Goondiwindi Organics Hub

Project Business Case

Clean Growth Choices

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Document Development History

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The Clean Growth Choices Consortium is delivering the Communities in Transition (CiT) pilot project with the support of the Queensland Government.

Extensive resources including case studies are available at: https://www.cleangrowthchoices.org/

Cover Photo: Goondiwindi Cotton tours – Drone. Source: Goondiwindi Regional Council

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1 Executive Summary

This business case proposes a number of actions to develop additional value from resources in the Goondiwindi region by identifying and facilitating circular economy principles in the region. A number of steps and a new model is proposed to identify and engage a development partner to develop a system to add value to farm waste and other organic residues in the region.

The project highlights the benefits of a circular economy approach, starting with an industrial ecology framework to find initial opportunities. It seeks to assist individual businesses in achieving resilience by potentially reducing both waste and input costs. The project will establish networked industries of the future with new science and technology.

The project will deliver value under *the Queensland Waste Management and Resource Recovery Strategy*, particularly *Strategic priority 2: Transitioning to a circular economy for waste*. Value can be gained from material otherwise destined for landfill when there are increased options for reuse, recycling and recovery of resources, energy and fuels from waste. This business case proposes a project which will contribute to achieving the *Queensland Government WMRR Strategy* targets of 90% of all waste diverted from landfill by 2050.

Our Future State: This business case advances projects that address a number of key government objectives including:

- Creating jobs in a strong economy by creating and maintaining jobs for regional employees in drought-affected communities
- Keeping Queenslanders healthy by reducing financial pressures on regional families and reducing suicides.

1.1 Communities in Transition (CiT): Clean Growth Choices

The CiT Pilot Program delivers on the *Queensland Climate Transition Strategy*'s action to build leadership capacity within communities to develop place-based climate transition roadmaps. These roadmaps, and this business case, identify opportunities for economic and social development and climate resilience in regional Queensland. Opportunities range across a number of sectors including agriculture, waste, water supply, tourism, energy, manufacturing, transport and human services. The multidisciplinary nature of the business case means that other Queensland Government priorities are being indirectly addressed, thus offering an opportunity to leverage efforts across government.

The CiT Pilot Program contributes to reducing emissions by identifying economic opportunities that support the transition to a low carbon economy, under the *Queensland Climate Transition Strategy.* Importantly this business case identifies not only low emissions opportunities, but offers economic diversification to build resilience in regional economies.

The *Goondiwindi Living Roadmap* outlines how a group of Goondiwindi residents came together to develop this business case including the options canvassed by the groups.

2 Introduction/Background

This business case establishes a pre-feasibility analysis of projects to secure long-term agricultural productivity in Goondiwindi. It recognises that soil health and water productivity will be key to the ongoing prosperity of Goondiwindi's agriculture sector.

The project has been identified in the Sustainable World Class Agriculture Pathway in the Goondiwindi Clean Growth Choices program. It has emerged from the Working Group's desire to empirically demonstrate the benefits of regenerative agriculture in improving water productivity and yield through a focus on soil health.

The project lays the foundation for a long-term move to more resilient and productive farming practices in the area. It consists of two main aspects:

1. Recirculating organic material to provide the opportunity to increase soil carbon and water holding capacity, whilst realising other benefits
2. Testing the efficacy of the resulting products by measuring aspects of soil health and farm profitability over time after the application of the above organic material.

The business case proposes a model to provide for the recirculation of food and agricultural residue and waste into a range of value-added materials to provide farm and community benefit and to answer the question posed by the Working Group: *Can it be demonstrated that regenerative agriculture increases gross margins?*

The project is developed in two levels:

1. Testing soil improvements and correlating them with productivity and profitability data
2. A project taking farm waste and returning nutrients to farmers along with other value-added products.

3 Overview

3.1 Vision

The vision is to develop a regenerative agriculture program with a new model for green and agricultural waste management that provides long-term improvement in soil organic matter and agricultural productivity.

3.2 Organisational Objective

This project has been identified by the Goondiwindi Clean Growth Choices working group

The objective of the project is to build an evidence base to demonstrate whether there are tangible environmental and economic outcomes arising from regenerative agricultural practices.

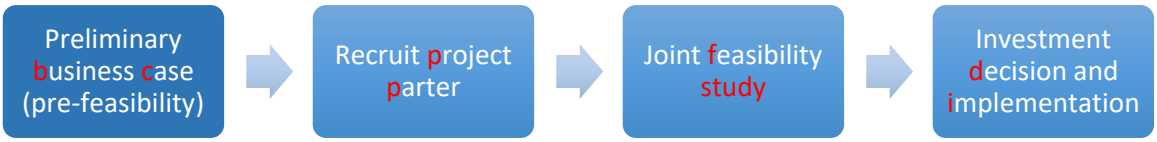
4 The Business Case

4.1 Purpose of the Business Case

The purpose of the business case is to provide a pre-feasibility level assessment of a number of options to return nutrients to soil to achieve soil quality and water holding capacity improvements; leading to greater long-term productivity. The business case proposes three project options to achieve the above outcome.

This is a preliminary business case that will provide the working group with:

1. A sound basis for a decision to proceed to the recruitment of a project partner
2. The next steps and estimated costs to deliver the project.



Sustainable Development Goals

The project aims to achieve sustainable economic development in Goondiwindi and, in particular, works towards achieving the following of the United Nations Sustainable Development Goals (SDGs):

Number	Goal	Explanation
SDG7	Affordable and Clean Energy	Two key targets under the goal: • 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix • 7.3: By 2030, double the global rate of improvement in energy efficiency.
SDG 8	Decent Work and Economic Growth	Roughly half the world's population still lives on the equivalent of about US$2 a day with global unemployment rates of 5.7% and having a job doesn't guarantee the ability to escape from poverty in many places. This slow and uneven progress requires us to rethink and retool our economic and social policies aimed at eradicating poverty.

SDG 9	Industries, Innovation and Infrastructure	Investments in infrastructure – transport, irrigation, energy and information and communication technology – are crucial to achieving sustainable development and empowering communities in many countries. It has long been recognized that growth in productivity and incomes, and improvements in health and education outcomes require investment in infrastructure.
SDG 13	Climate Action	Climate change is now affecting every country on every continent. It is disrupting national economies and affecting lives, costing people, communities and countries dearly today and even more tomorrow. Weather patterns are changing, sea levels are rising, weather events are becoming more extreme and greenhouse gas emissions are now at their highest levels in history. Without action, the world's average surface temperature is likely to surpass 3 degrees centigrade this century. The poorest and most vulnerable people are being affected the most.
SDG 17	Partnerships for the Goals	A successful sustainable development agenda requires partnerships between governments, the private sector and civil society. These inclusive partnerships built upon principles and values, a shared vision, and shared goals that place people and the planet at the centre, are needed at the global, regional, national and local level.

4.2 Business Case Sponsor

The business case is sponsored by the Department of Environment and Science (DES).

5 Situational Assessment and Problem Statement

This section outlines the benefit to the region for proceeding with the one or more of the proposed options and contains:

- A description of the current situation, challenges and opportunities
- An assessment of how the opportunities are currently being met or not met
- An analysis of the gap between the current situation and the stated objective(s).

Agriculture is a significant contributor to Goondiwindi's economy, contributing $530m[1] to GRP in 2015/16. The region is however subject to significant change. Steven Crimp, a climate applications scientist with the Climate Change Institute (CCI) at the Australian National University has found a number of critical climatic changes in the region[2] which, if they continue, will impact the choices farmers make about crops and future strategy:

1. _____

[1] ABARES, Australian Agricultural Census 2015-16 visualisations, http://www.agriculture.gov.au/abares/data/agricultural-census-visualisations

[2] Somes, T., 2019, Data shows Goondiwindi climate is changing: GRDC Update

- Warming has occurred between 1950 and 2018, with average temperatures now approximately 1.1°C warmer than in 1950
- Between 1950 and1985, a maximum temperature of 29°C occurred on average 14% year. Between 1986 and 2018, this temperature occurred around 35% year
- The number of frost events (defined as below zero degrees) has more than tripled, with an average nine events now occurring most years
- The average length of dry spells has increased, as has the average time between rainfall events.

