NORTH QUEENSLAND

COTTON GIN ASSESSMENT & FEASIBILITY STUDY

MITEZ
ECONOMIC DEVELOPMENT

AUDAX AT FIDELIS
Queensland
Government

DOCUMENT CONTROL

Document Name:	Feasibility Study Report
Project Name:	North Queensland Cotton Gin Assessment and Feasibility Study
Project Owner:	Mount Isa to Townsville Economic Development Zone Incorporated
Document Date:	14 May 2021
Document Prepared By:	PVW Partners
Contact Details:	carl.valentine@pvwpartners.com

REVISION HISTORY

Revision No.	Date	Nature of Revision	Approved by
1.1	20 December 2020	Initial Draft	PVW Partners
1.2	3 February 2021	Draft version 2	PVW Partners
1.3	22 March 2021	Draft version 3	PVW Partners
2.0	12 April 2021	Draft version 4	PVW Partners
Final	14 May 2021	Final version for release	MITEZ

PVW PARTNERS DETAILS

Approved by:	Carl Valentine
Address:	52 Walker Street, Townsville, QLD 4810
Telephone:	(07) 4721 8500
Email:	info@pvwpartners.com
Website:	www.pvwpartners.com

This study was proudly co-funded by the Queensland Government's Remote Area Board (RAB) funding program.

DISCLAIMER

This Report is confidential and is provided as part of the feasibility study investigation into the possible expansion of cotton production in North Queensland and the assessment of the viability of establishing a cotton ginning facility. This report is provided via a consultancy agreement between Peel Valentine Whitehead Partners Pty Ltd (PVW Partners) and Mount Isa to Townsville Economic Development Zone Incorporated (MITEZ). The feasibility study was prepared in accordance with the terms of the Financial Assistance Agreement (FAA) between MITEZ and the Queensland Government.

This report is strictly limited to the matters stated in it and subject to assumptions, qualifications and limitations outlined and does not apply by implication to any other matters. PVW Partners makes no representation that the contents should be utilised for any other purpose, and the report should be used only to inform a view of current state and possible future state of cotton production and processing in North Queensland.

The report must be read as a whole, and no single portion should be relied on as a substitute for the contents of the report. Any subsequent report, such as a detailed business case, should be read in conjunction with this report.

This report supersedes all previous drafts before the date of the report and will not be updated for any amendments after the date of completion or if any other matters arise that may have a material impact on this report. PVW Partners is not obliged to inform of any such events of which it becomes aware, after the report date.

Unless expressed in writing, PVW Partners does not accept duty of care or any other legal responsibility whatsoever in relation to this report or enquiries, advice or other work, nor does PVW Partners make any representation in connection with this report to any person or business other than MITEZ. Any person receipting a copy of this report (or portion of it) or where orally discussed (or portion of it) does so on the basis that they acknowledge and accept that they may place no reliance on this report for any purpose whatsoever.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY

Abbreviation	Description
Bales	Gin Processed Cotton
Barron Water Plan	Water Plan (Barron) 2002
BHWSS	Burdekin Haughton Water Supply Scheme
Burdekin Basin Water Plan	Water Plan (Burdekin Basin) 2007
CAPEX	Capital Expenditure
Cotton Gin	Cotton Processing Facility
Cotton Processing	Process of Cotton Ginning
Cotton Production	Growing of Cotton
CRC	Cooperative Research Centre
CRCNA	Cooperative Research Centre for Developing Northern Australia
CRDC	Cotton Research and Development Corporation
CSD	Cotton Seed Distribution
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAF	Queensland Government Department of Agriculture and Fisheries
DAFF	Queensland Government Department of Agriculture, Forestry and Fisheries (Previous Name for DAF)
DOLS	Distribution Operational Licenses
DNRME	Queensland Government Department of Natural Resources, Mines and Energy
DPI	Queensland Government Department of Primary Industries
DSDIP	Queensland Government Department of State Development, Infrastructure and Planning
DSITI	Queensland Government Department of Science, Information Technology and Innovation
EBITDA	Earnings Before Interest, Tax, Depreciation and Amortisation
FAA	Financial Assistance Agreement
GAB	Great Artesian Basin
GAB Water Plan	Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017
Gulf Water Plan	Water Plan (Gulf) 2007
Ha	Hectare
Irrigated	Irrigated Method of Growing Cotton
Km	Kilometres
LBW	Lower Burdekin Water
MDWSS	Mareeba-Dimbulah Water Supply Scheme
MITEZ	Mount Isa to Townsville Economic Zone
ML	Megalitre of Water
Modules	Raw Unprocessed Cotton

Abbreviation	Description
NPV	Net Present Value
OPEX	Operational Expenditure
PRG	Project Reference Group
Rain Grown	Dryland Method of Growing Cotton
ROL	Resource Operations License
ROP	Resource Operations Plan
Study Areas	Five Identified Catchments and Regions in Scope of the Study
Study Region	Collective North Queensland Study Areas
UWA	Underground Water Area
Water Act	Water Act 2000 (Qld)
Water Legislation	Collective reference for Water Act and Water Regulations
Water Regulations	Water Regulations 2016 (Qld)
WMA	Water Management Area
WMP	Water Management Plan
WRP	Water Resource Plan
WSS	Water Supply Scheme

EXECUTIVE SUMMARY

Study Background and Objectives

The expansion of broadacre cropping in North Queensland has been the subject of discussion, trials and studies for many years. Cotton is viewed as an integral component of this expansion, with it having the potential to yield significant economic benefits and employment opportunities for the region.

Interest in North Queensland as a cotton production region has resulted in strategic cropping land investments by Southern growers. Extensive cotton trials, applying both rain grown and irrigated production methods, have also been completed by current and past landholders. However, without a cotton processing facility (cotton gin) in North Queensland, all cotton is currently transported over 1,000km to Central Queensland for processing.

Mount Isa to Townsville Economic Development Zone Incorporated (MITEZ), through funding provided by the Queensland State Government, commissioned a Feasibility Study (the Study) to investigate the potential for the establishment of a cotton gin in North Queensland, as a means of supporting a cotton industry in the region. The Study further considers the preferred locations for such a facility.

Five defined areas (the Study Areas) in North Queensland were considered as part of the assessment:

- Flinders River Catchment;
- Gilbert River Catchment;
- Mount Surprise Region;
- Mareeba-Dimbulah Region;
- Lower Burdekin Region.

The Study also considers the potential ownership structures suitable for such a facility and provides a roadmap to converting the opportunity through investment.

Stakeholders

The Study was overseen by a Project Reference Group (PRG) comprising of representatives of MITEZ member organisations and the Queensland State Government.

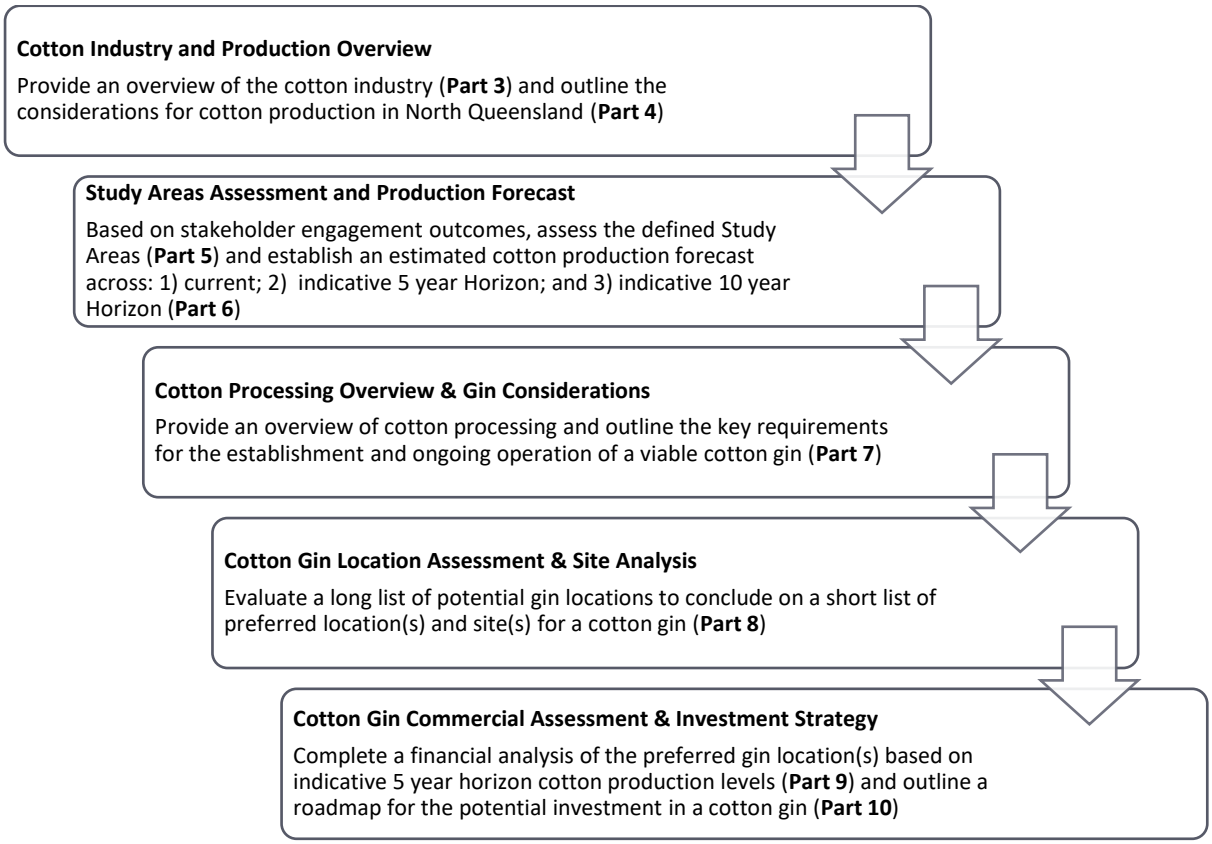
A PVW Partners joint venture team was appointed to complete the Study. The team comprised of:

- W.Wightman Advisory;
- Northern Australia Agricultural Solutions Advisory;
- Brazier Motti;
- Captive Communications.

