

From: Peter Serov
To: [fracking inquiry](#)
Subject: Northern Territory Fracking Inquiry - Groundwater Dependent Ecosystems
Date: Thursday, 17 August 2017 12:37:20 PM
Attachments: [Joint CV Pserov.docx](#)
[gde_risk_assessment_guidelines_volume_1_final_accessible.pdf](#)
[Aquifers the ultimate groundwater dependent ecosystem.PDF](#)
[Basflow ecology.pdf](#)
[Basflow stygo ecology.pdf](#)
[Veg Groundwater use by dominant tree species in tropical remnant.PDF](#)
[Namoi GDE Report Final.docx](#)
[Pilliga Stygofauna Report 2017 Final.pdf](#)

To the Northern Territory Fracking Inquiry

I have recently been asked to provide information regarding groundwater dependent ecosystems for the Northern Territory Fracking Inquiry and thought it prudent to officially introduce myself, my business and my area of expertise. My name is Dr Peter Serov and I am the owner of an environmental consultancy called Stygoecologia.

I am an Aquatic and Groundwater Ecologist, and Invertebrate Taxonomist who has worked in a range of environments including surface aquatic, marine, terrestrial, and groundwater ecosystems. I specialise in the identification of aquatic macroinvertebrates and stygofauna/troglofauna (groundwater/cave fauna) as well as in the valuation and preservation of High Conservation Value Aquatic Ecosystems including all Groundwater Dependent Ecosystems, such as rivers, wetlands, terrestrial, estuarine and marine. I have been one of the main contributors in the recognition of Groundwater Dependent Ecosystems (GDE's) in NSW government, New Zealand and in the USA and have also been intrinsically involved in the development and implementation of NSW legislation involving Groundwater Dependent Ecosystems and High Conservation Value Rivers (HCV). I have worked in all states of Australia for government and the resource industries for over 30 years on macroinvertebrate, stygofauna and GDE projects as well as in New Zealand and America.

In conjunction with Dr Stephanie Clark, who is a world renowned Mollusc specialist we run Stygoecologia. StygoEcologia is a specialist consultancy that provides expertise in invertebrate ecology and taxonomy for surface water, groundwater and terrestrial ecosystems including Rivers, Wetlands, Stygofauna and other Groundwater Dependent Ecosystems or GDEs. Our services include: environmental risk assessment, valuation and management of groundwater ecosystems with a particular expertise on the impacts of mining such as Coal Seam Gas Fracking, and coal mines; biological survey and monitoring specialising in invertebrate biodiversity as well as species level identification, taxonomy, and systematics of aquatic and terrestrial crustaceans, molluscs, and insects.

The issues regarding CSG and the impact of fracking and the extraction process on groundwater and the associated groundwater ecosystems requires it's consideration to be a high if not one of the highest environmental priority as the likelihood of long-term damage to the groundwater and receiving surface water resources and the associated ecosystems has been already demonstrated to very high. This consideration in regards to the Northern Territory is particularly important as it is an area that has probably had the least stygofauna and general Groundwater Dependent Ecosystem work done of anywhere in Australia. Having said this though, the studies that have been done have shown the NT to be quite comparable to surrounding states and therefore it is guaranteed to have a high biodiversity with many new species and nlarge umbers and extent of GDE's. In addition, many of the ecosystems have a high dependency on groundwater, so the protection of groundwater sources needs to be a very high priority, if not the highest. In this regards as we have had substantial experience in all Australian states and overseas with the impacts and

management of CSG operations we are interested in providing our services to the Panel or in future to the NT Government in this regard.

In order to demonstrate our experience with the mining industry and in particular CSG industries and our knowledge and experience with groundwater and groundwater dependent ecosystems I have supplied our CV's, a GDE Risk assessment guidelines I wrote for the NSW government and a number of papers concerning the importance of GDE's and the services they provide. In the Australian Journal of Botany 2006 paper, look at pages 122~125 on ecosystem services.

If you have any questions please contact me either by email or phone. My details area below.

