GISERA Gas Industry Social & Environmental Research Alliance

Project Order

Proforma 2011

1. Short Project Title (less than 15 words)

Project 5 – Without a trace

Long Project Title	A study into potential soil damage and its management during CSG development.
GISERA Project Number	A5 1214
Proposed Start Date	July 2012
Proposed End Date	June 2014
Project Leader	Neil Huth

2. GISERA Research Program

☐ Biodiversity Research ☐ Marine Research ☒ Land Research

☐ Water Research ☐ Social & Economic Research

3. Research Leader, Title and Organisation

Dr Neil Huth Research Scientist CSIRO Ecosystem Sciences

4. Summary (less than 300 words)

The establishment of coal seam gas infrastructure will see the development of an extensive network of access tracks, pipes and thousands of wells on agricultural land, requiring the use of heavy equipment. A primary goal of rehabilitation following disturbance of this type is the return of land to its original condition. Disturbance during establishment, operation and removal of gas infrastructure will result in changes in the physical, chemical and structural properties of soil. Changes in the biological properties of soil are also anticipated (e.g.

grass/weed seed banks). Designs for coal seam gas infrastructure should account for these risks and seek to minimise damage, both by avoiding damage and minimising it where it is unavoidable. Processes for rehabilitating unavoidable damage have yet to be fully described. This research will provide insight into these issues via literature review and on-farm case studies.

5. Budget Summary (From Excel Budget Pack worksheet "Project Plan Summary")

Expenditure	2012/13 Year 1	2013/14 Year 2	2014/15 Year 3	2015/16 Year 4	2016/17 Year 5	Total
Labour	118,458	172,532				290,990
Operating	17,000	32,000				49,000
Total Costs	**135,458**	**204,532**				**339,990**
University of Southern Queensland (USQ)	135,458	204,532				
Total Expenditure	**135,458**	**204,532**				**339,990**

Expenditure per Task	2012/13 Year 1	2013/14 Year 2	2014/15 Year 3	2015/16 Year 4	2016/17 Year 5	Total
Task 1 Task 2 Task 3 Task 4 Task 5	135,458	204,532				339,990
Total Expenditure	**135,458**	**204,532**				**339,990**

Cash Funds to Project Partners	2012/13 Year 1	2013/14 Year 2	2014/15 Year 3	2015/16 Year 4	2016/17 Year 5	Total
USQ	97,500	162,500				260,000
Total Cash to Partners	**97,500**	**162,500**				**260,000**

Source of Cash Contributions	2012/13 Year 1	2013/14 Year 2	2014/15 Year 3	2015/16 Year 4	2016/17 Year 5	Total
Australia Pacific LNG	97,500	162,500				260,000
Total Cash Contributions	**97,500**	**162,500**				**260,000**

In-Kind Contribution from Partners	2012/13 Year 1	2013/14 Year 2	2014/15 Year 3	2015/16 Year 4	2016/17 Year 5	Total
USQ (Subcontractor)	37,958	42,032				79,990
Total In-Kind Contribution from Partners						

	Total funding over all years	Percentage of Total Budget
Australia Pacific LNG Investment	260,000	76.5%
USQ Investment	79,990	23.5%
Total Other Investment		
TOTAL	**339,990**	**100%**

Task	Mile-stone Number	Milestone Description	Funded by	Participant Recipient	Start Date (mm-yy)	Delivery Date (mm-yy)	Fiscal Year	Fiscal Quarter	Payment $
Task 1	1	Activity Planning Meeting	GISERA	USQ	Jul-12	Sep-12	2012/13	3rd	32,500
Task 1	2	Literature Review	GISERA	USQ	Oct-12	Dec-12	2012/13	4th	32,500
Task 1	3	Establishment of Case Study Sites	GISERA	USQ	Jan-13	Mar-13	2012/13	1st	32,500
Task 1	4	Case Study Engagement	GISERA	USQ	Apr-13	Sep-13	2013/14	2nd	65,000
Task 1	5	Case Studies Complete	GISERA	USQ	Oct-13	Mar-14	2013/14	4th	65,000
Task 1	6	Publication of Findings	GISERA	USQ	Apr-14	Jun-14	2013/14	2nd	32,500

6. Other Researchers (include organisations)

Researcher	Time Commitment (project as a whole)	Principle area of expertise	Years of experience	Organisation
Allen Jack McHugh	0.5FTE	Farming Systems Research; Mechanisation and the environment; Soil and water physics; Proximal sensing.	>15	USQ
Simon White	0.3FTE	Farming systems research; Broad-acre agronomy, field to catchment scale hydro-climatic modelling and sustainable farming system research	>10	USQ
Jochen Eberhard	0.45FTE	Agricultural engineering; Agronomy, Irrigation system optimisation, Spatial variability in farming systems	>15	USQ

7. GISERA Objectives Addressed

- Research that improves and extends knowledge of environmental impacts and their management, enabling the CSG-LNG industry to better meet the expectations of farming communities and the broader public
- Informing farmers and CSG operators on ways to improve current operations
- Publication of scientific papers
- Universities, particularly those local to CSG and LNG activity, participating in research projects.

