

***eriss*** research summary

2005–2006



DR Jones, KG Evans  
& A Webb (editors)



**Australian Government**

**Department of the Environment and Water Resources  
Supervising Scientist**

It is SSD policy for reports in the SSR series to be reviewed as part of the publications process. This Supervising Scientist Report is a summary of the 2005–2006 research program of the Environmental Research Institute of the Supervising Scientist and has been reviewed internally by senior staff and the editors of the volume.

---

Dr David R Jones – Environmental Research Institute of the Supervising Scientist, GPO Box 461, Darwin NT 0801, Australia

Dr Kenneth G Evans – Environmental Research Institute of the Supervising Scientist, GPO Box 461, Darwin NT 0801, Australia

Ann L Webb – Office of the Supervising Scientist, GPO Box 461, Darwin NT 0801, Australia

This report should be cited as follows:

Jones DR, Evans KG & Webb A (eds) 2007. *eriss research summary 2005–2006*. Supervising Scientist Report 193, Supervising Scientist, Darwin NT.

**The Supervising Scientist is part of the Australian Government Department of the Environment and Water Resources.**

© Commonwealth of Australia 2007

---

Supervising Scientist  
Department of the Environment and Water Resources  
GPO Box 461, Darwin NT 0801 Australia

**ISSN 1325-1554**

**ISBN-13: 978-1-921069-02-4**

**ISBN-10: 1-921069-02-3**

This work is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced by any process without prior written permission from the Supervising Scientist. Requests and inquiries concerning reproduction and rights should be addressed to Publications Inquiries, Supervising Scientist, GPO Box 461, Darwin NT 0801.

e-mail: [publications\\_ssd@environment.gov.au](mailto:publications_ssd@environment.gov.au)

Internet: [www.environment.gov.au/ssd](http://www.environment.gov.au/ssd) ([www.environment.gov.au/ssd/publications](http://www.environment.gov.au/ssd/publications))

The views and opinions expressed in this report do not necessarily reflect those of the Commonwealth of Australia. While reasonable efforts have been made to ensure that the contents of this report are factually correct, some essential data rely on the references cited and the Supervising Scientist and the Commonwealth of Australia do not accept responsibility for the accuracy, currency or completeness of the contents of this report, and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the report. Readers should exercise their own skill and judgment with respect to their use of the material contained in this report.

Printed and bound in Darwin by uniprint NT

# Contents

<b>Preface</b>	<b>ix</b>
<b>PART 1: RANGER – CURRENT OPERATIONS</b>	<b>1</b>
<b>Development of a contaminant pathways conceptual model for Ranger uranium mine</b>	<b>5</b>
R van Dam & P Bayliss	
<b>Chronic toxicity of uranium to <i>Lemna aequinoctialis</i> and <i>Amerianna cumingi</i></b>	<b>7</b>
R van Dam, A Hogan, M Houston, S Nou & N Lee	
<b>Chronic toxicity of uranium in Magela Creek water to a local freshwater fish</b>	<b>12</b>
R van Dam, K Cheng, A Hogan & D Parry	
<b>Development of a reference toxicity testing program for routine toxicity test species</b>	<b>14</b>
A Hogan, M Houston, N Lee & R van Dam	
<b>Toxicity of magnesium in Magela Creek water to local freshwater species</b>	<b>18</b>
R van Dam, A Hogan, M Houston & N Lee	
<b>Toxicity of treated pond water from Ranger uranium mine to five local freshwater species</b>	<b>21</b>
R van Dam, A Hogan & M Houston	
<b>Atmospheric radiological monitoring in the vicinity of Ranger and Jabiluka</b>	<b>24</b>
A Bollhöfer	
<b>Monitoring of groundwater at Ranger</b>	<b>28</b>
B Ryan & A Bollhöfer	
<b>Introduction to SSD's stream monitoring program for Ranger, 2005–06</b>	<b>30</b>
C Humphrey & D Jones	