External stakeholder engagement was conducted through the course of the assessment and involved various growers and landowners, industry representatives, Government representatives, researchers and community members.

Study Methodology

A staged methodology was adopted in completing the Study. Outlined below are the key stages completed and a reference to the relevant Report section to which each relates.



The Lower Burdekin region was introduced into the Study in February 2021. As a result, Step 2 of the methodology for the Lower Burdekin was completed by way of a desktop review, with stakeholder engagement limited to only selected industry representatives for the region.

Cotton Production Assessment

An assessment of each Study Area was completed to establish an estimated cotton production volume forecast across three defined point in time scenarios:

- Current Production;
- 5 Year Horizon Production;
- 10 Year Horizon Production.

Referencing grower and industry stakeholder production expectations, the assessment considered the factors critical for cotton production and evaluated each Study Area against these. The production forecasts by growing region are provided below:

Growing Region	Study Area	Scenario 1 Current (bales)	Scenario 2 5 Year Horizon (bales)	Scenario 3 10 Year Horizon* (bales)
Cloncurry	Flinders River Catchment	-	-	-
Julia Creek	Flinders River Catchment	5,800	52,800	60,000
Richmond	Flinders River Catchment	400	38,000	65,000
Hughenden	Flinders River Catchment	-	-	18,000
Normanton	Flinders River Catchment	-	9,000	49,500
Mount Surprise	Mount Surprise Region	8,000	26,650	36,550
Georgetown	Gilbert River Catchment	5,350	44,800	111,075
Ayr	Lower Burdekin Region	-	24,000	48,000
Mareeba	Mareeba - Dimbulah Region	7,200	7,560	19,800
Total North Qld		**26,750**	**202,810**	**407,925**

**10 Year Horizon total volumes include expected cotton production from the Gilbert River Irrigation Project, Richmond Agriculture Project, and Hughenden Irrigation Project. It is noted that these projects are all still subject to investigation and are yet to be approved for construction.*

Scenario 2 - the 5 Year Horizon Production forecast has been adopted for assessments in this Study.

Cotton Gin Location Assessment

An assessment was completed to evaluate a long list of locations with the objective of identifying the preferred locations for a cotton gin in the region. The long list of locations considered as part of the assessment were:

- Cloncurry;
- Julia Creek;
- Richmond;
- Hughenden;
- Mount Surprise;
- Georgetown;
- Charters Towers.

The long list locations were assessed against a range of weighted criteria for suitability of establishing a cotton gin. Each location was rated accordingly.

Based on the outcomes of the assessment, the preferred cotton gin locations were:

- Richmond;
- Hughenden;
- Mount Surprise.

Specific sites within each of these locations were investigated and assessed in terms of the potential to establish a cotton gin.

Financial Assessment

A financial performance assessment was conducted for the three preferred gin locations based on the 5-Year Horizon production volumes for each gin location. In completing the assessment, and for the purposes of differentiating preferred options, only those cotton production volumes located within 350km radius of the gin location were included.

In practice, where only a single gin is located in North Queensland, it is expected that cotton supply beyond the 350km radius would be sourced for processing.

An income statement was prepared to report annual income, variable operating expenses and fixed operating expenses, to generate an Earnings Before Interest, Tax, Depreciation and Amortisation (EBITDA) outcome. The assessment considers the performance of a cotton gin from the perspective of the cotton gin operator or owner. The financial outcomes for growers were not assessed. The outcomes of the assessment were:

	Option 1 Richmond ($)	Option 2 Hughenden ($)	Option 3 Mount Surprise ($)
Total Income	6,356,000	6,356,000	5,530,700
Less: Variable Operating Costs	(3,050,880)	(3,050,880)	(2,654,736)
Less: Fixed Operating Costs	(1,188,603)	(1,188,603)	(1,188,603)
EBITDA	**2,116,517**	**2,116,517**	**1,687,361**
EBITDA % of Income	**33%**	**33%**	**31%**

The financial assessment identifies that all three locations are suitable options for the establishment of a cotton gin, however, Richmond and Hughenden present a higher EBITDA than Mount Surprise, primarily due to the greater cotton supply volumes. An estimated capital cost of $35,395,000 was determined to establish a cotton gin site to an operational level in North Queensland. This estimate includes costs associated with infrastructure, equipment and project management requirements.

Conclusion and Investment Roadmap

Based on the assessment completed, in a 5-year horizon, a cotton gin in the North Queensland region will be viable, and the establishment of such a processing facility presents as an attractive investment opportunity. **Overall, Richmond or Hughenden were identified as the preferences for a cotton gin and secondarily was Mount Surprise.** The establishment of further cotton gins in the region will be predicated on the ability to attract further cotton supply volumes.

Notwithstanding, certain impediments to the growth in cotton production volumes were identified by stakeholders, such as water access and availability, land tenure, vegetation clearing and environmental management. To maintain and grow the confidence of current and future growers to invest in cotton production enterprises, these matters must be addressed by Government.

The long-term sustainability of the industry is predicated on the growth of irrigated production, which is intrinsically linked to the establishment of large-scale water infrastructure in the region, such as the Gilbert River Irrigation Project, Richmond Agriculture Project and the Hughenden Irrigation Project. However, it is noted that, based on the current Water Plans, the ability to access the required volume of water to meet the needs of all three projects has been identified as a major challenge by project proponents.

It is recommended that a final investment structure and funding option for a cotton gin is determined through a structured engagement process, completed by MITEZ or another appropriate industry advocate. It is anticipated that the establishment of a cotton gin will be primarily sourced through private funding, with the preferred investment structures likely to be a grower owned and operated model, direct corporate investment, or a combination of these.

It is recommended that further evaluation of the preferred gin location is completed through a business case or similar assessment. This assessment would also be supported by a targeted marketing campaign to identified investors, with detailed due diligence and transaction structuring completed subsequently.

Recommended Actions

To advance this Study and to progress further towards a sustainable cotton industry in North Queensland, supported by one or more cotton gins, we recommend the following actions are undertaken by MITEZ or other appropriate industry advocate.

1. Cotton Production

- Continued consultation with growers and landowners to formalise interest and commitments to growing cotton, and to supply a locally established cotton gin;
- Education for existing growers regarding the opportunities for the integration of cotton as a rotational crop or into a livestock production enterprise;
- Lobbying of Federal and State Governments to review existing land use, environmental and vegetation management legislation and regulations to enable the establishment and expansion of broadacre cropping operations;
- Lobbying State Government to provide increased certainty to growers and landholders regarding water access and availability.

2. Cotton Gin Establishment

- Identify the primary proponent for the project and establish an appropriate governance structure to advance the project through further assessment and/or investment phases;
- Undertake an assessment of the investment appetite for a cotton gin based on the findings outlined in this Report;
- Engage professional services for the preparation of a detailed business case based on the preferred of the three identified location options. The business case should include preliminary design and planning, project management and structuring, economic and social impact assessment, funding assessment, operational planning, confirmation of supply volumes and establishment of preliminary supply chain requirements;
- Completion of a detailed risk assessment on the willingness of growers to pay for a cotton ginning service in the region and to establish a cotton supply commitment;
- Continue gin site land evaluations and zoning investigations, including engagement with Local Councils on environmental and community impacts;
- Review the status of the proposed major water and agricultural infrastructure projects and update production assessment information to reflect significant changes to operational timeframes for these projects.

3. Other Matters

- Assess the viability of utilising Port of Townsville as the primary export terminal for cotton grown in North Queensland. Engage existing cotton gin operators, port operators, shipping lines and merchant traders to investigate feasibility of the port terminal;
- Investigate the potential of integrating rail as a mode of transporting cotton from the growing region to gin, and from the gin to port terminal;
- Execute the Communication Strategy to distribute Report findings and messages to stakeholder groups.