The working group wishes to adapt agricultural practices and systems to meet these challenges. At the same time, the working group recognises that there is a significant amount of underutilised organic matter and green waste in the region. This project reflects the desire to increase soil organic matter and carbon content, thus increasing the water holding capacity of the soil.

The Working Group considered the benefits of regenerative agricultural practices to improve soils with organic material and improve soil water retention. Appendix E contains background information on regenerative agriculture.

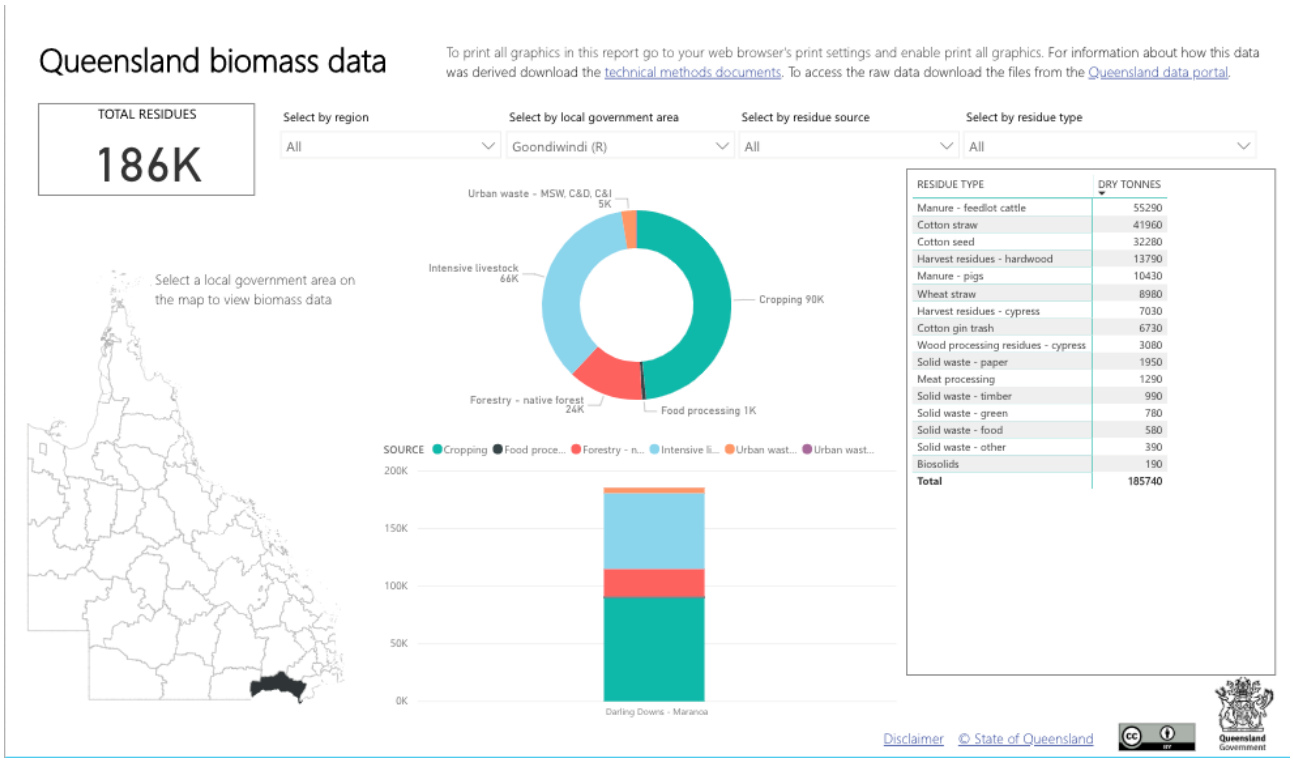


Figure 1: Results of AREMI Mapping with biomass data for Goondiwindi Region

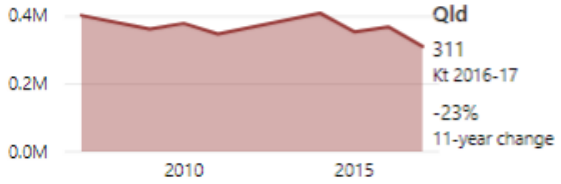
There is a significant amount of farm residue available in Goondiwindi Region, and the AREMI[3] mapping initiative indicates significant residues available. This is shown by the Queensland Biomass Map (Figure 1 above) which indicates that there is up to 186,000 tonnes of available biomass in Goondiwindi with some potential for adding value. Some of this waste is either already utilised (for example, cotton seed) or forms part of an urban waste stream (paper and food waste), so an assessment would be required to determine how much is readily available.

Opportunities to reduce greenhouse gas emissions have been strongly encouraged by the Emissions Reduction Fund with activities such as burning landfill methane gas and other waste, adopting energy efficiency technologies and the diversion of organic material for composting.

In Australia, 1.97 million tonnes of waste is used for energy recovery. 90% (130 landfills) of this is through landfill gas collection (methane-rich landfill gas is generated from food, garden and paper and cardboard waste in landfill waste streams). [4] [5] The captured methane is typically combusted to generate electricity that is sold to the grid.

A number of key challenges include:

- Energy recovery is typically undertaken by large landfill sites. Small landfill sites often just collect and flar the methane. This is because it is required by the landfill regulator to reduce odour or to generate credits under the Emissions Reduction Fund[4]
- In 2018 the Emissions Reduction Assurance Committee ruled that landfill gas collection operations will be unable to receive credits under the Emissions Reduction Fund after their standard seven-year contracts expire. Landfills will still be able to earn saleable 'large-scale generation certificates for producing renewable power[4]
- There has also been a declining interest thought to be due to reduced quantities of organics sent to landfill, lower rainfall reducing degradation rates, more focus on flaring and local government data collection problems[4].



It is well recognised that soil organic matter is critical for soil health. It improves soil structure, drainage, moisture holding ability, and the retention and release of nutrients. Soil organic carbon is a measurable component of soil organic matter. Soil carbon levels have dropped by up to 50% of pre-agricultural levels in many areas.[2] Most agricultural soils in Queensland contain between 0.5-2.5% total soil organic carbon in the top ten centimetres of soil (5-25 t/ha of organic carbon or 8-40 t/ha of organic matter). [6] In the Goondiwindi area soil carbon levels are typically around 1%.

- For every 1% increase in soil carbon, up to 144,000 litres of water per hectare can be stored in the top 30 cm of the soil [7]
- One tonne of soil organic carbon per ha (~0.1%) is associated with ~100 kg organic nitrogen and around $150 – $200 fertiliser replacement value of all nutrients. Therefore, a

1.

[3] https://nationalmap.gov.au/renewables/
[4] Blue Environmental, 2018, National Waste Report 2018
[5] Capturing the true wealth of Australia's waste 2017, Capturing the true wealth of Australia's waste
[6] Future Beef, 2015, Soil organic matter and carbon in agriculture
[7] Christine Jones, Colin Seis, David Rowlings, Dr Maarten Stapper, Ian Moss, David Hardwick, and Bart Davidson, 2015, Building high carbon - low emission farming and grazing soils A land managers guide

1% change in soil organic carbon is associated with about a $1500-2000 per ha gain or loss in soil nutrient value. [8]

Other councils are beginning to implement easy-wins. For example, Ipswich Council who has established a Green Waste Service which also takes kitchen vegetable waste and some paper that cannot be placed in traditional recycling bins (eg tissues) which is composted https://www.ipswich.qld.gov.au/residents/waste/green_waste_service.

6 Assumptions and Constraints

The business case provides a pre-feasibility level assessment of the project. It has been prepared by the Clean Growth Choices team under the direction of the Clean Growth Choices working group. The working group largely consists of volunteers who are providing guidance and input.

Details of the amount of farm waste has been made available by farmers voluntarily and it is not known what proportion of the district's farm wastes are included or how accurately information has been provided. Other waste details have been taken from the AREMI Map.

