a leader in understanding wastewater chemistry in relation to household chemical use, presented papers internationally in this field and unique research outcomes have been adopted by many local authorities. Research papers are distributed widely by State and Local authorities to lift community awareness in choice of laundry products.

Responsible for numerous research projects related to drinking water quality across northern NSW, surface and groundwater quality monitoring. Key achievements have been publication of specific data demonstrating the variable quality of drinking water and effects of natural and induced chemicals on the environmental quality of these waters.

Current research interests include mapping of on-site systems using electromagnetic instruments, and the chemistry of laundry products as greywater and their effects upon soil physical properties.

Currently continuing a review of "Nitrate Toxicity" for a major agricultural group.

Public Representation

Current member of Certified Professional Soil Science Board for Soil Science Australia (two year term 2012/13)

Provide technical expertise and representation as part of a team at public meetings, commissions of enquiry, for individuals, business organisations, community and resident action groups. Key achievements have been in areas where pressure has brought about reviews to planning issues for major highway diversions, flooding issues, wetlands, land acquisition, land use zoning and mining.

Member of Armidale Dumaresq Council's Floodplain Management Committee (1999-2001).

Member of Armidale Dumaresq Council's Landfill Community Consultative Committee for the life of that committee (2003/04),

Member of Armidale Dumaresq Council's Waste Management Committee (2004-2010).

Past Chair of the Northern Group of the Newcastle Division of Engineers Australia (2005 - 06).

Committee member, Engineers Australia Regional Convention organising committee for Conventions in March 2007, June 2009 and September 2011.

Sole organiser for five On-site Conferences 1999, 2001, 2003, 2005 and 2007 each culminating in a three day conference with printed proceedings. Each conference drew audiences of more than 250 professionals working in the area of on-site wastewater. Edited international and national keynote speakers and 50 technical papers.

Professional Publications

Prepared numerous professional papers on water, water quality, effects of effluent disposal by land application, presented paper on On-site disposal in New Orleans, USA in January 1997, on liquid trade waste and septage treatment at conference in Indonesia, Chemical effects of wastewater in Sydney 1998, septic tank effluent disposal 1999, Peat bed treatment systems in 1999 and 2001, Paris in July 2001, phosphorus isotherms 2001, nitrate research 2004 presented at Sacramento March 2004. All publications are freely available on web site.

Editor of "Sustaining our Regions: The Engineering Challenge" Proceedings of Engineers Australia Regional Convention, Armidale 16-18 September 2011

Editor of "Transport and Communication: Australia's Backbone, Past, Present and Future" Proceedings of Engineers Australia Regional Convention, Grafton June 2009.

Editor of "Wines, Mines and Community: Engineering the Future for Regional Australia" Proceedings of Engineers Australia Regional Convention Hunter Valley March 2007.

Joint editor of five "On-site" conference on wastewater management held in 1999, 2001, 2003, 2005 and 2007 in Armidale NSW. These conferences each attracted over 250 international, interstate and intrastate delegates.

Prepared technical publications on sodicity, salinity and evapotranspiration systems for NSW Department of Local Government as part of the "Septic Safe" Program

Author of "Soil Capability for On-site Wastewater Management", a training manual for on-site wastewater management professionals.

Organisational Skills

Responsible for the financial and professional operation of Lanfax Laboratories as a private consultancy working in the environmental field, with particular emphasis on water and soil resource projects for Government, industry and the private sector. Key achievement has been the development of a successful laboratory and consulting business.

Co-ordinated the technical papers, their reviewing and editing for publication the proceedings for three Engineers Australia Regional Conventions (2007, 2009, 2011).

Conference Coordinator for On-site '99 (July 1999), On-site '01 (Sept 2001), On-site '03 (Sept 2003), On-site '05 (Sept 2005), On-site '07 (Sept 2007), responsible for all facets of the international conferences which attracted over 250 delegates to Armidale on each occasion. Senior technical editor of the technical sessions and editor of the published proceedings of the conferences. Key achievement has been the Australian and international standing of the conferences and the technical expertise to the on-site wastewater sector.