1 STUDY OVERVIEW

1.1 Background

Expansion of broadacre cropping in North Queensland has been discussed, reported and trialled on numerous occasions. Cotton production is widely regarded as an integral component of this expansion, with the potential to yield significant economic benefits and employment opportunities for the region.

Interest in North Queensland as a cotton production region has resulted in significant investment in strategic cropping land by Southern growers. In addition, several existing landholders, in all five Study Areas, have completed successful cotton trials, applying both rain grown and irrigated production methods. All cotton produced as part of the trials was transported to Central Queensland for processing, a distance of approximately 800km - 1,200kms.

To support the expansion of broad acre cropping in the region, numerous water infrastructure projects have been proposed and progressed through to feasibility study and business case stages. The focus of these being to ensure appropriate and reliable water supply is available to support agriculture growth through the establishment of broad scale irrigation. Projects such as the Gilbert River Agricultural Project, Hughenden Irrigation Project, Richmond Agricultural Project and Burdekin River Dam Stage 2 are important strategic precursors for development of the region.

It is widely regarded that the critical factor influencing the expansion of cotton production in North Queensland is the establishment of suitable processing facilities within the region. The expansive distance between the identified North Queensland growing regions and current processing facilities located in Central Queensland presents as a significant impediment to the long-term sustainability of cotton production in the region.

1.2 Study Areas

This Study considers five defined Study Areas within the North Queensland region (collectively referred to as the Study Region), being:

- Flinders River Catchment;
- Gilbert River Catchment;
- Mount Surprise Region;
- Mareeba-Dimbulah Region;
- Lower Burdekin Region.

The profile and characteristics of each Study Area has been outlined in detail in Part 5 of this Report.

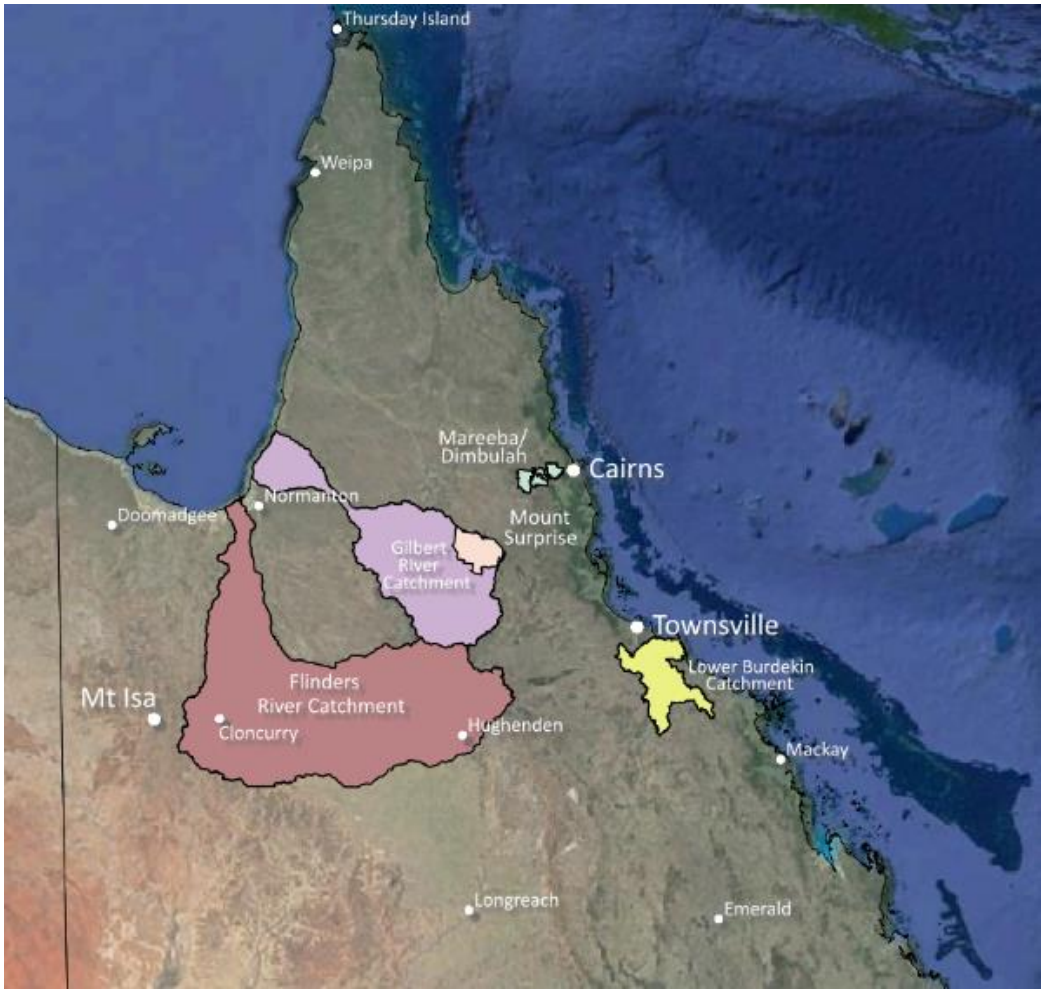


Figure 1 Map of Study Areas

1.3 Related Studies

Recent investigations have been completed by various organisations, assessing the viability of broadacre cropping and agricultural expansion in Northern Australia and North Queensland. These investigations consider the strategic rationale behind expansion, provide context for the requirements underpinning the development, and outline the anticipated benefits available to the region.

The primary recent investigations referred to as part of this Report have been outlined below:

- **Commonwealth Scientific and Industrial Research Organisation (CSIRO) - The Flinders and Gilbert Agricultural Resource Assessment (FGARA)**[1] forms part of the North Queensland Irrigated Agriculture Strategy (NQIAS) which is a suite of projects investigating the potential for development of water resources in North Queensland. The FGARA provides a comprehensive and integrated evaluation of the feasibility, economic viability and sustainability of water resource development in the catchments of the Flinders and Gilbert rivers in North Queensland, an area known locally as the 'Gulf region'.

[1] https://www.csiro.au/en/research/natural-environment/water/Flinders-Gilbert

- **CRC for Developing Northern Australia (CRCNA) – Northern Australia Broadacre Cropping Situational Analysis** [2] - provides a comprehensive analysis of the potential for the expansion of broadacre cropping in Northern Australia and outlines the benefits and considerations related to this expansion.
- **Cotton Catchment Communities CRC** – **Feasibility of Cotton Production in the Burdekin** [3] – a collaborative study by Queensland Government Department of Agriculture Fisheries and Forestry (DAFF), CSIRO, Cotton Catchment Communities CRC and commercial partners, assessing the feasibility of cotton production in the Burdekin region. This research is a thorough review of cotton trials over a 5-year period.

1.4 Study Governance

A structured governance and project management approach was implemented in undertaking the Study, to ensure the tracking of progress, engagement, validation of information and risks were managed through all stages of the assessment. In addition, the skills and experience of the project team engaged to deliver the Report ensured the right expertise was applied to the appropriate areas in each part of the Study.

1.5 Study Owner

MITEZ is the owner of this Study and has been a long-time advocate of the expansion of broadacre agricultural development in the North Queensland region. MITEZ has lobbied State and Federal Government representatives to consider this initiative and to provide certainty to stakeholders through commitments to infrastructure investments. MITEZ view cotton production as a potential cornerstone crop within the agricultural industry in North Queensland.

The Queensland Government has provided financial assistance to MITEZ, in accordance with the Financial Assistance Agreement (FAA), to complete this Study and Report.

1.5.1 Project Reference Group and Project Team

The Project Reference Group (PRG) are chartered with guiding the scope and progress of the Study and for providing referrals to relevant stakeholders and stakeholder groups. The PRG is comprised of representatives from MITEZ member organisations and the Queensland Government.

The project team were tasked with delivering the scope of the Study and delivering the final Report and communications strategy in accordance with the requirements of the FAA. MITEZ appointed a PVW Partners led project team to complete the Study. PVW Partners was supported by their joint venture partners:

- W.Wightman Advisory;
- Northern Australia Agricultural Solutions Advisory;
- Brazier Motti;
- Captive Communications.

[2] https://crcna.com.au/resources/publications/northern-australian-broadacre-cropping-situational-analysis
[3] Grundy, P. (2012) Feasibility of Cotton Production in the Burdekin. Project Report. Cotton Catchment Communities CRC

Regular meetings between the PRG and the project team were completed to provide status updates and to address any impediments encountered during the course of the Study.

1.5.2 Governance Structure

The established governance structure to support the delivery of the Study is represented in Figure 2.