Box 2: Partnership Model for Project Development

In a Partnership-type model, the Council and Community create the conditions for investment and seek industry partners to develop projects. Councils can significantly reduce the risk of projects and may also play a role as the owner of large areas of land. It is suggested that expressions of interest are invited from interested parties to initiate, build, own and operate a project to treat farm residues and other organic matter and generate value-added products including fertilisers, heat, methane, carbon dioxide and even hydrogen. The Council may offer land at reduced rent. The working Group will compile the following information in a data room to provide to potential proponents:

- details of potential sites with details of any approvals required
- Tentative commitments from businesses to supply materials and off-take products from the hub with any conditions
- letters of support from any regulatory authorities
- Details of the energy and water networks that may be available in the area and with any conditions
- Exclusivity (ie Council will work exclusively with the selected proponent for a certain period)
- Any other value, such as facilitation, pre-lodgement and approvals advice.

Proponents would be invited to express interest in developing the project in Partnership with the Council and working group and in their proposal should be asked to provide details of:

- the system and technology that they propose to use and details demonstrating its local suitability by farms and through their own research.
- their experience in initiating, building, owning and operating such developments
- their level of commitment to the project
- their proposed financial model for the project indicating;
  - rent to be paid to Council (or other land owner)
  - revenues and incomes for the project
  - local employment opportunities
  - any other benefits to be accrued to the community

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[8] Future Beef, 2015. Soil organic matter and carbon in agriculture

This seems out of place

Details on the amount of business waste has been made available by small businesses voluntarily and it is not known what proportion of the local food wastes are included. Costings and pricing estimates are considered to be at a prefeasibility level of accuracy.

The project recognises that regenerative agriculture includes a range of practices, and this project focuses on a small component: the reuse of organic material.

7 Identification and Analysis of Options

This is a high level analysis of the possible alternatives that could be employed to bridge the gap between the current situation and what is proposed, as outlined in Section 4.

7.1 Identification of Options

Three options are provided for assessment. They are not mutually exclusive options and any number could be pursued. Option 1 can be adopted independent of the other options, though it is recommended that Option 1 is adopted to accompany either or both of Options 2 and 3 in order to prove the efficacy of those projects.

7.1.1 Option 1: Testing Regime for Soil Organics

This option involves the testing of soils to verify improvements to soil, organic matter, soil carbon, water holding capacity, and other relevant measures. The objective of the testing should be to gather evidence to demonstrate the effectiveness of the organic material in improving soil and soil water holding capacity with the following groups of participants:

1. Farms that agree to participate in Options 2 and/or 3 below, noting that these will occur after a significant amount of time
2. A control group
3. Farms that are engaging in broader regenerative agricultural practices.

There are a number of farms in the region that are known to be working to improve their soil through the use of organic materials that could be incorporated into Groups 1 or 2 above, including:

- Feedlot (to be named) and DA Hall and Co egg farms at Pittsworth
- Other farms (to be identified by Waggamba Landcare).

Note that the soil testing method should be chosen so as to establish a baseline for carbon reporting to enable the farms to participate in carbon abatement markets.

7.1.2 Option 2: Farm Waste Recirculation Strategy

This option involves the processing and beneficial reuse of farm materials through a central facility. The project would facilitate the processing and reuse of farm and other green waste through a "hub" located centrally. The process would occur such that:

1. Farmers deliver wastes to the hub
2. The Hub manages and processes the materials
3. Processed materials are collected and or delivered to farm.

Considerations for this option include:

- There are many possible variations of the above process including the materials
- Suitable site within a short distance to farms
- That the risks to sensitive land uses are managed, such as odours, rodents, noise, traffic
- Power connection and waste water connection
- The potential to produce gas and generate electricity to be exported to the grid
- Purchase/lease and operating costs of the land and technology
- Supply chain commitments – long-term materials' availability to feed the hub and off-takers for materials
- Serviceability and repair response time of the machine if there is a fault
- Input Volume – achieving the correct size for the unit.

This project involves seeking a suitable technology provider to develop a project in partnership through a Partnership Model (refer Box 2) competitive process as outlined below. As a partner, the successful proponent would have the opportunity to develop the project to the point of investment decision.

Partnership Model

It is suggested that expressions of interest are invited from interested parties to initiate, build, own and operate a materials hub. The working group will compile the following information in the form of a more comprehensive business case to provide to potential proponents:

- An inventory of farm wastes that may be available in the area and with any conditions of use
- Tentative commitments from farms to off-take organic material from the hub with any conditions
- Details of potential sites with details of any approvals required
- Letters of support from any regulatory authorities.

Proponents would be invited to express interest in developing the project in partnership with the Council and working group and in their proposal should be asked to provide details of:

- The technology that they propose to use to process materials supplied, and details demonstrating its suitability for the waste streams identified by farms and through their own research
- Their experience in initiating, building, owning and operating such developments
- Their level of commitment to this project

- Their proposed financial model for the project indicating;
  - Rent to be paid to Council (or other land owner)
  - Revenues and incomes for the produce
  - Local employment opportunities
  - Any other benefits to be accrued to the community.

Option 1 should be conducted in conjunction with this option to verify soil quality improvements

7.2 Comparison of Options

It is important to note that these options are not mutually exclusive, in that more than one could be selected and developed independently.

Criteria	Option 1: Testing	Option 2: Farm Waste
Benefits: • Farmers • Council • Goondiwindi community	• Potential for conclusive results	• **Removal of farm residues and increased availability of organic materials to farmers** • **Reduced waste to landfill** • **Utilisation of a vacant site** • **Opportunity to start to gather other materials using the same network once established** • **Low-risk way of engaging a developer**
Disbenefits: • Farmers • Council • Goondiwindi community	• Potential cost of testing	• **Time taken to secure the project** • **Potential in-kind contributions reqired to get the project to complete feasibility**
Costs: • Direct • Indirect • Recurrent	• Testing costs • Program management costs	• **Direct project development costs as per budget below**
Risks: • **Initial** • **Minimisation/ mitigation costs** • **Resulting risk**	• **Low risk** • **Some financial risk – cost of testing and analysis** • **Potential for inconclusive results as there are many independent variables**	• **Development risk – reduced through partnership model that provides certainty while reducing development phase risks** • **Commercial risks – guaranteed supply of materials to the plant** • **Commercial risk – guaranteed off-take of materials at a viable price** • **Suitability of materials for farm**

		use • **The current drought may limit farms' participation**

7.3 Recommended Option

The working group considers that options 1 and 2 should be progressed to detailed business case.

8 Risks and Benefits

8.1 Matters to be considered

Scientific and Economic Rigor: What needs to be tested and measured to ensure that the results can be demonstrated. There are two levels of testing for the project:

1. Farms that are participating or commencing regenerative agricultural practices independent of the project
2. Testing associated with the recirculation of farm materials:
   a) Ensure no contaminants are moved to farms (testing material produced)
   b) Measure benefits to the soil – soil carbon, nitrogen, water holding capacity (baseline)
   c) Changes in productivity that can be attributed to the project (yield, quality, water productivity)
   d) Economic benefits from higher increase in yield and/or quality.

Waste regulations relating to the movement of agricultural waste – what requirements and costs does it introduce and will it pose a risk to the viability?

The location of the site needs to be suitable for the project and include the following characteristics:

- Suitable size to accommodate plant, and for storage and collection of materials of approximately one hectare
- Transport access and maneuvering space for vehicles
- Access to grid power, water and possibly a sewer
- Planning approvals or a reasonable prospect of gaining approvals
- A suitable distance from sensitive land uses to protect amenity.

A number of sites have been identified for initial assessment, and are subject to further investigation in subsequent stages of the project (Refer to Appendix D).

8.2 Risks

The key risks that a detailed business case should resolve are the supply risks and off-take risks. That is, will there be a dependable, long-term supply of feedstock and customers for the outputs.

Technology Risk:

- Identifying the right technology once the supply and off-take risks have been managed

- No providers willing to bid for the project.

Supply Risk (ensuring sufficient supply of suitable materials for the life of the plant):
- Green waste quality and consistency of supply are issues
- The types of wastes identified so far are insufficient or unsuitable for available technologies
- Biosecurity – need to ensure acceptable management of any biosecurity risks.

Off-take Risk:
- Contamination – farms not prepared to use compost from an uncontrolled source.