Kind Regards

Dr Peter Serov

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FIELD OF EXPERTISE

Peter is an Aquatic and Groundwater Ecologist, and Invertebrate Taxonomist who has worked in a range of environments including groundwater ecosystems, surface aquatic, marine, and terrestrial ecosystems for over 30 years. He specialises in the identification of stygofauna (groundwater fauna), and aquatic macroinvertebrates with a particular interest in the Syncarida and other Crustacea. His PhD involved collecting and revising a group of groundwater crustaceans across South East Australia (NSW, Victoria, South Australia and Tasmania), New Zealand and South America. This study described new groundwater taxa including 1 new family, 2 new fossil families, 3 new subfamilies, 12 new genera and 19 new species. He has also worked in all states of Australia on macroinvertebrates and stygofauna projects.

His other expertise includes the valuation of High Conservation Value Aquatic Ecosystems including Groundwater Dependent Ecosystems, rivers and wetlands. Peter has been a significant contributor in the recognition of Groundwater Dependent Ecosystems (GDE's) in NSW government. He has been intrinsically involved in the development and implementation of NSW legislation involving Groundwater Dependent Ecosystems and High Conservation Value Rivers (HCV) including actioning the NSW GDE Policy by developing and writing the NSW GDE Risk Assessment Guidelines.

ACADEMIC QUALIFICATIONS

1986 - Bachelor of Science. Majoring in biology and geology at the University of Wollongong.

1988 - Bachelor of Science. Honours at the University of Tasmania.

2014 - PhD, the University of New England. Title "Evolution of the Anaspidacea, Syncarida, Crustacea."

WORK EXPERIENCE.

2009-Present: Stygoecologia (Environmental Consultancy)

Owner and Director

Aquatic/Groundwater Ecologist/Invertebrate Taxonomist, specialising in all Groundwater Dependent Ecosystems including surface and subsurface ecosystems.

Website: www.stygoecologia.com.au

1997-2012 – NSW Office of Water.

Aquatic Ecologist and sole departmental Invertebrate Taxonomist.

1997-2009: Invertebrate Identification Australasia (Environmental Consultancy)

Co-founder and Aquatic/Groundwater ecologist/taxonomist

1997: Ecology Lab (Environmental Consultancy)

Invertebrate Taxonomist.

1994-96: Australian Museum Business Services (Environmental Consultancy)

Aquatic Ecologist and Invertebrate Taxonomist.

1992 -94: Australian Museum, Marine Invertebrate Section.

Technical Officer/Invertebrate Taxonomist Studying the phylogenetics of the Asellota (Crustacea: Isopoda).

1991-92: University of Tasmania, Zoology Department.

Research Officer. Evaluating the potential of litter bags for assessing the effect of forestry practices on stream processes. Research Report No.7. Tasmanian Forest Research Council, Inc.

1989-91: University of Tasmania, Zoology Department.

Research Officer. Studying the impact of Introduced house mouse (*Mus musculus*) on the invertebrate fauna of Sub Antarctic Macquarie Island. Duties involved field research for six months on Macquarie Island.

Summary of Major Projects

- Review of Centennial Awaba Seep Management Stage 2 Options Report
- Bellingen Turtle Project
- Kosciusko Resort Environmental Health Monitoring
- Santos Pilliga CSG EIS Review
- Qualitative Modelling Workshop for Risk Assessment Project, Coal Seam Gas and Coal Mine Developments, Namoi Bioregional Assessments, CSIRO
- University of New England, Bachelor of Zoology Review. Invited panel member.