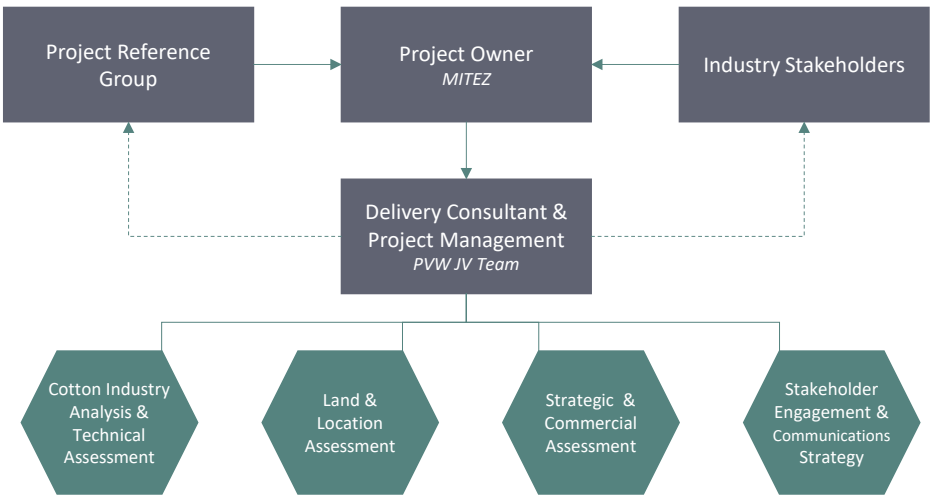


Figure 2 Study Governance Structure

2 STUDY OBJECTIVES AND METHODOLOGY

2.1 Study Objectives

The primary objective of the Study is to consider the potential to establish a viable cotton gin in North Queensland to support the long-term sustainability of the industry in the region. Secondarily, the Study seeks to determine the most suitable location for such a facility within the Study Region.

It is expected that establishing a cotton gin in the region will assist in the sustainable expansion of the cotton production industry and will support broader regional development.

2.2 Methodology

A staged methodology was adopted in completing this Study. Outlined below are the key stages completed and a reference to the relevant report section to which it relates.

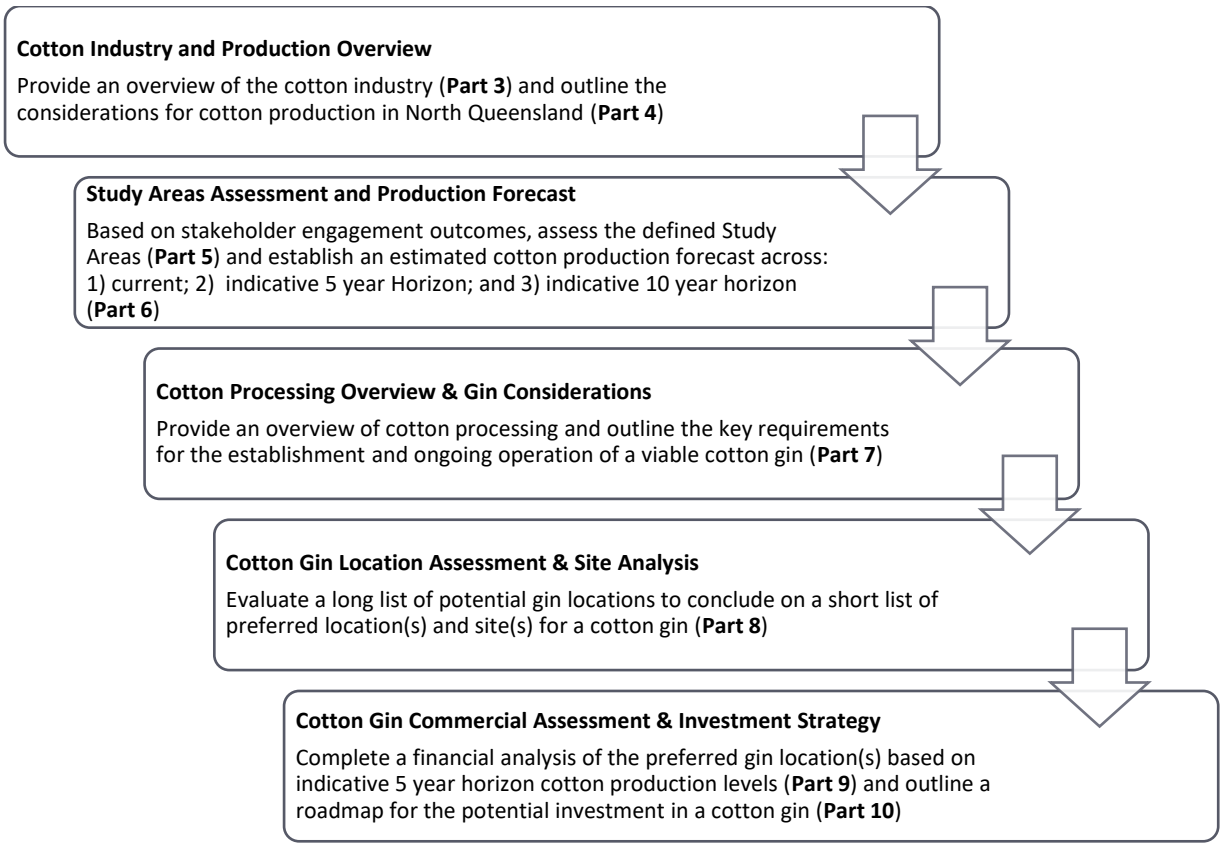


Figure 3 Study Methodology

The Lower Burdekin region was introduced into the Study in February 2021. As a result, Step 2 of the methodology for the Lower Burdekin was completed by way of a desktop review, with stakeholder engagement limited to only selected industry representatives for the region.

The Report provides recommendations to further advance the Study toward the establishment of a cotton gin in the region.

2.3 Study Opportunities

The establishment of a cotton gin, in close proximity to the cotton growing regions, is a critical factor to ensuring the commercial viability and long-term sustainability of cotton production in the region. It is imperative that growers, landowners and other stakeholders, who are likely to invest in such a facility, have confidence in the longevity of the industry.

To provide this certainty, stakeholder groups also look to the various levels of Government to support the expansion in terms of regulatory and legislative reform, investment in enabling infrastructure, such as water, roads and ports, and land usage policy initiatives.

Sustainable expansion of the industry must be addressed in a way, such that the environmental, social and economic impacts are adequately risk managed and balanced, to maximise the overall benefits flowing from the expansion.

The expected opportunities for North Queensland arising from the establishment of a cotton gin, are primarily linked to the potential for securing a long-term sustainable future for cotton production in the region. Specifically, this would include:

- Diversification of agriculture in North Queensland;
- Investment in infrastructure that will have flow on benefits for the broader community and industries;
- Secondary market for cotton by products, such as cotton seed;
- Employment opportunities and economic expansion for local communities;
- A cotton industry supply chain that could be fully regionalised, from farm to port, including reduction of transportation distances and costs.

2.4 Stakeholder Engagement

There is widespread interest in the potential for increasing cotton production, and for establishing cotton processing facilities within the Study Region.

In completing the Study, a comprehensive stakeholder engagement process was undertaken. The stakeholder engagement process was undertaken using various channels and methods, considering COVID-19 impacts and the geographical scale of the Study Region. The outcomes from the stakeholder engagement process have been incorporated in the appropriate sections of this Report. The channels and methods primarily adopted as part of this Study, included:

- Individual consultations via technology or in person;
- Feedback sessions;
- Study Area and site visits;
- PRG meetings;
- Stream lead working group discussions;
- Phone call discussions;
- On farm meetings; and
- Advisor briefing sessions.

A summary of the stakeholder engagement process that was undertaken as part of this Study has been provided in Table 1.

Stakeholder Groups	Stakeholder Sessions
Landowners, farmers and community members	21 individual interviews
Technical specialists and advisors	7 workshops and interviews
Gin owners/ operators	2 interviews
Government representatives	7 data collection interactions
Proposed water and agricultural infrastructure project proponents	3 interviews
Industry advocates	6 data collection interactions

Table 1 Stakeholder Engagement Summary

3 COTTON INDUSTRY AND MARKET OVERVIEW

3.1 Cotton Industry and Market

Australia is a key participant of the global cotton industry and is regarded as producing some of the highest quality cotton lint in the world. It is for this reason that the cotton industry in Australia is an important part of the broader agricultural sector.

Cotton lint is still the most widely used natural fibre and is applied in many industries beyond the main usage for textile manufacture. In addition, cotton seed (by-product of raw cotton processing) is a valuable supplement feed for grazing livestock due to its high protein content and may also be processed into oil or meal.

The Australian cotton industry operates under an unregulated market system. Cotton growers typically sell cotton through an independent merchant for sale in the global market. Australia exports the majority of its cotton to mill customers in various countries such as Bangladesh, China, India, Indonesia, Thailand, Turkey and Vietnam.

Market prices are influenced by many factors such as the quality of product, exchange rates, climate impacts, global market stock management strategies, global and domestic economic changes and pandemic effects, all of which translate into bale pricing ranges of between AUD$300 and AUD$664 per bale.[4] While predictions from industry stakeholders indicate a softening of cotton bale prices, in the short to medium term forecast prices are still averaging above AUD$500 per bale.

Future demand for cotton lint for use in apparel continues to fluctuate due to COVID-19 impacts and will remain unknown for the foreseeable future. An increase in demand for personal protection garments (such as face masks), however, may result in an increase in demand for cotton [5].