Regulation Risk:
- Failure to gain the necessary planning and environmental approvals required to enable this to occur
- Cost of complying with regulations.

A number of considerations relating to environmentally relevant activities:

- ERA 53 – Organic material processing (on farm AD and AD plants associated with WWT and meat processing excluded) ERA may be triggered if the facility processes more than 200 tonnes per year (4 tonnes per week) material is imported for AD (which is what this proposal includes). There may be an exclusion for this depending on the types of materials to be processed and the method of processing
- Regulated wastes includes animal processing residues such as abattoir waste and some food processing wastes (as per number 29 of the Schedule). Including these materials and transport of them would need to be done by a licensed operator (ie exclusion would not apply).

DES is developing End of Waste frameworks which may see some materials reclassified as resources - https://environment.des.qld.gov.au/waste/end-of-waste-framework.html

Risks are considered in Appendix B.

8.3 Potential Benefits

Below a list of benefits that may result from the project. They have been classified into direct and indirect.

No.	Benefit	Direct?	Details
1	Reduce cost and environmental effects of landfill	Direct	Cost of maintaining and establishing new landfill facilities is significant. Landfill has potential harmful environmental effects.
2	Skills for future jobs	Direct	As part of the O&M considerations, can local trades be trained to accreditation by the technology providers to maintain the systems?
3	Clean energy generation	Direct	Reduced greenhouse emissions. Current energy supply projections show that some

			industrial facilities will have to instigate temporary shutdowns.
4	Lower cost energy	Direct	Anecdotal evidence of industrial users replacing mains power with diesel generators for reliability and cost reasons.
5	Reducing waste to landfill and incinerated organic waste	Direct	Diversion of green waste, which is currently incinerated at the Goondiwindi Landfill Site, to a higher value use.
6	Generation of energy	Direct	The potential to generate energy from a processor, depending on the type of technology chosen.
7	Employment	Direct	The projects would secure existing employment or offer additional jobs.
8	Local investment	Indirect	The opportunity for local businesses to invest in the project.
9	Cost savings	Direct	Avoidance of waste to landfill from businesses will save the businesses $75 per tonne from 1 July 2019.
10	Job creation	Indirect	Resources required to conduct feasibility assessment. Direct jobs in construction, then operation, and management once the project operational.
11	Organic household waste	Indirect	The project could potentially expand to include organic household waste.
12	Biosecurity	Indirect	Processing food waste may improve biosecurity outcomes.

8.4 Other Opportunities

There is the potential for the project to be a catalyst for the Goondiwindi Organics Hub precinct to be an Innovation Precinct:

- Department of Industry, Science, Energy and Resources (Australia) - https://www.industry.gov.au/strategies-for-the-future/promoting-innovation-precincts
- CSIRO - https://www.csiro.au/en/Do-business/Collaborative-research/Active-opportunities/Precinct-partnerships.

A number of models could be structured around this program as an innovation precinct:

- Opportunity to act as a central point for collection of other materials from farms such as agricultural plastics, tyres, waste oils
- Industrial ecology model where complementary businesses may co-locate, such as those that may benefit from waste heat, waste CO^2 and other byproducts, or who have or residues that may be of use
- These would link strongly to the USQ, GRC Ag Tech Project where there may be local technology development opportunities.

Aggregation of Australian Carbon Credit Units (ACCUs)

As a central point for the collection and recirculation of materials, there may be potential for the farms to accrue ACCUs for increasing soil carbon.

Wider waste and recycling hub

A central point for the delivery of farm residues provides the opportunity incorporate the collection and recycling of other farm wastes such as:

- Waste oils – currently collected by Waggamba Landcare
- Tyres
- Agricultural plastics.

The risk of contamination of these materials would need to be managed to ensure the risk of contamination is minimised.

9 Implementation Strategy

9.1 Project Title

Goondiwindi Farm Organics Hub

9.2 Target Outcomes

The target outcome will be a commitment to proceed with the project.

9.3 Outputs

Testing: A scope of works for a scientific and economic investigation of the costs and benefits of regenerative agricultural practices.

9.4 Work Plan

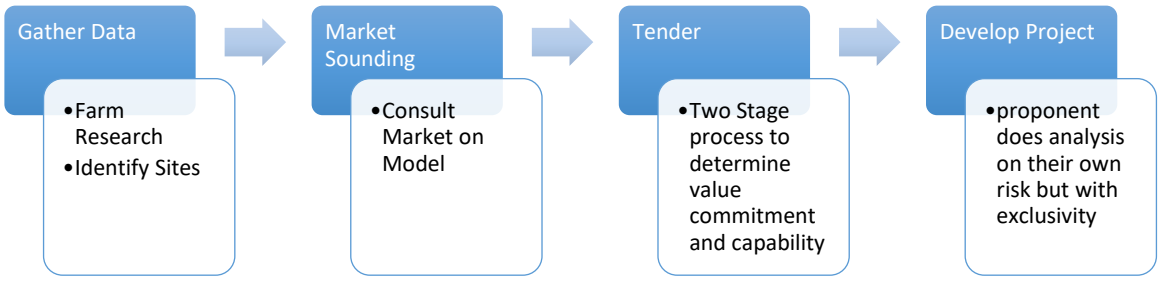
The work plan will consist of a range of key work packages. It will be necessary to break these packages up into a project plan prior to commencing:

Work Package	Details	Responsibility
Market documents	Develop documents for the market sounding and expression of interest processes including consideration of Council's commitments as a facilitator and partner.	Council and Project Manager
The Science	Further research to determine case studies of farms that have been using organic materials and the impact on farm productivity and profitability.	Waggamba Landcare, Council, Project Manager
Supply of materials	Identify farms that may be producing amounts of organic materials that would be prepared to consider participating in such a project. Also,	Potentially Waggamba Landcare to engage with their members and

	identify farms that are moving to greater use of organic materials and consider commencing a testing regime to test soil impacts and track alongside productivity.	others, with guidance from the project partner on suitable information to share and questions to ask.
Site availability	Further analysis of sites for Options 2 and 3 to determine suitability and any significant planning risks.	Project Manager with Council.
Stakeholder commitments	Gather additional detail from farms about waste and potential term sheets.	Project Developer with Waggamba Landcare.
Refine model through market sounding	Conduct a market sounding of potential suppliers to determine level of interest and refine the market offer, particularly with Options 2 and 3. The market sounding may consist of a data room where all available information would be provided and a number of questions answered.	Project Manager with Council.
Seek investment	Develop a process to invite expressions of interest and select a suitable proponent for Options 2 and 3.	Project Manager with Council.
Science	Expand testing to farms participating in the recirculation of material from Options 2 and 3 (once the project is established) and running to develop empirical results.	Project Manager, Developer, Waggamba Landcare, Scientific Advisor.

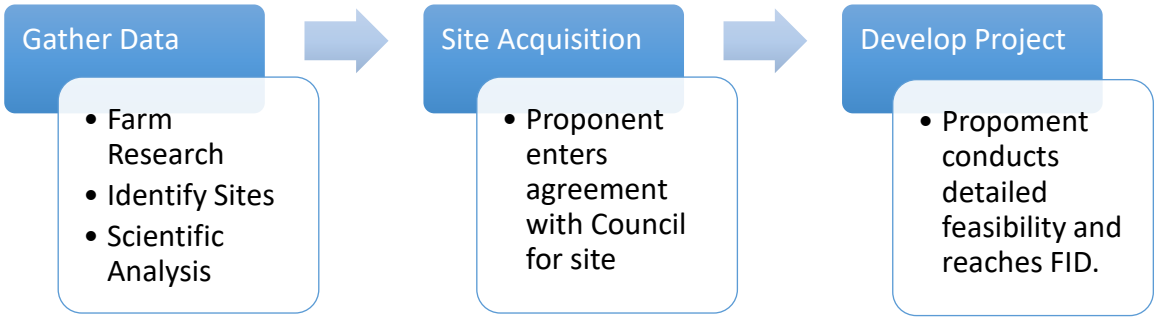
A number of options for engaging with a preferred developer for a project include:

1. Early expressions of interest and offer exclusive rights to develop a project



In this case, the project team gather information that is readily available, and undertake some de-risking of sites. Note that it would not include full technical assessment or detailed consultation with farmers as this would be undertaken in partnership with the project developer. All information would be available to the bidders in the tender room. The project includes a market sounding process to test the model with the market. The company that wins the tender would have exclusive rights to develop a project in the GRC area for an agreed period. The site access would form part of the tender and be part of the competitive tender for the project, with the bidder nominating a rent and terms as part of their offer. In this model, the partner would then work with Waggamba Landcare along with an agronomist and Dr Bernadette McCabe from the University of Southern Queensland as an independent advisor to the project.