- Northern Beaches Council Neverfail Creek Spill Monitoring & Evaluating Project
- OEH Warrumbungles Citizen Science Project
- NSW Central Coast Council Creek Monitoring Evaluating and Reporting Project
- King Island, NW Tasmania. Stream health education program covering all schools and classes between Year 3-9 for King Island NRM.
- Bioregional assessments – Namoi sub-region ecological receptors workshop.
- United and Wambo Open Cut Colliery, Pilot Stygofauna Assessment Study 1, Survey 1, December 2015.
- Maules Creek Coal Stygofauna Monitoring Program Survey 1, November 2015.
- NSW Major Project Assessment - Wallarah 2 Coal Mine Project, Northwest of Wyong, New South Wales (EPBC 20126388).
- Marulan Limestone Mine SSD Project Pilot Stygofauna Ecological Value and Risk Assessment Study 1, May 2015.
- Review of the Baralaba North Continued Operations Project for Depart of the Environment and the Depart of Environment and Heritage Protection, Queensland.
- Tahmoor South Project, Stygofauna Assessment, Prepared for Tahmoor Coal Pty Ltd 2013-14.
- NSW Major Project Assessment - Calga Sand Quarry Project (MP 06_0278)
- 3rd Annual Australian Environmental Assessments and Approvals, 28-30 May 2014, Sir Stamford Circular Quay, Sydney. WORKSHOP A: Improving your EIS through effective environmental monitoring, recording and management plans
- Committee member of the Coal Seam Gas Science Forum Committee and Public Workshops and Forum, Parliament House, Sydney, March 2014.
- Glenbrook Lagoon Following the Cabomba Weed Control Program 2013-16.
- A Review of Groundwater Dependent Terrestrial Vegetation and Groundwater Depth for the Namoi Catchment Management Authority, NSW. June 2013.
- Risk assessment guidelines for groundwater dependent ecosystems, Parts 1-4. Prepared for the New South Wales Government as a requirement under the NSW Water Act 2000, to assist in reporting for the Groundwater State Target, and for the Australian Government, National Water Commission, as part of the Coastal Groundwater Quality and Groundwater Dependent Ecosystems Project.
- Provide advice to the AETG (Aquatic Ecosystems Task Group and ANAE (Australian National Aquatic Ecosystems (Classification Scheme).
- Contributed to the development of the Federal Governments National Water Commission (NWC)
- Groundwater Dependent Ecosystem (GDE) Atlas.
- DECC 2010. Upland Swamp Environmental Assessment Guidelines. Guidance for the underground mining industry operating in the southern and western coalfields.
- Development of methodology for identification, valuation, classifying, risk assessment, protection and establishment of GDE database within NSW Groundwater Water Sharing Plans.
- Advising state government agency working groups on aquatic ecological issues for policy development including Aquatic biodiversity strategy, Groundwater Dependent Ecosystem Policy and High Conservation Value Rivers Assessments.
- Fieldwork for various projects conducting ecological assessments of water quality, macroinvertebrates, amphibians, reptiles and fish, including larval and adult fish studies. The field work involved working throughout NSW.
- Development of Groundwater Environmental Targets for the Natural Resource Commission (NRC).
- Advice to the National Groundwater Dependent Ecosystem Atlas (NWC)
- NSW government. Adaptive Spatial Framework Project Ecological decision support for low flows
- Monitoring River Health Initiative (MRHI) (throughout NSW)
- Snowy River Bench Marking Project
- Blue Mountain Bio-indicator Study

DR STEPHANIE CLARK

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Invertebrate Identification Australasia

Business address (Sydney)

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Mobile

0426 204 240

E-mail:

[REDACTED]

FIELD OF EXPERTISE

Malacologist and invertebrate taxonomist, Stephanie Clark, Ph.D., has over 30 years of experience in the identification, taxonomy and systematics of marine and non-marine Mollusca. She has carried out her work in surface subterranean aquatic, terrestrial and marine systems, in 16 countries, over 35 U.S. states, and all the states of her native Australia. Stephanie also has extensive experience with stygofauna sampling and stygofauna impact assessments.

Stephanie is recognized as an authority on the freshwater gastropod family Hydrobiidae and related families, with additional expertise in the terrestrial gastropod family Camaenidae. She has worked with several threatened and endangered species of snail and mussels, conducting targeted surveys, conservation and population genetics, translocation and monitoring.

Additionally, she has served as an expert witness for the Land and Environment Court in New South Wales; and as a panellist for several mollusc interest groups, including the IUCN SSC Mollusc Specialist Group. As a taxonomist she has had the good fortune to name numerous new species of gastropods.

ACADEMIC QUALIFICATIONS

Ph.D., 2005. University of Western Sydney, New South Wales, Australia. Taxonomy and conservation.

M.Sc., 1998. Macquarie University, New South Wales, Australia. Taxonomy and genetics.