Australia's position globally is strategically focused on quality fibre as opposed to volume thus giving a competitive advantage. Yield advances are continually being recognised due to improved farming practices, technology enhancements, pest and weed resistant seed varieties and expanded education awareness and education within the sector.

3.1.1 Cotton Production in Australia

Australia's main cotton growing areas are in Southern Queensland and New South Wales:

- **Southern Queensland** – Emerald, Theodore, Biloela, Darling Downs, St George, Dirranbandi and Macintyre Valley
- **New South Wales** – Gwydir, Namoi and Macquarie Valleys plus along Barwon, Darling, Lachlan and Murrumbidgee Rivers

[4] https://cottonaustralia.com.au/economics
[5] The ICAC Recorder: June 2020 Vol. XXXVIII, No.2. International Cotton Advisory Committee

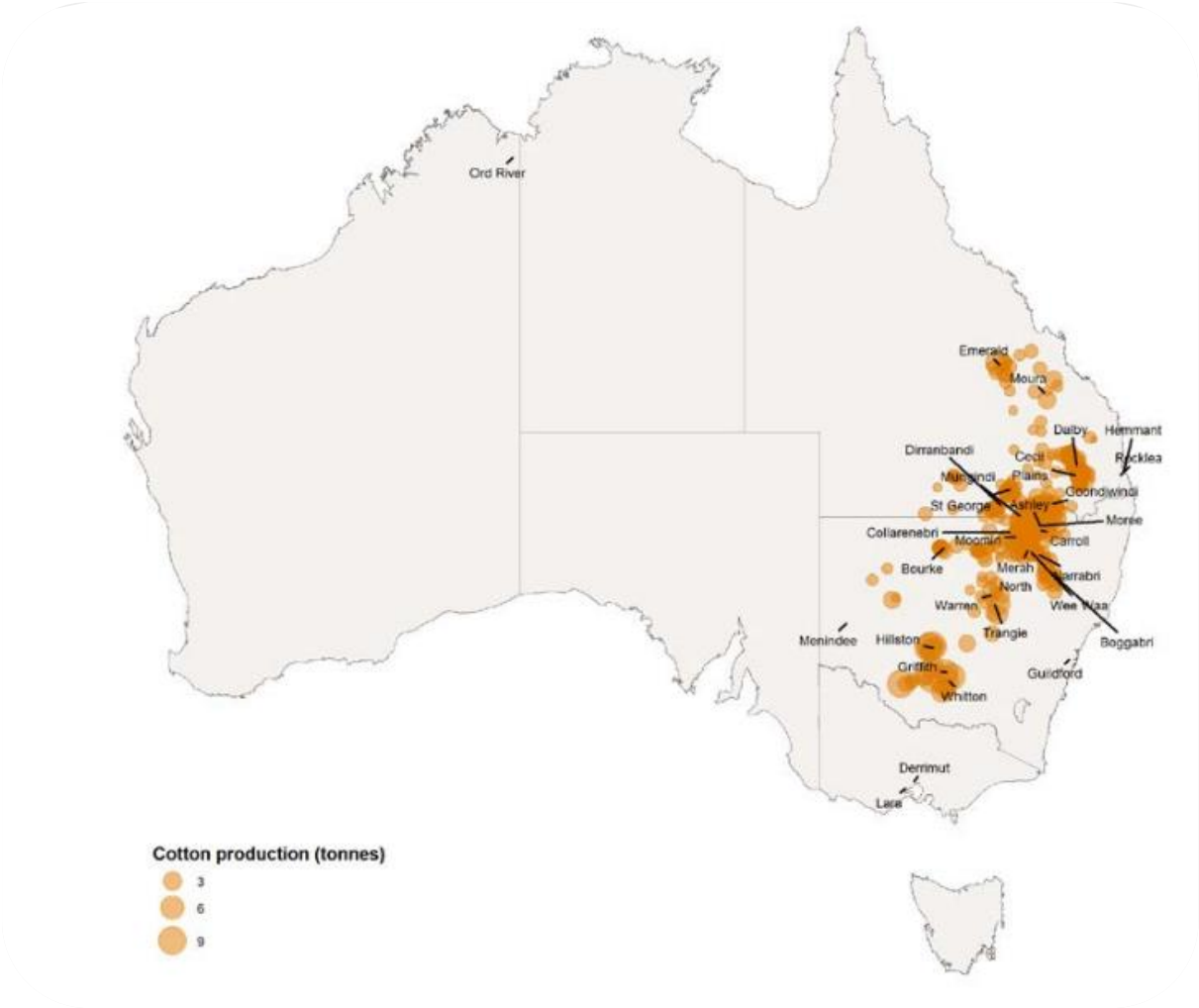


Figure 4 Cotton Growing Regions in Australia – 2015/16 [6]

There are approximately 1,500 cotton farms in Australia, with 90% being family-owned farms producing an estimated 80% of the total volume of cotton annually. Cotton Australia estimates that two thirds of cotton is grown in NSW and one third in Southern Queensland.[7]

On average Australia produces approximately 2.8 million bales of cotton per year. The annual volume, however, has been shown to fluctuate dramatically. Over a 10-year period, the annual volumes fluctuated from a low in 2008 of 600,000 bales to a high in 2012 of 5,300,000 bales.

[6] Department of Infrastructure and Regional Development, Bureau of Infrastructure, Transport and Regional Economics. Freightline 5 – Australian Cotton Freight Transport. February 2018
[7] https://cottonaustralia.com.au/industry-overview

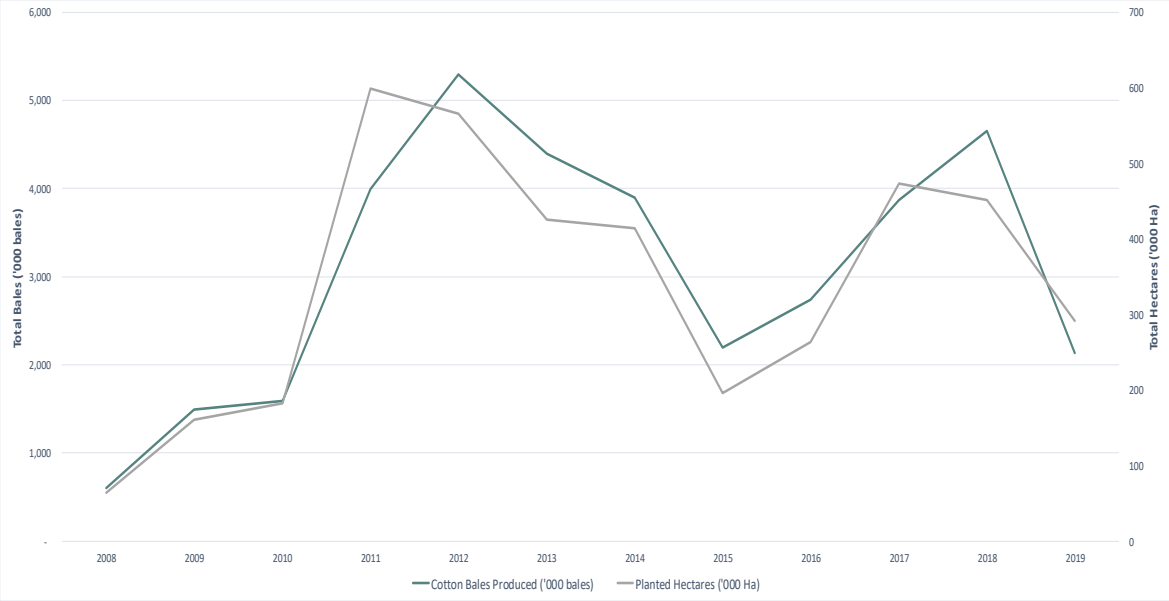


Figure 5 Australian Cotton Volumes and Total Hectares Planted - 2008 to 2019

While it is not within the scope of the Study to interrogate these results, areas of consideration to explain these fluctuations may include environmental conditions (e.g. drought) and shifting grower preferences for cotton over other crops.

3.1.2 Cotton Processing in Australia

Cotton processing is an important element of the cotton supply chain. Raw cotton is processed into lint, seeds and waste at a cotton gin. The refined product is subsequently baled and transported to market via warehousing at the relevant port terminal.

Australia has 38 cotton gins, although not all operate in each season. Cotton gins are typically located within, or within close proximity to, the primary cotton growing precincts. Currently, no cotton gins are located within North Queensland or broader Northern Australia.