2. Early Engagement with potential developer as a trusted advisor



In this model, a potential developer would be engaged to conduct a feasibility assessment of the project based on information gathered on the farms by Waggamba Landcare along with an agronomist and Dr Bernadette McCabe from the University of Southern Queensland as an independent advisor to the project.

This option risks gathering insufficient or incorrect data meaning the developer would need to re-consult with the farms.

Option 1 is potentially most suitable as it allows the Council to conduct a competitive process to select a developer. The Council and developer would then work in partnership to deliver the project with the Council providing some facilitation and the developer conducting the feasibility analysis.

9.5 Budget

Estimated project costs for the various aspects of the project are:

Work Package	Details Discipline	Est Cost.
Project facilitation	Part-time resource to facilitate the project as Council's representative	$80,000
Testing program for soils	Test soils of participating farms before the program and for a period of time to be agreed after the project commences	$50,000 - $100,000
Establish the operating conditions	Seek Council agreement on potential sites and likely planning conditions and potential exclusivity. Facilitiate grid connections and access to water	$30,000
Further farmer engagement	Landcare Group with experience in engaging farmers on operational matters	$50,000
Technical and scientific advice	Review identified materials and suggest technologies and assemble relevant information to potential bidders	$50,000
Market sounding and procurement advice	Optional - Could be conducted in-house by Council with some technical and financial advice provided	($50,000) $10,000
Legal advice, agreements etc	Optional – Could be conducted in-house by Council	($30,000)
Approvals	Cost of preparing reports to gain necessary regulatory and financial approvals needed to gain an investment decision	$250,000
Total		$520,000 -

		$650,000

9.6 Other Resources

Programs relevant to the project that could provide some facilitation or funding include:

- Resource Recovery Funding: Development of the next phase of the business case, leading to investment decision may be eligible for funding under Stream 3: Resource Recovery - Investment Pipeline Fund (https://www.statedevelopment.qld.gov.au/industry-development/resource-recovery-industry-development-program.html
- Clean Energy Finance Corporation Investment: The CEFC is an Australian Government-backed financial institution and is interested in investing in technologies - https://www.cefc.com.au/media/390741/cefc-and-clean-energy-for-agriculture-feb-2018.pdf
- Rural Research and Development for Profit: A proposal could seek funding assistance - http://www.agriculture.gov.au/ag-farm-food/innovation/rural-research-development-for-profit.

10 Project Management Framework

10.1 Governance

A key question for this project is “Who Owns the Project?”

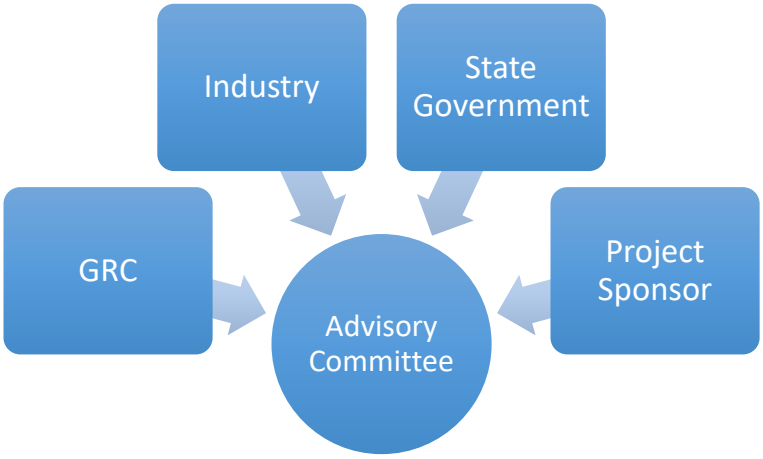
The governance system is proposed to deliver the business case as follows, with the exact representation to be determined at the commencement of the project.

- Advisory Committee: Responsible for the delivery of the project; meeting its objectives on time within budget. The Steering Committee members will also consult strategically with external stakeholders to ensure the project has the support of a wider network
- Working Group: Responsible for advising the Project Manager on technical and operational aspects of the project and will meet to advise the Project Manager
- Project Manager: Reporting to the Advisory Committee. The Project manager should sit within the GRC structure and have access to relevant expertise, including through regular meetings of the Working Group.

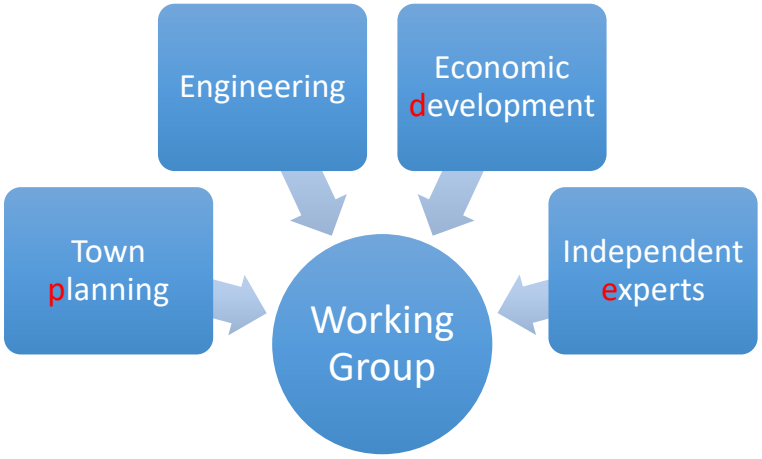
The Project Manager will be responsible for the delivery of the project.

The Advisory Committee should be established with representatives from the Goondiwindi Regional Council, TSBE and industry representatives. The Project Sponsor should be represented, particularly if funding is provided.

Suggested Project Advisory Committee



Suggested Project Working Group:



The business case should be progressed by a Project Manager, with the close advice of key agencies and advisors in an operational working group as suggested above.

10.2 Project and Quality Management

A detailed project plan will need to be prepared for the project incorporating a number of factors including:

1. Organisational Impact: How the work undertaken during the project will impact on the organisation and how these impacts will be addressed
2. Outcome Realisation: how outputs will be managed once they are delivered, and who will be accountable. This may change as the project evolves
3. Quality Management: Define suitable standards, requirements and best practices for the project to deliver against, and the internal quality requirements
4. Post-project Review: How the group will capture the lessons learnt throughout the project and what review will be done to assess whether the initiative delivered the intended benefits.

The Project Manager will need to ensure that the final project developed is robust and based on sound science. Methodologies for calculating carbon abatement should be recognised and calculations should be accredited, or conducted by an accredited person. Financial analysis should be sufficiently robust to allow decision making, so initial consultation should occur with potential funders and financiers about the level of detail required.

Appendix A: Benefit Analysis

This analysis assesses how each key stakeholder group (or individual stakeholders) may be impacted by the project and how they may impact on the project.

Option 1: Testing

Stakeholder	Positive Impact	Negative Impact	Overall
Goondiwindi farmers	Increased knowledge of soil conditions	Cost	Positive
Landcare groups	Data on wider farm soil conditions		Positive
Wider farming sector	Aggregated information about soil condition across the region		Positive

Option 2: Farm Waste

Stakeholder	Positive Impact	Negative Impact	Overall

Farmers	• Potential for increased soil quality and water holding capacity – greater ability to withstand drought • Potential to earn additional income by generating ACCUs • Potential reduction in mineral fertiliser inputs • Potential long-term productivity increase	• Potential costs • Adapting farm system • Potential for initial decrease in productivity as farm system adjusts	Positive
Council	• Reduced waste to landfill including sewage biosolids, farm waste and potentially municipal green waste • Potential income from the lease of a site that may currently be vacant • Facilitated a long-term economic benefit for a key industry sector • Reduced greenhouse emissions from a key sector	• Potential amenity impacts from the site and transport of wastes • Time spent working in partnership with proponent • In-kind costs – those not funded by the project	Positive
Community	• Long-term sustainability of farming sector	• Potential amenity impacts from the site and transport of wastes	
Project Developer	• Potential to become a	• Competition for internal capital	

	valuable member of the business community through a partnership approach • Streamlined project with key partners providing working relationships with farms • Security of business developmnet work and IP managed through a partnership approach	and time leading to delays	

Appendix B: Risk Analysis

As a pre-feasibility level business case, this is an initial consideration of risks, and the strategies that can be put in place, or investigations into further work that can mitigate these risks.