B.App.Sc. 1990. University of Technology, Sydney, New South Wales, Australia. Major biochemistry.

WORK EXPERIENCE.

1997 to present - Owner and Managing Director, Invertebrate Identification & Invertebrate Identification Australasia. Consultant work for various Australian and United States councils, government agencies (State, Commonwealth and Federal), environmental consultancies, mining companies and developers on short and medium term projects dealing mostly with molluscs and insects (particularly endangered species assessments).

June 2011 – present. Contracted with Deixis Consultants to write a Field Guide to the freshwater Molluscs of the Pit-Sacramento Rivers, California by the Cantara Trustee Council Grant Program.

Jan 2010 – Aug 2011. Co-founder and Executive Director, EKOsystems Services, LLP, Chicago, IL.

June 2009 – Dec 2009. Post-doctoral researcher, Field Museum of Natural History, Chicago, IL.

Oct 2006 – Oct 2008. Assistant Collections Manager / Malacologist, Chicago Academy of Sciences, Chicago, IL.

2005 – Aug 2006. Post-doctoral research fellow and Adjunct Assistant Professor, University of Alabama, Tuscaloosa, AL.

Sept 2003 - 2004. Post-doctoral research associate, University of Alabama, Tuscaloosa, AL.

Mir Group. Monitoring translocation of a threatened population of *Meridolum corneovirens* from one section of a housing development site to a reserved area of the development site. St Helens Park, Sydney, New South Wales.

STYGOECOLOGIA BUSINESS PROFILE

Stygoecologia is a specialist consultancy with over 30 years' experience and expertise in invertebrate ecology and taxonomy for groundwater, surface water and terrestrial biology particularly for Stygofauna and other Groundwater Dependent Ecosystems or GDEs, Rivers and Wetlands,. Our services include: species level identification, taxonomy, and systematics; biological survey and monitoring; and environmental risk assessment and management of groundwater ecosystems. We are dedicated to listening to and fulfilling our clients' needs, developing long term relationships and trust in industry and the community by providing timely and effective outcomes. We are also fully insured.

Our Services cover environmental services for Stygofauna (groundwater), Terrestrial, and surface freshwater. We are equipped to provide all of the company's requirements for the listed project areas. Our Each of our staff have over 30 years of experience in government and industry , a PhD in invertebrate taxonomy, ecology, systematics and groundwater, aquatic and terrestrial ecology management experience . We comply with each companies QA/QC procedures and have in place our own quality control procedures including vouchering of representative specimens and external verification of collections.

SERVICES

Land and Water Management

- Identification of Groundwater Dependent Ecosystems.
- Conservation, Environmental impact and Risk assessments.
- Biodiversity and targeted species surveys.
- Threatened and endangered species assessments.
- Biomonitoring Programs – short term and long term.

Species Identification

- Specialising in Stygofauna (Aquifer), Aquatic Macroinvertebrates, and Troglotic (Cave) invertebrates worldwide.
- Specific expertise with Crustaceans, Molluscs, aquatic insects and microfauna.
- Taxonomy, Systematics and phylogenetic studies.
- SRE (Short Range Endemics) terrestrial and aquatic invertebrates
- Verification of identified specimens and voucher collections.

Aquatic Ecology

- Research into Groundwater and surface water ecosystems.
- AusRivAS – river condition assessment.

Recent Examples Of Our Experience (For more see client list below and web page - www.stygoecologia.com.au).

- United Open Cut Coal Mine Project - Stygofauna Assessment
- Stygofauna monitoring Program for Maules Creek Coal Mine.
- Wambo Open Cut Coal Mine Project
- Marulan Limestone Quarry Pilot Stygofauna Impact Assessment.
- NSW Major Project Assessment - Wallarah 2 Coal Mine Project, Northwest of Wyong, New South Wales (EPBC 20126388).
- Review of the Baralaba North Continued Operations Project for Depart of the Environment and the Depart of Environment and Heritage Protection, Queensland.
- NSW Major Project Assessment - Calga Sand Quarry Project (MP 06_0278)
- Committee member of the Coal Seam Gas Science Forum Committee and Public Workshops and Forum, Parliament House, Sydney, March 2014.
- 2014. Russell Vale Coal Project, Wollongong Stygofauna Baseline Risk Assessment.
- 2014. Tahmoor Coal Mine Stygofauna Baseline Risk Assessment.
- 1998-2015. Aquatic biological monitoring for Stratford Coal Pty Ltd.
- 2000-2015. Aquatic biological monitoring for Duralie Coal Pty Ltd.
- Serov P, Kuginis L, Williams J.P., May 2012. *Risk assessment guidelines for groundwater dependent ecosystems, Volume 1 – The conceptual framework*, NSW Department of Primary Industries, Office of Water, Sydney.
- 2013. Environmental Monitoring Angove Creek, Albany for Water Corp, Western Australia.