Patrol officer, assistant district officer, then district officer with Australian Department of Foreign Affairs and after self-government with PNG Government. Officer-in-charge of the Kundiawa Staff Training Centre, then Madang Staff Training Centre, training national officers in the duties and role of field officers.

Commissioned Officer - 16 years with Australian Army Reserve in various senior battalion roles for leadership and management, retiring with rank of Major. Completed 18 months training to Lieutenant, 12 months training to Captain.

Administration capabilities

Responsible for the administration of Lanfax Laboratories in all its endeavours, including financial controls, taxation reporting requirements and personnel management. Key achievement has been the building of a successful and respected consulting business.

Previously operated a successful "Metaland" franchise employing up to seven permanent staff for a period of ten years. Prior to and during that period provided consulting to Tubemakers Australia in the use of high tensile pipe for manufacturing rural products.

Training Experiences

A qualified school teacher with eight years experience in NSW Schools including four years in teacher-in-charge positions. Trained at Balmain Teachers' College.

As a Specialist Local Government Adviser (PNG) responsible for all facets of administration and practical training of PNG nationals in local government. Roles. Key achievement was the training of administration and field staff in all facets of local government practice.

Four years as Principal Staff Development Officer for PNG administrative field officers responsible for training in practical skills and in-service training. Key achievement was the development of a staff training centre in Madang, training of national training officers and production of a "Handbook for Field Officers".

Temporary and casual lecturing positions with University of New England (1982-1999) in disciplines of Geography, Hydrology, Soil Science, Natural Resource Management, Environmental Engineering and Ecosystem Management, surveying and air photo interpretation.

Casual lecturer for NSW Agriculture's Farm Management Course (1983-1997) with responsibility for teaching in practical soil assessment and landscape aspects. Key achievement was the writing of "Soils and Their Management" a training manual published by NSW Agriculture.

Presented "Train the trainer" courses for industry in Armidale Region for a volunteer community group. Key achievement was the training of industry personnel in best management on-the-job training methods.

Team member teaching On-site wastewater management - involved since 1994 to present - responsible for soil component and water quality assessment. To date over 3000 professional health inspectors, consultants and manufacturers have attended the various courses across Australia and New Zealand.

External examiner for various PhD theses from Australian universities (New England, Newcastle, Wollongong, Melbourne, Central Queensland, Queensland, Queensland University of Technology, Southern Queensland).

External examiner for various Honours and Masters Theses from Australian Universities (New England, Newcastle, Southern Cross, Queensland)

Currently supervising Ph.D. candidate (engineering topic) at University of New England

Web Site Development

Developed and managed web site for the Northern Group of the Newcastle Division of the Institution of Engineers Australia (ceased April 2012)

Developed and manage the Lanfax Labs web site, in particular the extensive site on laundry products research. The laundry products component is unique and accessed widely. This website is referenced by Governments (state and local) community groups and publishers in Australia and New Zealand.

Computer Literacy

Competent with word processing, financial management packages, spreadsheets, web site development and management, statistical packages, CAD and other drawing packages and the use of these tools for modelling and statistical analysis.

Undertook training program for the hydrologic modelling program "MUSIC" in May 2002.

Leadership

Manage and operate Lanfax Laboratories as a commercial and research laboratory in the fields of soil science, water quality management and environmental assessment.

Previously (1992-2002) owned and operated a franchise as Metaland New England, providing a range of manufacturing services to the agricultural sector.

Sixteen years service and retired from Australian Army Reserve with the rank of Major having reached the position of infantry company commander. Commanded troops in peace time exercises in Australia and New Zealand (Exercise Tasman Reserve). Took part in a leadership role in major training exercises including a Divisional Exercise K89 in Katherine (NT) and a 5th Brigade exercise in Broome (WA).

Reached position of District Officer (Clerk Class 9) with PNG Administration, responsible for management of Provincial Training Centre Madang as Officer-in-Charge. Initially contracted to Australian Foreign Affairs, then to PNG Government.

Interests

Photography, welding and metal fabrication, family history research.

PUBLICATIONS

ACADEMIC THESES (examined)

T3. PATTERSON, R.A. (1997) Environmental Indicators of Effective Sewage Effluent Re-use. Project Report, Master of Engineering. Deakin University, Geelong.