Option 1: Testing

Major Risk and what does it do to the project?	Mitigation Strategy
Unable to engage any farmers in a testing program	**Effective communications to inform the farmers of the benefits of soil testing to assist the farmers to make an informed choice**
Testing is not able to demonstrate that the project results in a positive impact on soils	**No mitigation**

Option 2: Farm Waste Circulation

Major Risk and what does it do to the project?	Mitigation Strategy
Probity and transparency of decision making leading to a perception that the selection process is biased	Manage all process and communications in accordance with Council's policies to ensure that there is no actual bias, and concerns about perceived bias can be effectively managed.
Project costs exceed expected meaning additional funds are required or the project is not completed	Regular budget planning and monitoring to be reported to the Steering Committee to ensure that costs don't exceed reasonable expectations and that funds are appropriately spent.
Development partner unable to reach a final decision on a project	There is no guarantee that a project will succeed. The expectations of partners should be to work hard to give the project the best chance of success.
Development partner unable to achieve commitment from farmers for waste streams	Engage a partner such as Waggamba Landcare to assist in engaging farms, **and** partner with them to ensure that comprehensive information is gathered.
Amenity concerns from facility	To be managed at the time of development assessment. Generally, the projects utilise all materials so will process all gases and the amenity impacts will be less than a sewage treatment plant.
Project is unable to achieve sevelopment approvals	During early stage feasibility, consider likely impacts of the proposal, consult the Planning Scheme and Council, and **DES** to ensure that planning risks are managed.
Developer is unable to secure funds for the project internally	Selection process (EOI or RfP) needs to target companies who are committed to the project, have available capital, can demonstrate a competent experienced team, with commitment from senior management or board level to commit funds to the project.
Biosecurity at Hub site	Management measures are put in place to ensure biosecurity risks are appropriately managed.
Gas regulation and annual safety check	Fees and licence process should be assessed and understood.

Appendix C: Background Information

Resource Availability

The Queensland Government has mapped availability of biomass residues and integrated it with the Commonwealth Governmet AREMI Mapping - https://www.statedevelopment.qld.gov.au/industry-development/queensland-biomass-mapping-and-data.html.

The National Renewables Map has a bioenergy layer with a general level of feedstocks available showing Goondiwindi high in animal, cotton and some other materials https://nationalmap.gov.au/renewables/.

Government Policy

Queensland Government

- Energy From Waste Strategy (draft)
- Waste Management and Resource Recovery Strategy - https://www.qld.gov.au/environment/pollution/management/waste/recovery/strategy
- Biofutures Roadmap - https://statedevelopment.qld.gov.au/resources/plan/biofutures/biofutures-10yr-roadmap-actionplan.pdf
- The Queensland Government released the *Energy from Waste Policy Discussion Paper* for public consultation in July 2019 - https://www.qld.gov.au/environment/pollution/management/waste/recovery/energy-waste

Australian Government

Carbon Credits:

The food-based project may be eligibile for the creation of ACCUs through the source-separated organic waste method - http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-industry/landfill-and-alternative-waste-treatment-methods/source-separated-organic-waste

Case Studies

Case Study: Electricity generated from methane gas from Maryborough's Saltwater Creek landfill site powers 2000 households

The initiative is part of a LGI's project to install 6 MW biogas-fired generators at six landfill sites in Southern and Central Queensland. Australia's Clean Energy Finance Corporation contributed $10 million to help facilitate the project. Both the council and resource recovery contractor LGI share in the profits that offset the costs of operating waste operations across the region. LGI uses GE Jenbacher gas engines as its preferred power generation equipment.

https://www.cefc.com.au/media/107390/cefc-factsheet_lgi_lr.pdf

https://www.frasercoastchronicle.com.au/news/electricity-rubbish-finding-new-use-maryborough/3432790/

Similar business models

Agri Cycle	http://www.agri-cycle.uk.com/	UK recycler of agricultural plastics
Degraves Street Melbourne	https://www.melbourne.vic.gov.au/business/waste-recycling/Pages/degraves-street-recycling-facility.aspx	Melbourne central waste recycling hub
Farm Plastics Recycling	https://www.abc.net.au/landline/farm-waste:-the-growing-problem-of-plastic-farm/11264632	Landline 29 June 2019 about Farm plastics
Biomix	https://www.biomix.com.au/about-biomix	Victorian compost company

Technologies and Providers

Farm-scale projects:

Technology	Website	Details
Rainbow Bee Eater	www.rainbowbeeeater.com.au	Converts farm wastes to syngas and biochar.
Utilitas	www.utilitas.com.au	Build own and operate anaerobic digestion plants and bio hubs.
Biogass	http://www.biogass.com.au/#_blank	
Future Biogas	http://www.futurebiogas.com/	
Pyrocal Pty Ltd (local to Darling Downs)	https://www.pyrocal.com.au/	Wellcamp based pyrolysis technology producing biochar. Outputs include biochar, thermal energy, CO_2
Moxiepel	https://moxiepel.com/	Have a technology that can dewater anaerobic digestate for application to farms or for use in boilers.
Waste to Work	https://www.wastetowork.com.au/	Brisbane-based new gasification technology producing syngas, electricity, biochar.
Wildfire Energy	https://www.wildfireenergy.com.au/	Brisbane-based new gasification technology.

Laneway projects:

Technology	Website	Details
Closed Loop Recycling	https://closedloop.com.au/organics/	In use at Spicers Balfour Retreat, Newfarm QLD.
Enrich 360	http://enrich360.com.au/enrich360-equipment/	In use at Brisbane Airport Domestic Terminal Lease Model Not sure of power consumption or liquid wastes. No additives required.
Biobin	http://www.biobin.net/index.php?id=2	Brisbane Convention and Exhibition Centre and the Currumbin RSL have a Bio-Bin.
Ecoguardians Soil Food	https://www.ecoguardians.com.au/soilfood/soilfood	No additives required. Condensate water produced considered grey water.

Other Research

Sustainability Victoria has conducted research into farmers' perceptions of organic materials and their potential use on farms:

https://www.sustainability.vic.gov.au/-/media/SV/Publications/About-us/What-we-do/Strategy-and-planning/Victorian-Organics-Resource-Recovery-Strategy/RRE015-Social-research-Perceptions-of-recycled-organic-products.pdf?la=en

GRDC is doing work on soils nearby. Could Goondiwindi gain funding to become a trial site to provide evidence/data on the efficiency and environmental and economic gains (e.g. soil carbon) of using green waste to add carbon to the soil?