Previous and ongoing clients:

Mining Companies

- Maules Creek Coal Mine
- United Coal Pty Ltd
- Wambo Coal Pty Ltd
- Marulan Limestone Mine Boral Pty Ltd
- Russell Vale Coal Pty Ltd.
- Tahmoor Coal Pty Ltd
- Australian Zirconia Ltd
- Stratford Coal Pty Ltd
- Duralie Coal Pty Ltd
- Leyton Mining Pty Ltd.
- Gallilee Mine Pty Ltd
- Styx Mining Pty Ltd
- Rolleston
- METServe AMCI South Galilee
- Cockatoo Coal
- QCoal
- Newlands Coal
- Collinsville Coal
- Adani Coal
- Waratah Coal
- Incitec Phosphate Hill
- Middlemount Coal

Government Agencies

- University of New England
- CSIRO
- Blue Mts Council
- NSW Office of Environment and Heritage
- Warrumbungles Resource Centre
- WA Water Corp
- NSW Environmental Defenders Office (EDO)
- NSW Department of Environment and Climate Change (DECCW)
- NSW Office of Water (NOW)
- Alabama Department of Conservation and Natural Resources. (USA)
- United States Fish and Wildlife Service, Western Region. (USA)
- NSW National Parks and Wildlife Service
- Australian Quarantine and Inspection Service (AQIS).
- King Island NRM
- Sydney Catchment Authority.
- Northern Territory Government.
- Western Australian Government CALM.
- Queensland, Department of Natural Resources and Mines.
- Environmental Planning and Management, Sydney Water Corporation.
- Homebush Bay Olympic Committee.
- Tasmanian Parks Wildlife and Heritage Service.
- Tasmanian Forest Research Council, Inc.
- Tasmanian Primary Industries and Energy
- Australian Antarctic Division
- Zoology Department, University of Tasmania.
- Zoology Department, University of New England
- Landcom.
- Olympic Construction Authority.
- Pacific Power
- Morisset Forestry Commission
- Water Corporation WA
- Namoi Catchment Management Authority
- Blue Mountains City Council
- Department of Education

Museums;

- Australian Museum

- Museum of Victoria
- Queen Victoria Museum
- Tasmanian Art Gallery and Museum
- South Australian Museum
- Northern Territory Museum

Consultancies:

- Umwelt (Australia) Pty Ltd
- EMM Consultants Pty Ltd
- Niche Environment and Heritage Pty Ltd.
- Australian Museum Business Services.
- AWT Ensignt
- Mallesons Stephen Jaques Pty Ltd.
- Urban Bushland Management Consultants Pty Ltd.
- FEV Mono Pty Ltd & Kenna Real Estate.
- Mark Topic / Acuiti Legal.
- Gadens Lawyers.
- Rose Consulting Group.
- Halliburton KBR.
- EcoSearch Environmental Consultants.
- Hayes Environmental.
- Hills Development Corporation.
- Molino Stewart.
- Gunninah Consulting.
- Countrywide Ecological Services.
- Biosis.
- Insektus
- Greenloaning Biostudies
- Lesry K Environmental
- GHD Pty Ltd.
- ALS Pty Ltd.
- Biodiversesolutions Pty Ltd.
- C& R Consulting Pty Ltd.
- AustralAsian Resource Consultants Pty Ltd.
- Sinclair Knights, Mertz Pty Ltd.
- IESA Pty Ltd.
- NRA Pty Ltd.