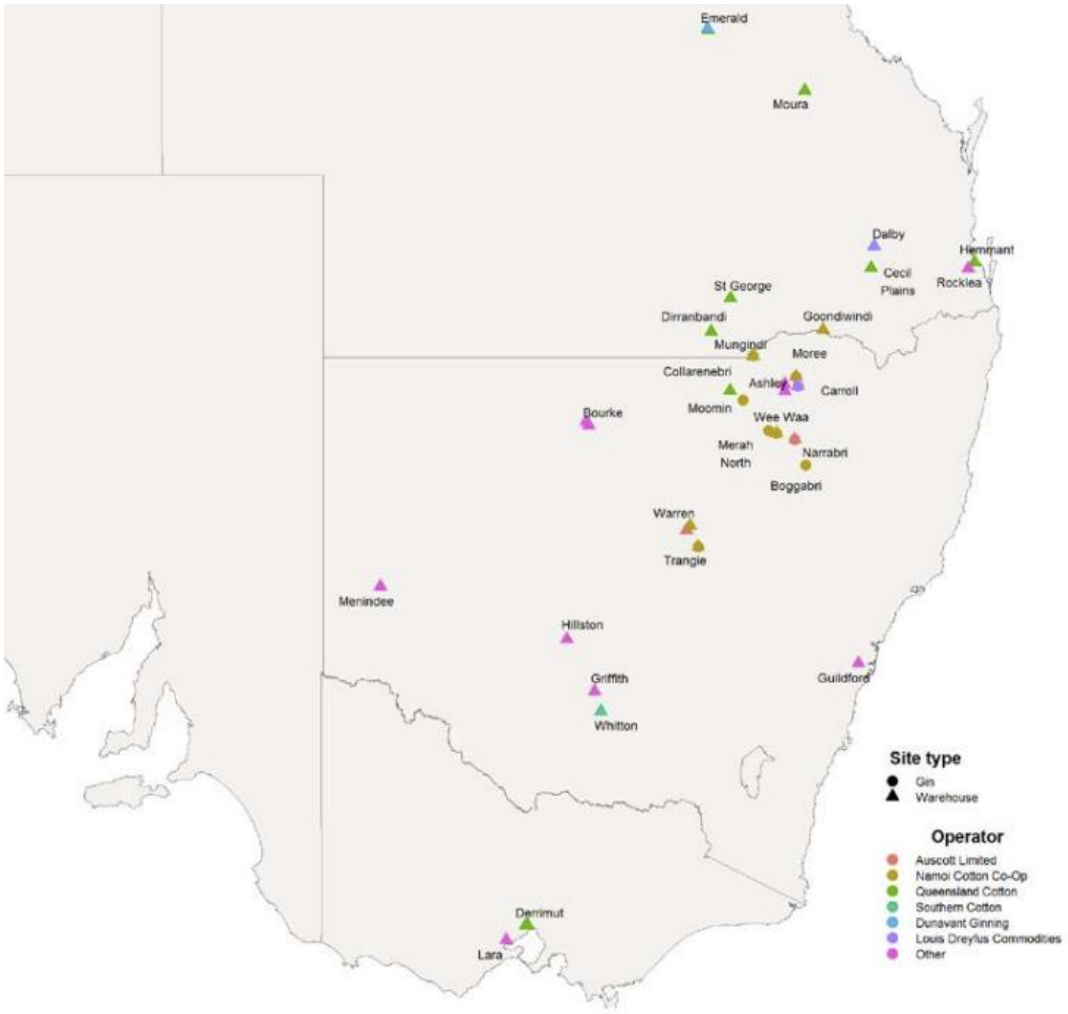


Figure 6 Location of Cotton Gins and Warehouses in Australia [8]

It is important to note that in Australia cotton gins do not purchase the raw cotton from producers but rather operate as an intermediary between the grower and merchant. The cost of cotton ginning is commonly borne by the grower (payable to the gin operator) with the merchant taking possession of the processed cotton at the gin yard (i.e. after processing). The merchant is responsible for the risks and costs associated with transporting the processed cotton bales from gin to market.

3.2 Cotton Industry in Northern Australia

Northern Australia is well positioned to diversify its broadacre cropping industry, with the expansion of cotton production being a likely key component. In comparison to the broad acre cropping industries in southern regions, Northern Australia is relatively undeveloped and presents competitive advantages such as lower land costs, high annual rainfall and underutilised export port infrastructure.

[8] Department of Infrastructure and Regional Development, Bureau of Infrastructure, Transport and Regional Economics. Freightline 5 – Australian Cotton Freight Transport. February 2018

Notwithstanding the potential for development, Northern Australia does also present a range of challenges to this expansion with regard to variable climatic conditions, geographical spread of the region, limited transport infrastructure and land use and water management constraints.

Cotton has been trialled and grown on smaller scale over the past decades across Northern Western Australia, Northern Territory and Northern Queensland with varying success.

A recent business case, commissioned by the Northern Territory Farmers Association (NT Farmers), confirmed that there is significant interest to pursue increased cotton production in Northern Australia, however, identified that the success of this is predicated on establishing appropriate cotton processing facilities close to the production areas [9].

Tipperary Group, a major stakeholder of the NT Farmers business case, has advanced the project through the establishment of WANT Cotton Pty Ltd. The entity was established with the sole purpose of enacting a plan to build a 100 per cent grower-owned cotton gin in the north[10]. The stakeholders are actively investigating funding options for this project.

The Western Australia State Government recently committed funding to commence preliminary design works and approvals for the establishment of a cotton ginning facility in Kununurra. The State funding will supplement work already completed by local investors, Ord River District Co-operative, Kimberley Agriculture Investment Pty Ltd and the MG Corporation[11].

3.3 Cotton Industry in North Queensland

The cotton industry in North Queensland is immature compared to Southern Queensland growing areas, with only small-scale production or trials having been completed. Cotton production trials in North Queensland have been undertaken over the last three decades, with varying outcomes. Many of these trials have been completed in the Gilbert River catchment, Flinders River catchment and the lower Burdekin region. Trials have been completed under both rain grown and irrigation production methods.

Recently, North Queensland has seen an increased interest in cotton production, evidenced by significant investments in strategic cropping land by growers from southern cotton areas, such as investments in Etta Plains and Woodlands in the Flinders River catchment and St Ronan's near Mount Surprise.

The main cotton growing regions in North Queensland are those Study Areas identified in this Report. While North Queensland's cotton industry has not progressed at pace it is widely regarded as a region with a high potential to support broad scale cropping.

Notwithstanding the potential for growth, currently all cotton produced in North Queensland is trucked to Central Queensland for processing which is 800km – 1,200km in distance. The cost of transport for farmers is regarded as one of the main impediments to future expansion of the industry in the region.

[9] PwC (2019) NT Farmers Association: Business Case for the Construction of a Cotton Gin in the Northern Territory.
[10] https://www.northqueenslandregister.com.au/story/7050624/want-cotton-plans-north-australia-gin/
[11] https://www.graincentral.com/news/wa-govt-pledges-4m-to-progress-ord-cotton-gin/

3.4 Supply Chain Considerations

The cotton supply chain is complex, involves numerous participants and stakeholders and is influenced by many factors, as illustrated in Figure 7.

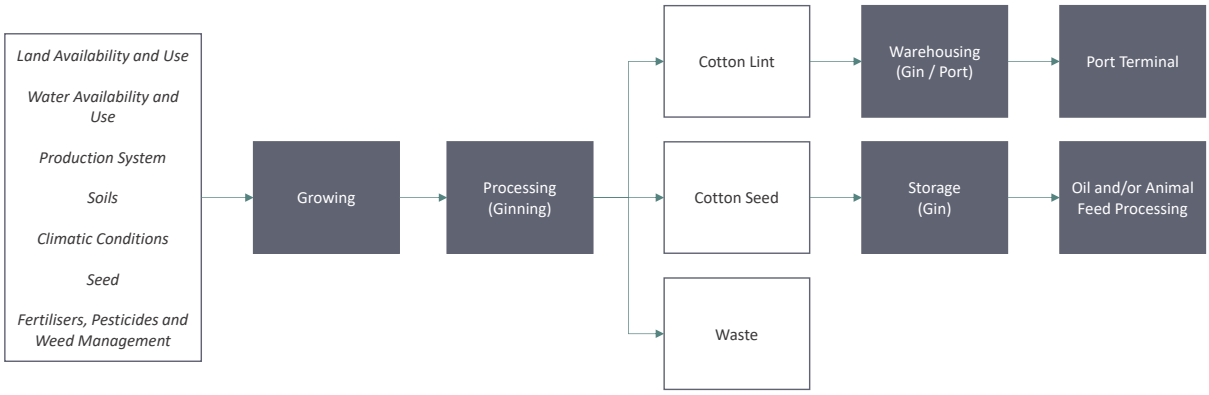


Figure 7 Cotton Production and Supply Chain

Supply chain costs are a critical factor for consideration in relation to cotton production in North Queensland and have a direct impact on crop profitability. Production of cotton in the region must be cost effective for growers to ensure they are incentivised to continue producing cotton and in turn ensuring long term sustainability of the industry in the region.

Transport and export logistics from farm gate to gin location (expense to the grower) and from gin yard to port terminal, including warehousing (expense to the cotton merchant), are significant costs in the supply chain. As such minimising the distance between growing region and gin, and gin to port terminal is critical to maximising returns for the grower and the merchant.

In North Queensland, road transport is most used for transporting raw and processed cotton through the supply chain up to delivery at the port terminal. Part 8 of this Report assesses road transport costings per bale to support the gin location analysis.

Warehousing and handling of cotton occur at three stages of the supply chain:

1. Raw cotton modules receipted by the gin;
2. Processed cotton bales storage at the gin yard;
3. Bulk cotton bale warehousing at the port facility.