Appendix D: Potential Site Analysis

Site Details

FARM WASTE RECIRCULATION POTENTIAL SITE REQUIREMENTS

ASPECT	REQUIREMENTS	**Comments**
Land	min land area required is 2.0 ha, an 'ideal' land area would be 3.5-4.0 ha	The following are all blocks within the industrial zone of the *Goondiwindi Region Planning Scheme 2018:* Lot 4 RP222151 - 4.473ha Lot 40 SP266727 - 229ha Lot 4 SP164148 - 11.82ha (there is a subdivision approval over this lot however it is not registered yet, and one of the lots in the subdivision is 3.94ha) Lot 22 SP120170 - 21.94ha Lot 24 SP173915 - 6.9ha (there is a subdivision approval over this block however it is not registered yet, the subdivided blocks would all be smaller than 2ha)
	Medium Impact (limited proximity to sensitive receptors)	
Power	*Grid Connection Required - posslble to feed to grid*	
Gas	*No supply may be required?*	
Waste Outputs	*To be determined*	What waste outputs and volumes?
Water	*Not sure of water requirements - connection to water system and trade waste likely to be required. May be able to take recycled water.*	The Manager of Water & Sewerage advised that if there is the possibility of this industry being developed in Goondiwindi, Council will need sufficient time to analyse water allocation to ensure there is sufficient volume for this type of industry. Lot 40 SP266727 - could feed into a bore onsite if the water is compatible Lot 22 SP120170 - no water currently available to this block, the water main on Cemetery Road would need to be extended to service this block. Lot 4 on SP164148 - there is water available to this block, however there is no sewerage available to this block. Lot 4 RP222151 - there is water available to this block, however there is no sewerage available to this block. Lot 24 SP173915 - water is available, however would possibly need to install a sewerage pump station.
Transport & Logistics options		Lot 4 SP164148 - is adjacent to the Cunningham Highway, however unsure if direct access is permitted. If no highway access is permitted, Henderson may require upgrading. Lot 4 RP222151 - has frontage to Boundary Road and the Cunningham Highway, which are both State-controlled roads, Lot 40 SP266727 - has frontage to Boundary Road, which is a State-controlled road which links to the Cunningham Highway and the Leichhardt highway. Lot 22 SP120170 - is adjacent to the South West rail line,

however Fairlands road is gravel and would require significant upgrades for this type of development, and Cemetery Road may also require widening.
Lot 24 SP173915 - has frontage to the Old Cunningham Highway and Boundary Road.

Appendix E: Regenerative Agriculture Briefing

Regenerative Agriculture

1. What is it? Why is it important?

Soil organic carbon is a determinant of the water holding capacity of the soil and is a key driver of the nutritional status of plants, and in turn, food for animals and people. Long-term studies have shown that continuous cropping using conventional methods can deplete soil organic carbon (Reeves, 1997). Rebuilding soil organic carbon is important because of its impact on other physical, chemical and biological indicators of soil quality. Water is also one of the drivers of farm valuations, particularly in drought conditions, and building soil organic carbon helps to drought-proof farms (Howard, 2018). Loss of topsoil, soil compaction and erosion also depletes the soil nutrients required for agricultural and pastoral activities.

Regenerative Agriculture (RA) is an approach to farming that aims to rebuild topsoil, increase soil organic matter including carbon, and restore degraded soil biodiversity. This has the effect of improving the water holding capacity of the soil, reducing runoff and erosion, sequestering carbon and building resilience to climate extremes. It is a holistic approach to landscape management that integrates soil, water, vegetation and biodiversity (DPIRD, 2018, Massy, 2017).

RA principles vary, but they typically include no-till or minimal tillage, keeping the soil covered at all times, increasing plant diversity, using organic composts and fertilisers, and reducing or ceasing the use of synthetic chemicals (www.soilsforlife.org.au). While consistent principles underlie RA, there is not a 'one size fits all' approach to land management, and a range of techniques have been adopted on Australian farms, such as:

- Implementing time-controlled planned grazing
- Using grazing management and animal impact as farm and ecosystem development tools
- Retaining stubble or performing biological stubble breakdown
- Constructing interventions in the landscape or waterways to slow or capture the flow of water
- Fencing off waterways and implementing water reticulation for stock
- Pasture cropping
- Direct-drill cropping and pasture sowing
- Changing crop rotations
- Incorporating green manure or under-sowing of legumes
- Investing in revegetation
- Managing for increasing species diversity
- Integrating enterprises.

2. Evidence

There are many books, articles and websites on regenerative and conservation agriculture that document increased water retention, cooler soils in summer, increased biodiversity and a reduction in run-off and erosion (Batterham, 2018; Montgomery, 2017; Massy, 2017). Studies also report reduced costs, increased production efficiency and greater resilience, particularly during drought conditions. However, reported benefits are often highly variable (Serraj and Siddique, 2012).

Much of the reported evidence is anecdotal, and empirical studies often focus on the costs and benefits of individual farms before and after they transition to RA. There is also a paucity of studies that compare RA with conventional farming across regions and farming systems, or compare RA with farms that combine some RA principles (e.g. no-till) with precision agriculture and computer based technologies that improve efficiencies and environmental outcomes (Francis 2017).

Results can be misleading if studies of transitions on individual farms do not consider other interrelated trends such as weather conditions over the same period (Batterham, 2018). Objective, science-based studies using farming trials are necessary to fully understand any discrepancies between the scientific literature and the experience of farmers (Batterham, 2018). It will also dispel questions over whether farms achieve improvements with RA because their farms were previously depleted and intensive agriculture was no longer profitable.

One study compared RA with conventionally grown corn in the USA and found 10-fold more pests in insecticide-treated corn fields than on insecticide-free regenerative farms (LaCanne and Lundgren, 2018). Also, profits were 78% higher with RA even though grain production was 29% lower. The lower profits on the conventional farms were associated with the higher cost of seed, fertiliser and insecticides whereas higher profits on the RA farms was from higher crop value and from diversifying the revenue generated from the fields (e.g. cover mixes and livestock).

Another study, from NSW, compared the profitability of graziers whose farms exhibited healthy functional traits and biodiversity with all other sheep, sheep-beef and mixed cropping-grazing businesses in their regions (Ogilvy et al., 2018). The RA farms were often more profitable than comparable conventional farms, especially in dry years, and levels of farm profit were similar to industry benchmarks of ‘elite’ producers. The RA farmers also had significantly higher than average wellbeing than other NSW farmers.

Numerous case studies on the ‘Soils for Life’ website (www.soilsforlife.org.au) and in the report *Innovations for Regenerative Landscape Management* (Soils For Life, 2012) report higher profits resulting from lower expenditure on machinery, synthetic inputs and labour. Profits also increased when farms achieved higher sales prices for higher quality products. In many instances, yield, productivity and carrying capacity were higher or maintained once the farms had transitioned to RA. The case studies reported that production was generally more even across weather conditions under RA than on conventional farms that experienced profit peaks and troughs.

Soils for Life (www.soilsforlife.org.au) emphasise that there is not a 'one size fits all' approach to land management. Tailor-made approaches for different farming systems address the concerns of McGuire (2018), who argued that protecting the soil is hard to implement with crops like potatoes or carrots, because they require tillage to harvest them, and with small-seeded vegetables because they require precise shallow planting which is difficult to achieve when crop residues are retained between crops. McGuire (2018) also questioned some anecdotal evidence claiming large increases in productivity and topsoil depth on RA farms, but this only demonstrates the need for trials that measure differences across locations and across farming systems.

Satellite-based observations, combined with mapping of features such as soils, terrain, biomass and evaporation and information about farm management practices could be a way of comparing farming outcomes, including soil organic carbon, across wide areas quickly and comprehensively (Batterham, 2018).

3. Current state and trajectory in Australia/Queensland?

RA has been practiced in Australia for many years by a relatively small number of farmers but is gaining in popularity (www.soilsforlife.org.au). It is not clear what the rate of uptake is, but there is considerable online interest across Australia from a broad range of farmers, community groups, governments and universities (See Section 6). Media, such as *The Land* and *The Conversation* have also featured recent articles on the topic.
There are numerous Australian and international websites that provide information to help farmers (See Section 6) and there is an obvious willingness of many RA farmers to share their knowledge and experiences. The Soils For Life website provides information, videos, case studies, mentoring and links to Australia-wide research programs (www.soilsforlife.org.au). In a series of case studies, farmers describe how they transitioned to RA, the costs and benefits of transitioning, and yields and landscape outcomes before and after transitioning.

4. How does it work and what are the intervention options?

Landscapes are complex systems and benefits can be highly variable, so a practical, flexible, and locally-tailored approach is needed (Serraj and Siddique, 2012). Charles Massy, an RA farmer, researcher, and educator advises farmers to find out what is going on in their district and suggests that it is not necessary to commit to huge investments in machinery or other things, but to try out small experiments to see what works. He provides many examples, including his own, in his book *Call of the Reed Warbler* (Massy, 2017).