T2. PATTERSON, R.A., (1994) On-site treatment and disposal of septic tank effluent Ph.D. thesis, University of New England

T1. PATTERSON, R.A., (1982) Hydrologic Parameters - A Strategy for Subdivision. B.Nat.Res. Thesis Faculty Resource Management. University of New England.

BOOKS and MAJOR PUBLICATIONS

B.13 PATTERSON, R.A. (Ed) 2011. Sustaining our Regions: The Engineering Challenge. Proceedings of 2011 Regional Australia Convention 16-18 September 2011 Engineers Australia Newcastle Division, Newcastle. ISBN 978-0-85825-870-9

B.12 PATTERSON, R.A. (Ed) 2009. Transport and Communication: Australia's Backbone, Past, Present and Future. Proceedings of 2009 Regional Convention 12-13 June 2009. Engineers Australia Newcastle Division, Newcastle. ISBN 0858259761.

B.11 PATTERSON, R.A. and JONES, M.J. (Eds) *Innovation and Technology for On-site Systems*. Proceedings of On-site '07 conference. 25-27 September 2007. Lanfax Laboratories. Armidale. ISBN 978-0-9579438-3-4. Copies available from Lanfax Laboratories.

B.10 PATTERSON, R.A. (Ed) 2007. Wines, Mines and Community: Engineering the Future for Regional Australia. Proceedings of 2007 Regional Convention 23-25 March 2007. Engineers Australia Newcastle Division, Newcastle. ISBN 0 85825 798 X.

B9. PATTERSON, R.A. and JONES, M.J. (Eds) (2005) *Performance Assessment for On-site Systems*. Proceedings of On-site '05 Conference held in Armidale 27-30 September 2005. Lanfax Laboratories. Armidale ISBN 0-9579438-2-2

B8. PATTERSON, R.A. and JONES, M.J. (Eds) 2003. *Proceedings of On-site '03 Conference: Future Directions for On-site Systems* 30 September to 2nd October 2003. Held at University of New England. Armidale. Lanfax Laboratories, Armidale ISBN 0-9579438-1-

B7. PATTERSON, R.A. and JONES, M.J. (Eds) 2001. *Proceedings of On-site '01 Conference: Advancing On-site Wastewater Systems* 25-27 September 2001. Held at University of New England. Armidale. Lanfax Laboratories, Armidale ISBN 0-9579438-0-6

B6. PATTERSON, R.A. (Ed) 1999. *Proceedings of On-site '99 Conference: Making on-site wastewater systems work*. 13-15 July 1999. Held at University of New England, Armidale. Lanfax Laboratories, Armidale. ISBN0-646-37668-3

B5. PATTERSON, R.A. (1998) *Soil Capabilities for On-site Wastewater Treatment and Disposal*. Lanfax Laboratories. Armidale (out-of-print)

B4. PATTERSON, R.A. (1998) Ed. *Waste Management Initiatives. Proceedings of New England Regional Seminar Series*. Armidale 20 May. 1998.(out of print)

B3. REEVE, I.J., PATTERSON, R.A. AND LEES, J.W., (1988) *Land Resources: Training Towards 2000*. Rural Development Centre, University of New England, Armidale.

B2. PATTERSON, R.A., (1987) *Soils and Their Management*. NSW. Department of Agriculture, Tocal Agricultural College.

B1. PATTERSON, R.A. (1978) *Field Handbook - A Manual for Field Officers*, 3ed. Department of Provincial Affairs, Madang, Papua New Guinea.