8. Program Outcomes Achieved

Details are provided in *Section 13. Project Objectives and Outputs.*

9. Program Outputs Achieved

Details are provided in *Section 13. Project Objectives and Outputs.*

10. What is the knowledge gap that these research outputs will address?

The nature and extent of actual and potential soil damage caused by the different elements of CSG development is currently not well documented. Furthermore, the methods for avoiding, managing or remediating soil quality impacts are not fully understood. This research will

develop guidelines for minimising and remediating soil damage derived from literature review and on-farm case studies.

11. How will these Research outputs and outcomes be used by farmers or the CSG-LNG industry?

This research will provide clear and actionable guidelines for avoiding damage to soil productivity during the establishment and operation of gas infrastructure, as well as for remediating damage that is not avoidable. This information will be made publicly available, such that it can inform mutual deliberation and planning by agricultural and gas industry concerns. Where appropriate, links to regulatory considerations will be explored.

While the research focuses on impacts arising from gas development, the results will also find application in the minimisation and remediation of soil damage caused by other operations within farming enterprises. As such, it is expected to provide benefit beyond CSG production areas.

12. Project Development (1 page max.)

The project was developed in consultation with staff from Australia Pacific LNG, CSIRO and USQ, each of whom have engaged with a wide range of farmer/stakeholder groups. The issues being considered in this study were consistently identified as an important research need.

Much current public discussion arises from uncertainty within the farming community regarding the likely impacts and opportunities brought about by CSG development on farming land. Concern regarding possible soil damage is a common theme for farming and CSG communities, and is the subject of policy discussion, especially with regard to what are often termed 'strategic cropping lands'.

The existing policy for protecting Queensland's strategic cropping land states that, on such lands, temporary diminution of productivity during development must be followed by restoration to strategic cropping land condition when development has ceased (Department of Environment and Resource Management (DERM), 2010).

One possible cause of damage to agricultural soils is compaction by heavy machinery during the various phases of development. It has been shown that damage by heavy farm machinery can be ameliorated via modern farming techniques (McHugh 2009, Radford and Thornton 2011). Similarly, techniques currently used by farmers are likely to be useful in overcoming other possible damage to soils. The studies mentioned above showed that remediation took several years.

It is common for researchers, when selecting sites for long term field studies, to investigate the long term management history of sites through the use of aerial photography or satellite imagery spanning a long period of time (e.g. Huth 2010, Poulton et al 2005). The impacts of site disturbance can often be seen long after the fact and this information is used to locate trial sites. Soil measurements at these sites can then determine changes in site characteristics (Poulton et al 2005). Such methods allow researchers to identify, locate and study soil conditions for sites covering a range of

durations since disturbance. Methods for quantifying impacts and remediation could be tested on these existing locations thus providing insights to long term impacts and their management.

This project builds strongly on past and ongoing research activities of this and the companion project teams in farming systems research based upon strong stakeholder engagement. Team members are currently involved on a range of cross-disciplinary studies, many occurring within GISERA. Linkage with the *Shared Space* and *Making Tracks* projects of GISERA ensures the relevance of this research to the broader research portfolio.

References

DERM (2010) Protecting Queensland's strategic cropping land: A policy framework. Department of Environment and Resource Management, Brisbane. (http://www.derm.qld.gov.au/land/planning/pdf/strategic-cropping/strategic-cropping-policy-part.pdf)

Huth, NI (2010) Measuring, modelling and managing tradeoffs in low rainfall agroforestry for Australia's subtropics. PhD thesis, University of Queensland.
McHugh AD, Tullberg JN, Freebairn DM (2009) Controlled traffic farming restores soil structure. Soil & Tillage Research 104, 164-172.

Poulton PL, Huth NI, Carberry PS (2005) Use of simulation in assessing cropping system strategies for minimising salinity risk in brigalow landscapes. Australian Journal of Experimental Agriculture 45, 635-642.

Radford BJ and Thornton CM (2011) Effects of 27 years of reduced tillage practices on soil properties and crop performance in the semi-arid subtropics of Australia. IJEE Vol. 19, pp 6.

13. Project Objectives and Outputs

This project will:

- Identify risks of damage to agricultural soils and methods to avoid this damage by changes in management and design
- Assess the existing methods for ameliorating damage that is likely to occur
- Incorporate these insights into clear and actionable guidelines for avoiding damage to soil productivity during the establishment and operation of gas infrastructure, as well as for remediating damage that is not avoidable.

The first aim will be achieved via an extensive review of the literature and evaluation of existing methods of infrastructure development. This includes evaluation of data and findings from the *Making Tracks, Treading Carefully* project and further testing of options monitored during this work. The second aim will be met via case studies where similar damage has been observed on local farms. This may include remediation damage from CSG operations, previous farm laneways or other compaction damage by machinery or livestock.