5. Challenges and opportunities for implementation

By implementing RA strategies, many farmers are able to diversify their income stream by introducing complementary activities and increasing the range of products that they produce. One example is on farms that use pasture cropping methods, where crops are sown using no-till methods into perennial native pastures. Extra income can be sourced, for example, by incorporating grazing animals into the management system and by harvesting native grass seeds (See Section 6: Winona and Jillamatong farms).

The Emissions Reduction Fund is a potential source of income by incorporating approved methods to sequester soil carbon under pasture, crops or mixed farming systems. There is also potential for carbon sequestration from carbon plantings and from environmental plantings (Bryan et al., 2015).

Some RA farms gain organic certification and tap into the growing market of consumers, particularly in Asia, who are increasingly willing to pay for assurances around food safety (Stanway, 2016). Gaining organic certification can be a rigorous process to achieve food safety and quality assurances. The WA government website 'Going organic' provides useful information and links. Australian organic certifying organisations accredited by the Australian Department of Agriculture and Water Resources include AUS-QUAL, Australian Certified Organic, Bio-Dynamic Research Institute, NASAA Certified Organic, Organic Food Chain, and Southern Cross Certified Australia. There are also international certification bodies such as Organic Growers of Australia and SAI Global.

There is a growing interest and investment in RA from business (e.g. fund and asset management – Open Resolve Funds Management, Wide Open Agriculture, and SLM Partners), superannuation funds (e.g. VicSuper), banks (e.g. BankAustralia) and law firms (e.g. Norton Rose Fulbright).

6. Example/stories of implementation

There are many examples of challenges and opportunities can be found online, including on the SoilsForLife website (www.soilsforlife.org.au). Here are three stories of implementation:

The Seis family on Winona in NSW apply pasture cropping where no-till crops grown in perennial pastures are combined with sheep grazing. Since converting to RA, productivity (wool and grain) has been maintained, while annual costs have decreased by over $120,000, and soil organic carbon has increased by 203% over ten years. Waterlogging declined and tree health and biodiversity improved. In the pasture, native perennial species increased from 10% to 80% and weeds declined from 60% to 5%. The family also run merino sheep, have sheep and kelpie studs, harvest native grass seed and have around 500 acres of pasture crops sown to oats, wheat and cereal rye. https://soilsforlife03.worldsecuresystems.com/assets/doc/12%20Winona.pdf

Martin Royds on Jillamatong in NSW practices holistic regenerative farming by implementing a range of ecological practices, including natural sequence farming, bio-dynamics and permaculture. He not only grazes beef cattle, but also harvests native grass seed, truffles, garlic and yabbies. He reports a significant reduction in costs, consistent profits, healthy soils and high personal well-being. www.jillamatong.com.au and www.soilsforlife.org.au

The Laffy 1500 acre farm near Dalby was uneconomic, with outlays going on farm overheads, chemicals and fertilisers with income directly linked to market prices irrespective of production costs. They switched to organic RA, which they initially found daunting, but do not regret the shift despite the changeover costs, primarily on re-fencing and adding more water infrastructure. Labour costs increased because the cattle had to be moved more frequently, but finances improved by cutting out chemical costs. They found that talking to the right people and tapping into networks were key to their success. https://www.laffyfamilyfarms.com.au/blog-organic-beef-and-lamb/

7. Links and Resources

This list provides links to some of the many sites that provide information, case studies, videos, education, training and networking opportunities:

SoilsForLife - www.soilsforlife.org.au
An Australian non-profit organisation dedicated to encouraging the widest possible adoption of regenerative agriculture across rural, remote and urban environments.

RegenAG - http://regenag.com/web/
A community-based family enterprise providing farmers, professional organisations and communities with education, training and consultancy opportunities.

Regeneration International - https://regenerationinternational.org/
An international organisation that engages with a network of over 250 partners and regenerative alliances through education, network building and policy work.

The Organic & Regenerative Investment Co-op - https://organicinvestmentcooperative.com.au/
An organisation focussed on increasing the amount and productivity of organically and regeneratively managed farmland around Australia.

Healthy Soils Australia - http://www.healthysoils.com.au
A collective of farmers, scientists, environmentalists and advocates that have consolidated and distilled research into commercial RA solutions and undertakes outreach, training and mentoring.

The Mulloon Institute - https://themullooninstitute.org/
A research, education and advocacy not-for-profit organisation that connects environment, farming and society through practical demonstration.

Tarwyn Park Training – https://www.tarwynparktraining.com.au/
Family run training, teaching the principles and implementation of Natural Sequence Farming.

The WA Department of Primary Industries and Regional Development provides information and links for RA and pastoralism.

Southern Cross University based research and collaborative hub between RA practitioners and researchers - www.facebook.com/regener8ag

Australian Institute of Ecological Agriculture - http://ecoag.org.au/category/regenerative-farming/
A collective promoting and coordinating activities based on ecology, ethics, education, farming and food.

The No-Till Farmers Associations of Victoria, Western Australia and South Australia are farmer driven organisations that promote the benefits of no-till and conservation farming systems.

FutureBeef: Climate Clever Beef - https://futurebeef.com.au/knowledge-centre/climate-clever-beef-project/ On-farm practices with the potential to improve methane emissions intensity of cattle production and increase carbon stored in soil and vegetation. This site includes links to publications, case studies, fact sheets and videos.

8. References

Videos

Charles Massy https://www.youtube.com/watch?v=Et8YKBivhaE

Mangarara, New Zealand - https://www.youtube.com/watch?v=ob_asuZ6OtE

Books, Journals and Websites

Batterham, R. 2018. Conservation and regenrative versus intensive agriculture. Future Directions International. Available: http://www.futuredirections.org.au/publication/conservation-and-regenerative-versus-intensive-agriculture/.

Bryan, B., Hatfield-Dodds, S., Nolan, M., McKellar, L., Grundy, M. and McCallum, R. 2015. Potential for Australian land-sector carbon sequestration and implications for land use, food, water, and biodiversity: Report for the Australian National Outlook 2015. CSIRO, Australia.

DPIRD. 2018. *Regenerative agriculture and pastoralism in Western Australia.* [Online]. Western Aatralia Government, Department of Primary Industries and Regional Development, Western Australia. Available: https://www.agric.wa.gov.au/land-use/regenerative-agriculture-and-pastoralism-western-australia.

Howard, M. 2018. *Australian farmers driving up profits through regenerative agriculture* [Online]. Available: https://www.commercialrealestate.com.au/news/australian-farmers-driving-up-profits-through-regenerative-agriculture/.

LaCanne, C. E. and Lundgren, J. G. 2018. Regenerative agriculture: merging farming and natural resource conservation profitably. *PeerJ,* 6.

Massy, C. 2017. *Call of the Reed Warbler: A New Agriculture - A New Earth.* University of Queensland Press.

McGuire, A. 2018. *Regenerative Agriculture: Solid Principles, Extraordinary Claims. Centre for Sustaining Agriculture and Natural resources (CSANR) Washington State University* [Online]. Available: http://csanr.wsu.edu/regen-ag-solid-principles-extraordinary-claims/.

Montgomery, D. 2017. Growing a Revolution: Bringing Our Soil Back to Life. W. W. Norton Company.

Ogilvy, S., Gardner, M., Mallawaarachichi, T., Schirmer, J., Brown, K. and Heagney, E. 2018. NESP-EP: Farm profitability and biodiversity project final report. Canberra Australia.

Reeves, D. 1997. The role of soil organic matter in maintaining soil quality in continuous cropping systems. *Soil & Tillage Research,* 43, 131-167.

Serraj, R. and Siddique, K. 2012. Conservation agriculture in dry areas. *Field Crops Research* 132: 1-6.

Soils For Life 2012. Innovations for Regenerative Landscape Management: Case Studies of Regenerative Landscape Management in Practice. Fairbairn ACT.

SoilsForLife. 2018. *Catalysts for change* [Online]. Available: www.soilsforlife.org.au.

Stanway, D. 2016. *China uncovers 500,000 food safety violations in nine months.* [Online]. Reuters. Available: https://www.reuters.com/article/us-china-food-safety/china-uncovers-500000-food-safety-violations-in-nine-months-idUSKBN14D046