Infrastructure at both the cotton gin and the relevant port facility must adequately cater for the storage of product. Part 7 of this Report, outlines some of the requirements needed to manage these functions.

The largest market for cotton produced out of North Queensland is South East Asia, which is currently Australia's largest cotton trading partner. North Queensland is geographically located closer to these trading partners than existing export port terminals in Brisbane, Sydney or Melbourne. Investigation into shipping and warehousing via ports located in North Queensland, such as Townsville, Cairns or Karumba, would potentially support lower overall transportation costs. Additionally, enquiry of the relevant shipping lines and/or merchant traders to utilise regional port terminals would be of importance, as ultimately this is not a decision of the growers, gin operators or port terminal operators.

4 COTTON PRODUCTION

4.1 Cotton Production Overview

The establishment and commercial viability of a cotton gin is predicated on the ability to source sufficient volumes of raw cotton to process. To determine the potential to establish a cotton gin in North Queensland it is necessary to understand the ability to produce cotton in the region to levels that may support such processing infrastructure.

This section of the Report considers the key elements and influences within the cotton production process and highlights considerations specific to the North Queensland region. The Study identifies the critical factors necessary to transform the region from the trial stage to a sustainable production region. Importantly, this section provides context to the cotton production potential of each of the five Study Areas, as assessed in Part 5 of the Report.

The following key consideration within the cotton production process have been discussed in further detail throughout this section.

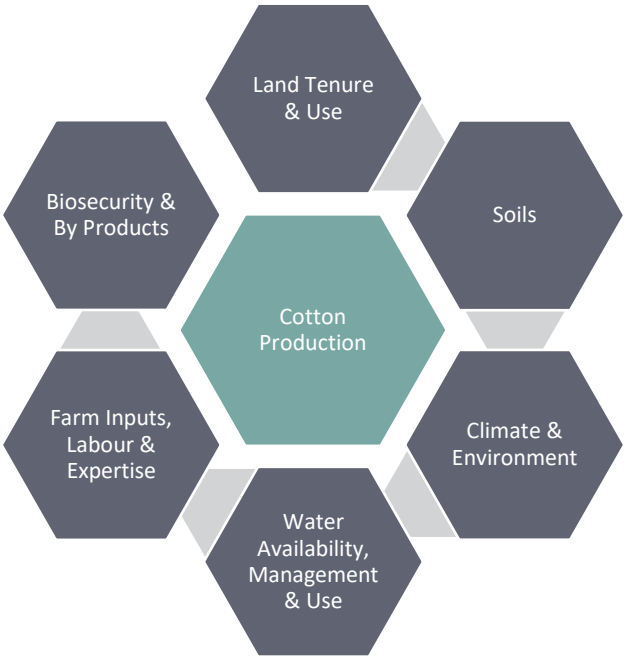


Figure 8 Cotton Production Factors and Considerations

4.2 Growing Cotton Overview

The hibiscus plant species is where a derivation of the cotton plant originates. There are many varieties of cotton, however, in Australia production generally relies on seeds with traits to be more weed and pest resistant and have a potential for greater yields and quality of fibre. Australia's commercial cotton crop is primarily based on *Gossypium hirsutum*, or 'upland cotton' which originated from central America and makes up about 90% of the world production[12]. The cotton plant produces white lint natural fibre as well as cotton seeds.

[12] Grundy P, Yeates S, Grundy T (2012) NORpak: Cotton production and management guidelines for the Burdekin and north Queensland coastal dry tropics region 2012. Australia. © CSIRO 2013

The CSIRO and associated organisations have been breeding and refining cotton for over 30 years, which has resulted in the development of over 100 cotton varieties in Australia. Innovations and research into genetics has resulted in a less water intensive crop with associated improvements to yields and quality and pest and weed resistance [13].

While there are many varieties of cotton seed available, currently the primary varieties sold are those that consist of three distinct technology features, being

- Bollgard 3: stacked three gene, including Roundup Ready Flex;
- Roundup Ready Flex: single gene;
- Conventional.

Cotton Seed Distributors (CSD) are the sole distributor of cotton seed to growers in Australia. The variety selected for growing cotton in North Queensland will be determined by the grower, however, considering known weed and pest issues in the region, there are preferences towards Bollgard 3 varieties [14].

Cotton is harvested with specialised mechanical harvesters once the cotton bolls crack open and the lint is exposed. Once harvested, the cotton is processed into round modules and wrapped in plastic, prior to being transported to the cotton gin for processing into lint, seed and waste. The cotton lint is then graded for quality based on characteristics of length, density, strength, contamination and stickiness, with a premium being paid for higher quality cotton lint. Australian cotton is known for its quality, especially in length, strength and low amount of contamination.

The typical cotton growing seasons in Australia vary depending on location. Table 2 identifies the indicative growing seasons based on region.

Region	Soil Groundwork	Planting	Growing Period	Harvesting
Northern	Aug-Dec	Dec-Jan	Jan-Jul	Jul-Aug
Southern	Apr - Jul	Aug - Dec	Sept – May	Jan - Jul
Other Region	Jul - Sep	Oct – Nov	Nov - Mar	Mar – Jun

Table 2 Australia Geographical Cotton Growing Seasons

4.3 Land Tenure and Use

Legislation and regulation related to land tenure, use and management can be complex. There is an extensive amount of legislation that applies to the establishment and management of scaled cropping operations. Based on feedback from growers, landholders and other industry stakeholders, vegetation management, environmental management and land tenure are some of the major impediments to the expansion of any cropping operations in the region. These matters are regulated by both the Australian and Queensland governments.

[13] https://www.csiro.au/en/Research/AF/Areas/Crops/Cotton
[14] https://www.graincentral.com/news/cotton-makes-a-comeback-in-australias-north/

The following list summarises some of the relevant legislation that must be considered by landowners prior to establishing new broad acre cropping operations:

Queensland Government Legislation & Regulations
Land Act 1994
Sustainable Planning Act 2009
Vegetation Management Act 1999
Fauna Conversation Act, 1974
Biosecurity Act, 2014
Reef Protection Regulations
Planning Act, 2016
Agriculture Standards Act, 1994
The Environmental Protection Act, 1994
Nature Conservation Act, 1992

Table 3 Queensland Government Legislation and Regulations

Commonwealth Government Legislation & Regulations
Environment Protection and Biodiversity Conversation Act 1999
Native Title Act 1993

Table 4 Commonwealth Government Legislation and Regulations

It is widely agreed that to provide certainty to landholders and future growers, all tiers of Government need to align on policy framework, and support changes simplifying the application of vegetation clearing, land tenure and use, environmental standards and native title legislation and regulations. Professional advisory is often required to understand the matrices of Acts and Regulations to analyse the impacts of these before any capital investment can be made.

4.3.1 Vegetation Clearing and Environmental Management

The clearing of vegetation in Queensland is regulated by both the Queensland and Australian governments. Some Local Governments also regulate clearing. The Regulations are specifically focused on the protection of flora and fauna and ensuring proposed land uses are sustainable. Based on feedback from landholders, the three Acts below have been identified as the primary considerations for the expansion of any broad acre cropping in the region:

- **Environmental Protection and Biodiversity Conservation Act 1999** – to be considered where proposed clearing has a significant impact on matters of environmental significance, such as threatened species or ecological communities.
- **Nature Conservation Act 1992** – to be considered where proposed clearing impacts protected native flora and fauna.
- **Vegetation Management Act 1999** – to be considered where proposed clearing involves native vegetation (original or regrown).

The application of these three Acts is regarded as onerous, rigid and complex. In the current form, these Acts combined provide little certainty or incentive for growers to establish or expand broadacre cropping enterprises.

4.4 Soils

Cotton is a hardy species and is grown in various locations around the world, however, each location brings a distinct set of challenges typically due to the specific climate and soils present. In Australia, cotton plants are most successfully grown in grey, brown and black cracking clay soils (part of Vertosol group of soils). Cracking clay are also well regarded for irrigation systems due to their high-water retention capability. These soils tend to be more fertile than sandy loam soils.

Notwithstanding, cotton has been grown successfully in a wide range of sandy loam soils in Australia and abroad. Certain soils, such as some red soils, have challenges regarding high salinity levels which will impact growth of the cotton plant.

Soil mapping for the Study Areas, in Part 5, was completed by a desktop review of soil mapping studies completed by the CSIRO and other Queensland Government agencies and departments.

4.4.1 Soil Management

The quality and conservation of Australian soils through crop rotations and land management practises has supported the uplift in cotton yields, compared to other countries.