PROFESSIONAL PUBLICATIONS

- P85. Patterson, R.A. (2013) Monitoring soil organic carbon as a determinant of sustainable effluent reuse. To be presented as an oral presentation at the conference: Soils in Space and Time, Ulm, Germany, 30th September to 5th October 2013. Paper in print.
- P84 Patterson, R.A. (2013) Disturbance of soils for food production by urban expansion – a piggy case-study, Sydney Australia. To be presented as an oral presentation at the 7th International Conference on the Urbans Soils Working Group, SUITMA of the International Union of Soil Sciences to be held at the Nicolaus Copernicus University, Torun, Poland, 16-20th September 2013. Paper in print
- P83. Patterson, R.A. (2012) The impact of National Standards on greywater re-use initiatives. Proceedings of the New Zealand Land Treatment Collective Conference, Tauranga, NZ. 28-30 March 2012. NZ Land Treatment Collective. pp (in print)
- P82. Moore, J.C., Mahini, S., Glencross-Grant, R & Patterson, R. (2012) Regional Timber Bridge Girder Reliability: Structural Health Monitoring and Reliability Strategies. *Advances in Structural Engineering* (in print)
- P81. Moore, J.C., Mahini, S., Glencross-Grant, R & Patterson, R. (2012) How do Australian Bridges Stack up? A comparative study with international timber bridge developments. *International Public Works Conference*, Canberra (in print)
- P80. Moore, J.C., Glencross-Grant, Mahini, S., R & Patterson, R. (2011) Towards predictability of bridge health. In Patterson, R.A. (Ed) 2011. *Sustaining our Regions: The Engineering Challenge*. Proceedings of 2011 Regional Australia Convention 16-18 September 2011 Engineers Australia Newcastle Division, Newcastle. pp 111-118
- P79. Patterson, R.A. (2011) Sewage Effluent Management – Waste or Asset? in Patterson, R.A. (Ed) 2011. *Sustaining our Regions: The Engineering Challenge*. Proceedings of 2011 Regional Australia Convention 16-18 September 2011 Engineers Australia Newcastle Division, Newcastle. pp 111-118
- P78. Patterson, R.A. (2011) Greywater appears to be the answer – but to what question. *Proceedings of the New Zealand Land Treatment Collective Conference*, Palmerston North, 23rd March 2011. NZ Land Treatment Collective. pp
- P77. Patterson, R.A. 2010. Environmental Impacts of Municipal Effluent Re-use in Armidale NSW. in Workshop proceedings *Recent Advances in Soil Science and Management*. Australian Society of Soil Science Inc. University of New England. Armidale February 2010.
- P76. Moore, J., Glencross-Grant, R, and Patterson, R.A. (2009) How to stop the rot? Continuous monitoring of short span timber bridges. In Patterson, R.A. (Ed) 2009. *Transport and Communication: Australia's Backbone, Past, Present and Future*. Proceedings of 2009 Regional Convention 12-13 June 2009. Engineers Australia Newcastle Division, Newcastle. Pp 163-170.
- P75. Patterson, R.A. (2009). Re-use of municipal effluent for crops and stock - impact of urban water use. in *Proceedings of New Zealand Land Treatment Collective 20th Anniversary Conference*. 25-27 March 2009, Taupo New Zealand. New Zealand Land Treatment Collective. pp 135-141
- P74. Patterson, R.A. (2007) Solutions in soil science – analytical and measurement uncertainty. In Patterson, R.A. (Ed) 2007. *Wines, Mines and Community: Engineering the Future for Regional Australia*. Proceedings of 2007 Regional Convention 23-25 March 2007. Engineers Australia Newcastle Division, Newcastle. Pp 179-186.
- P73. Patterson, R.A. 2007. Greywater re-use - Impact of household chemicals on useability. in Patterson, R.A. & Jones, M.J. (Eds) *Innovation and Technology for On-site Systems*. Proceedings of On-site '07 conference. 25-27 September 2007. Lanfax Laboratories. Armidale. pp 247-254

P72. Patterson, R.A., Pfaeffli, J. and Fraser, B. 2007. On-site wastewater management - a community and environmental asset. in Patterson, R.A. & Jones, M.J. (Eds) *Innovation and Technology for On-site Systems*. Proceedings of On-site '07 conference. 25-27 September 2007. Lanfax Laboratories. Armidale. pp 253-260

P71. Whitehead, J.H. and Patterson, R.A., 2007. Assessing sustainable greywater re-use and application rates in Patterson, R.A. & Jones, M.J. (Eds) *Innovation and Technology for On-site Systems*. Proceedings of On-site '07 conference. 25-27 September 2007. Lanfax Laboratories. Armidale. pp 331-338