Case studies will cover a range of examples of soil damage and may even apply novel rehabilitation techniques with landholders if practicable.

Outputs include:

- An extensive literature review
- Evaluation of potential impacts and their management on case study farms
- Communication of findings via farmer engagement on case study farms and a range of communication forums
- A publication documenting the findings of the literature review and case studies.

14. Project Plan

14.1 Project Schedule

ID	Task Title	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
1.1	Activity Planning Meeting	Allen McHugh	Jul-12	Sep-12	
1.2	Literature Review	Allen McHugh	Oct-12	Dec-12	Task 1.1
1.3	Establishment of Case Study Sites	Allen McHugh	Jan-13	Mar-13	Task 1.2
1.4	Case Study Engagement	Allen McHugh	Apr-13	Sep-13	Task 1.3
1.5	Case Studies Complete	Allen McHugh	Oct-13	Mar-14	Task 1.4
1.6	Publication of Findings	Allen McHugh	Apr-14	Jun-14	Task 1.5

Task 1.

TASK NAME: Activity planning meeting

TASK LEADER: Allen McHugh

OVERALL TIMEFRAME: 2012/13

TASK OBJECTIVES:

- Establish a project team including links with companion projects (*A Shared Space*, *Gas-Farm Design*, *Making Tracks*)
- Develop a plan for the literature review and case study site selection
- Refine work plan according to Australia Pacific LNG-CSIRO-USQ discussions.

Task 2.

TASK NAME: Literature review

TASK LEADER: Allen McHugh

OVERALL TIMEFRAME: 2012/13

BACKGROUND: A clear understanding of previous research findings is required before future work is planned.

TASK OBJECTIVE: Gather relevant information to provide a good understanding of the likely impacts and their management.

SPECIFIC DELIVERABLE: A draft literature review detailing previous research findings.

Task 3.

TASK NAME: Establishment of case study sites

TASK LEADER: Allen McHugh

OVERALL TIMEFRAME: 2013/14

BACKGROUND: A range of potential soil damage issues will be identified. Some of these will be investigated in detail on case study sites.

TASK OBJECTIVE: Identify, scope and benchmark case study farm locations for monitoring, testing or evaluation of soil damage and management issues.

SPECIFIC DELIVERABLE: A brief report describing the choice of study sites, their nature and soil damage issues to be studied within them.

Task 4.

TASK NAME: Case study engagement

TASK LEADER: Allen McHugh

OVERALL TIMEFRAME: 2013/14

BACKGROUND: By this stage of the project, case studies will have been undertaken to investigate likely soil impacts and their management.

TASK OUTPUTS & SPECIFIC DELIVERABLES: A brief progress report describing the work to date on the case study sites and plans for the remaining duration of the case studies.

Task 5.

TASK NAME: Case study complete

TASK LEADER: Allen McHugh

OVERALL TIMEFRAME: 2013/14

BACKGROUND: By this milestone, case studies should be complete. This timing should ensure adequate opportunity to document findings before the end of the project.

TASK OUTPUTS & SPECIFIC DELIVERABLES: A brief progress report outlining the results of the case studies, probable findings and plan for publication/communication of results.

Task 6.

TASK NAME: Publication of results

TASK LEADER: Allen McHugh

OVERALL TIMEFRAME: 2013/14

BACKGROUND: Research should be complete and results synthesised into a format for publication.

TASK OUTPUTS & SPECIFIC DELIVERABLES: A draft publication prepared for the scientific literature (journal and/or conference proceedings).

15. Budget Justification

The budget for this project has been approved by GISERA's Research Advisory Committee and Management Committee.

16. Project Governance

Progress against project milestones and tasks (specified in item 14) will be assessed regularly as part of GISERA's general research portfolio management.

17. Communications Plan

General communication of project results will be managed by GISERA.

Project outputs will be made available on the GISERA website and will, be further supported by a range of activities designed to facilitate adoption by the broader agricultural and gas industries, and awareness by appropriate regulatory agencies.

18. Risks

Capacity to deliver: Staff have sufficient experience to lead and supervise the various activities and ascertain the research outcomes. Close links with GISERA Land Management companion projects will provide extra support. Therefore the impact of key staff departure is low and can be mitigated.

In projects of short duration the risk of adverse weather conditions on field work is heightened. However, this will not affect the literature review component of the work, and the use of more than one case study should minimise the risk of weather being an impediment to project completion.

19. Intellectual Property and Confidentiality

Background IP (clause 10.1, 10.2)	**Party**	**Description of Background IP**	**Restrictions on use (if any)**	**Value**
Ownership of Non-Derivative IP (clause 11.3)	CSIRO			
Confidentiality of Project Results (clause 15.6)	Project results are not confidential.			
Additional	Not Applicable			