<b>Chemical and physical monitoring of surface waters in Magela and Gulungul Creeks</b>	<b>31</b>
M Iles	
<b>Continuous monitoring of water quality</b>	<b>35</b>
K Turner	
<b>Toxicity monitoring in Magela Creek</b>	<b>38</b>
C Humphrey, D Buckle & R Luxon	
<b>Bioaccumulation in fish and freshwater mussels from Mudginberri Billabong</b>	<b>42</b>
K Turner, B Ryan, C Humphrey & A Bollhöfer	
<b>Monitoring using macroinvertebrate community structure</b>	<b>48</b>
C Humphrey, J Hanley & C Camilleri	
<b>Monitoring using fish community structure</b>	<b>51</b>
C Humphrey & D Buckle	
<b>Monitoring support tasks</b>	<b>54</b>
C Humphrey	
<b>Surface water radiological monitoring in the vicinity of Ranger and Jabiluka</b>	<b>55</b>
A Bollhöfer, P Medley & C Sauerland	
<b>Surface water transport of uranium in the Gulungul catchment</b>	<b>59</b>
K Mellor, A Bollhöfer, C Sauerland & D Parry	
<b>PART 2: RANGER – REHABILITATION</b>	<b>65</b>
<b>Geomorphic stability of the currently proposed final landform at the Ranger mine using landform evolution modelling</b>	<b>69</b>
J Lowry, KG Evans, D Moliere & G Hancock	
<b>Assessment of the significance of extreme events in the Alligator Rivers Region</b>	<b>72</b>
KG Evans, MJ Saynor & DR Moliere	
<b>Radio- and lead isotopes in sediments of the Alligator Rivers Region (PhD project)</b>	<b>73</b>

A Frostick, A Bollhöfer, D Parry, N Munksgaard & KG Evans	
<b>Use of a natural analogue to determine Ranger pre-mining radiological conditions</b>	<b>78</b>
A Bollhöfer & K Pfitzner	
<b>Developing water quality closure criteria for Ranger billabongs using macroinvertebrate community data</b>	<b>82</b>
C Humphrey & D Jones	
<b>Use of analogue plant communities as a guide to revegetation and associated monitoring of the post-mine landform at Ranger</b>	<b>84</b>
C Humphrey, I Hollingsworth M Gardener & G Fox	
<b>Establishing demonstration landform-vegetation plots at Ranger</b>	<b>87</b>
P Bayliss & M Gardener	
<b>Hydrochemical and ecological processes of constructed sentinel wetlands and reconstructed wetlands in the Magela Creek catchment</b>	<b>90</b>
P Bayliss, D Jones, C Humphrey & J Boyden	
<b>Seed biology of native grasses: BSc (Honours) project by Kathryn Sangster</b>	<b>92</b>
K Sangster, S Bellairs, P Bayliss & M Gardener	
<b>Bioaccumulation of radionuclides in terrestrial plants on rehabilitated landforms</b>	<b>94</b>
B Ryan, A Bollhöfer & R Bartolo	
<b>Development of a spectral library for minesite rehabilitation assessment</b>	<b>98</b>
K Pfitzner, A Bollhöfer & G Carr	
<b>Development of key indicators and indices of ecosystem 'health' to monitor and assess rehabilitation success</b>	<b>104</b>
C Humphrey, G Fox & J Boyden	
<b>Incorporation of disturbance effects in predictive vegetation succession models</b>	<b>105</b>
P Bayliss, D Walden, J Boyden, M Gardener & S Bellairs	

<b>Monitoring sediment movement along Gulungul Creek during mining operations and following rehabilitation</b>	<b>114</b>
D Moliere, M Saynor & K Evans	
<b>Monitoring sediment movement along Magela Creek up and downstream of Ranger</b>	<b>118</b>
D Moliere & K Turner	
<b>PART 3: JABILUKA</b>	<b>123</b>
<b>Monitoring sediment movement at Jabiluka</b>	<b>126</b>
D Moliere, M Saynor & K Evans	
<b>Stream bedload characterisation: Ngarradj catchment</b>	<b>129</b>
MJ Saynor, WD Erskine, DR Moliere & KG Evans	
<b>PART 4: NABARLEK</b>	<b>135</b>
<b>Quantitative use of remotely sensed data for minesite revegetation assessment</b>	<b>138</b>
K Pfitzner & P Bayliss	
<b>Radiological impact assessment of the rehabilitated Nabarlek site</b>	<b>143</b>
A Bollhöfer & B Ryan	
<b>PART 5: GENERAL ALLIGATOR RIVERS REGION</b>	<b>147</b>
<b>Changes in Melaleuca distribution on the Magela floodplain 1950–2004</b>	<b>150</b>
G Staben, J Lowry & G Boggs	
<b>Significant habitats and species in the Alligator Rivers Region</b>	<b>155</b>
C Humphrey	
<b>Ecological risk assessment of Magela floodplain to differentiate mining and non-mining impacts</b>	<b>157</b>
P Bayliss, R van Dam, D Walden & J Boyden	
<b>RESEARCH CONSULTANCIES</b>	<b>163</b>
<b>The tropical rivers inventory and assessment project (TRIAP)</b>	<b>164</b>
R van Dam, R Bartolo, P Bayliss & J Lowry	

<b>Appendix 1 SSD publications for 2005–06</b>	<b>169</b>
<b>Appendix 2 ARRTC Key Knowledge Needs 2005–2006</b>	<b>175</b>
<b>Appendix 3 ARRTC membership and functions</b>	<b>187</b>