P70. Van de Graaff, R., Patterson, R.A., and Whitehead, J.H. 2007. Regulation, Guidelines and Standards - Is science winning? in Patterson, R.A. & Jones, M.J. (Eds) *Innovation and Technology for On-site Systems*. Proceedings of On-site '07 conference. 25-27 September 2007. Lanfax Laboratories. Armidale. pp 323-330

P69 Patterson, R.A. (2007) Salinity - much more than a rural issue!. in Proceedings of 2007 Urban Salinity Conference, Western Sydney Regional Organisation of Councils Ltd held at WaterView Convention Centre, Bicentennial Park Homebush 22-23 May 2007 (in print)

P68. Patterson, R.A. (2007) Solutions in soil science – analytical and measurement uncertainty. In Patterson, R.A. (Ed) 2007. Wines, Mines and Community: Engineering the Future for Regional Australia. Proceedings of 2007 Regional Convention 23-25 March 2007. Engineers Australia Newcastle Division, Newcastle. Pp 179-186.

P67 Patterson, R.A. (2006) Soil Assessment - What value a number in National Soils Conference The University of Adelaide 3-7 December 2006, jointly convened by Australian Society of Soil Science Inc. and Australasian Soil and Plant Analysis Council Inc.- only abstract available, no formal papers required or printed.

P66 Patterson, R.A. (2006) Greywater Re-use - Learn to Protect the Resource in The Third Queensland Decentralised Wastewater Treatment Symposium held at Queensland University of Technology 30th November 2006, pp B3-B8

P65 Patterson, R.A. and Brennan, M.J. (2006) Economics of Using Local Peat for Biofiltration of Domestic Wastewater in New Zealand Land Treatment Collective, 2006 Annual Conference Proceedings, Nelson, New Zealand 14-17th March 2006, p63-68

P64 Patterson, R.A. (2005) Monitoring of On-site Systems: Regulators, Inspectors and Operators Beware! in Patterson, R.A. and Jones, M.J. (Eds) *Performance Assessment for On-site Systems*. Proceedings of On-site '05 Conference held in Armidale 27-30 September 2005. Lanfax Laboratories. Armidale pp329-336

P63 Mitchell, A., Patterson R.A. and Lamb, D. (2005) Electromagnetic Monitoring of Three Dimensional Water Flow around a Septic Trench. in Patterson, R.A. and Jones, M.J. (Eds) *Performance Assessment for On-site Systems*. Proceedings of On-site '05 Conference held in Armidale 27-30 September 2005. Lanfax Laboratories. Armidale pp289-296

P62 Patterson, R.A. (2004) Meeting the Challenge of Monitoring to get Representative Samples in *Queensland On-site Wastewater Treatment Symposium: A Practitioners Forum*. held at Queensland University of Technology 28th October 2004.

P61 Brennan, M.J, Patterson, R.A. and Dingsdag, D.P. (2004) Risk Assessment within a Triple Bottom Line Framework in *Proceedings of Sewage Management: Risk Assessment and Triple Bottom Line 5 – 7 April 2004*, Convention Centre, Cairns, Queensland. Queensland Environment Protection Authority.

P60 Patterson, R.A. (2004) A Resident's Role in Minimising Nitrogen, Phosphorus and Salt in Domestic Wastewater. in *Tenth National Symposium on Individual and Small Community Sewage Systems*. American Society of Agricultural Engineers. Sacramento California March 21-24, 2004. pp740-749

P59 Patterson, R.A. (2004) Effective Treatment of Domestic Effluent with a Peat Biofilter: A Case Study at Tingha in *Tenth National Symposium on Individual and Small Community Sewage Systems*. American Society of Agricultural Engineers. Sacramento California March 21-24, 2004. pp526-536

P58 Patterson, R.A. (2004) Water Efficiency, Domestic Appliances and Hydraulic Design for On-site Systems in *Proceedings of 1st International Conference on Onsite Wastewater Treatment and Recycling* held at Fremantle 11th - 13 February, 2004, convenor Murdoch University Perth.

P57 Brennan, M.J. and Patterson, R.A. (2004) Economic Analysis of Greywater Recycling in Proceedings of *1st International Conference on Onsite Wastewater Treatment and Recycling* held at Fremantle 11th - 13 February, 2004, conveynor Murdoch University Perth

P56 Brennan, M.J, Patterson, R.A. and Dingsdag,D.P. (2003) Wetlands - Pristine Ecology or Catchment Sinks. in Proceedings of ICam Catchment Management Conference, University of Western Sydney, 26th -28th November 2003. Australian Water Association, Sydney.

P55 Patterson, R.A (2003) Temporal Variability of Septic Tank Effluent in *Proceedings of On-site '03 Conference: Future Directions for On-site Systems* by R.A. Patterson & M.J. Jones (Eds). Published by Lanfax Laboratories, Armidale ISBN 0-9579438-4-1, pp 305-312

P54 Patterson, R.A (2003) Nitrogen in Wastewater and its Role in Constraining On-site Planning in *Proceedings of On-site '03 Conference: Future Directions for On-site Systems* by R.A. Patterson & M.J. Jones (Eds). Published by Lanfax Laboratories, Armidale ISBN 0-9579438-4-1, pp

P53 Szymanski, N. and Patterson, R.A (2003) Effective Microorganisms (EM) and Wastewater Systems in *Proceedings of On-site '03 Conference: Future Directions for On-site Systems* by R.A. Patterson & M.J. Jones (Eds). Published by Lanfax Laboratories, Armidale ISBN 0-9579438-4-1, pp

P52 Patterson, R.A. 2002. *Salts, Soils and Solutions* in Proceedings of Queensland On-site Wastewater Treatment Symposium - A Practitioners' Forum held at Queensland University of Technology, 21 November 2002 by Queensland University of Technology and Department Natural Resources and Mines, pp 26-27

P51 Patterson, R.A. (2002) *Evapotranspiration Bed Design for Inland Area Septic Safe* Technical Sheet 05/15 NSW Department of Local Government (view on DLG web site at www.dlg.nsw.gov.au). Draft for public Comment February 2002

P50 Patterson, R.A. (2002) *Consideration of Soil Salinity when assessing land application of Effluent*. Septic Safe Technical Sheet 01/2 NSW Department of Local Government (view on DLG web site at www.dlg.nsw.gov.au).

P49 Patterson, R.A. (2002) *Consideration of Soil Sodidity when assessing land application of Effluent*. Septic Safe Technical Sheet 01/7 NSW Department of Local Government (view on DLG web site at www.dlg.nsw.gov.au).

P48 Patterson, R.A (2001) Phosphorus Sorption for On-site Wastewater Assessments in *Proceedings of On-site '01 Conference: Advancing On-site Wastewater Systems* by R.A. Patterson & M.J. Jones (Eds). Published by Lanfax Laboratories, Armidale ISBN 0-9579438-0-6, pp 307-314

P47 van de Graaff, R and Patterson, R.A. (2001) Explaining the Mysteries of Salinity, Sodidity, SAR and ESP in On-site Practice in *Proceedings of On-site '01 Conference: Advancing On-site Wastewater Systems* by R.A. Patterson & M.J. Jones (Eds). Published by Lanfax Laboratories, Armidale ISBN 0-9579438-0-6, p 361 – 368

P46 Patterson, R.A., Davey, K. and Farnan, N. (2001) Peat Bed Filters for On-site Treatment of Septic Tank Effluent in *Proceedings of On-site '01 Conference: Advancing On-site Wastewater Systems* by R.A. Patterson & M.J. Jones (Eds). Published by Lanfax Laboratories, Armidale ISBN 0-9579438-0-6, p 315-322.

P45a. PATTERSON, R.A. (2001) Water quality relationships with re-use options in *Water Science and Technology Vol 43 No 10 pp 147-154*
This paper is the same as P45 and was selected from the papers presented at the Paris Conference for the International Journal.

P45. PATTERSON, R.A. (2000). Water Quality Relationships with Re-use Options. in 3rd International Symposium on Waste Water Reclamation, Recycling and Re-use. 3-5 July 2000. Paris France. International Water Association. (accepted for oral presentation)

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[Back to top of page](#)

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[Back to top of page](#)

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