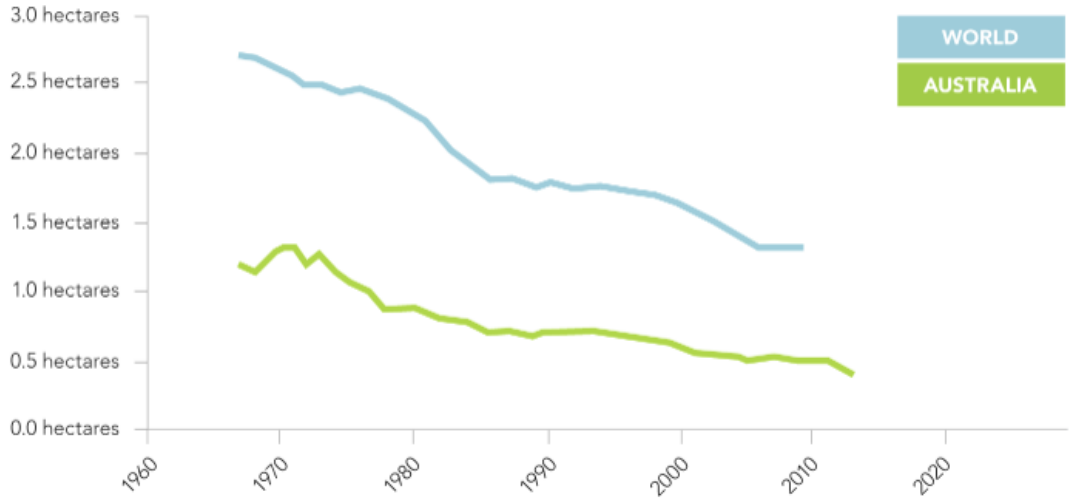


Figure 9 Hectares to Produce a Metric Ton of Cotton Fibre [15]

The primary factors considered in relation to optimal soil management practices include:

- Crop rotation;
- Stubble retention;
- Weed management;
- Erosion management;
- Reducing compaction;
- Improved nutrients / fertiliser;
- Moisture retention.

Optimising soil management techniques is largely dependent on the environmental, soil and land characteristics specific to the location of the farming operation.

[15] https://cottonleads.org/sustainable-production/land-soil-australia/

4.4.2 Crop Rotations

A widely adopted means of optimising soil management for any broadacre cropping model is to reduce tilling, retain stubble and manage pests via appropriate crop rotations.

Globally, high cotton demand has resulted in many producer nations to strategically seek quantity over quality and therefore crop rotations are limited in these regions. Australian's cotton industry strategy has always tended towards quality, and this includes the adoption of crop rotation management.

The significance of cotton crop rotation with other fodder or vegetable crops is to reduce the incidence of pests, to protect soil quality and subsequently improve soil productivity. Australian cotton growers often select crop rotations with mungbeans, corn, chickpeas or sorghum for these reasons.

Cotton, as an alternative crop for other broad acre cropping operations (such as sugar cane) and for inclusion in mixed use livestock and fodder production operations, has also garnered interest from landowners within North Queensland.

4.5 Climate and Environment

Cotton grown in North Queensland faces some very different challenges when compared to traditional temperate growing regions in Southern Queensland and New South Wales. While cotton is a hardy and resilient species, crop management reflective of the specific environmental conditions in North Queensland is important for crop success and yield outcomes.

North Queensland has a highly seasonal and variable climate with two seasons generally categorised across the region - the wet season and dry season. Year on year climate conditions may also vary significantly with extended dry years not uncommon for much of the region.

The wet season typically extends from November to April and involves high volume of rainfall in a condensed period, combined with high to extreme average temperatures. During this time, tropical cyclones and low-pressure systems are also common which typically bring heavy rainfall, flooding and damaging winds to some parts of North Queensland. The impacts of these, however, are typically worse in coastal areas.

The dry season is characterised by extended periods of low to very low rainfall and high average day time temperatures. In North Queensland, the dry season typically extends from April to November and sometimes beyond these dates.

Cotton requires periodic water application, high temperatures and ample sunlight. Cotton seeds typically require a high soil moisture content and mid-range temperatures for germination. During the growth phase, the optimal temperature is between 14 and 26 degrees Celsius (night time) and below 32 degrees Celsius (day time)[16].

However, the average cotton plant can survive in high temperatures for short periods without significant damage. As the growth phase of cotton plant progresses, the requirement for watering becomes more frequent.

[16] https://www.cottoninfo.com.au/index.php/blog/managing-heat-stress-cotton-january-2018

4.6 Water Availability, Management and Use

Access to water is regarded as one of the major challenges for the expansion of broad acre cropping in North Queensland. While the region does have high seasonal rainfall, other climatic conditions, such as evaporation rates and the timing of rainfall, do impact the viability of cropping in the region. In particular, high evaporation rates during the dry season and condensed rainfall periods during the wet season, that are common in North Queensland, increase cropping risks for purely rain grown crops. Notwithstanding, successful rain grown cotton production still occurs in North Queensland.

It is widely held that the long-term sustainability of the cotton production industry in North Queensland is predicated on the growth of irrigated production, which is intrinsically linked to the establishment of large-scale water infrastructure.

Much of the water identified for irrigation across the Flinders and Gilbert River catchments (including Mount Surprise) would be obtained directly from natural watercourses (rivers and creeks). Some groundwater (bores) is available in the region, however, the accessible volumes are significantly less than those obtainable from surface water sources. There currently exists limited suitable off or instream water infrastructure (dams and irrigation schemes) in these areas to provide readily accessible, continuous and reliable water for growers.

For the Mareeba-Dimbulah and Lower Burdekin regions on the other hand, water for irrigation is supplied through supplemented Water Supply Schemes (WSS) which is fed out of major water storages. This type of system provides a high degree of reliability in terms of water delivery to water allocation holders.

The water that is available through existing unsupplemented water sources (that is, natural water courses and groundwater) is impacted by factors such as the location and timing of rainfall, run off rates and aquafer recharge rates and therefore the annual volume of water available for use significantly varies year on year.

In addition, availability of water is also impacted by strict water regulations regulating the volume and timing of water harvesting. Farmers, landholders, growers, water infrastructure project proponents and other industry members have identified access to water as one of the leading impediments to growth in the North Queensland cotton industry. Current regulations do not provide adequate certainty to industry participants to obtain access to sufficient water to meet the requirements of individual operations or major water projects into the future.

4.6.1 Water Management

Water resource management in Queensland is regulated under the Water Act 2000 (Qld) (Water Act) and the Water Regulation 2016 (Qld) (Water Regulation) (collectively referred to as 'Water Legislation'). The Water Legislation establishes a framework for the sustainable planning, allocation and use of water in Queensland.

The framework for managing water consists of the following key elements:

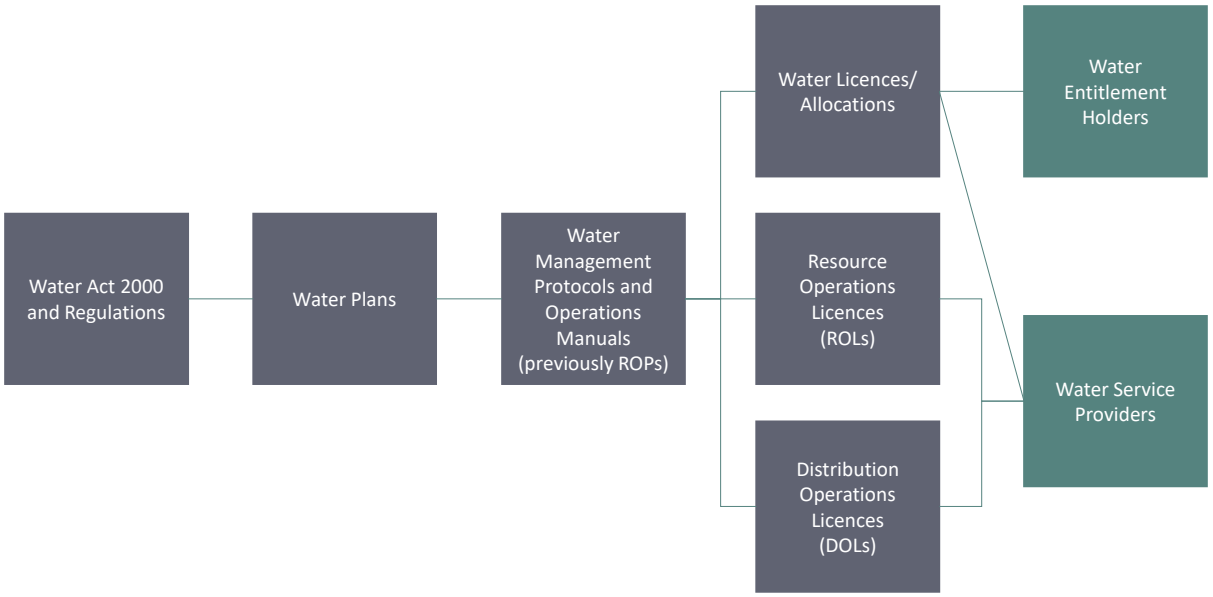


Figure 10 Queensland Water Legislation and Management Framework

Water Plans establish a system for the allocation and use of water resources of a specific region, considering a range of factors regarding how water may be allocated and used. Water allocations are separate from land, tradeable, perpetual in tenure and are subject to the requirements of the overall framework.

Water Plans manage supplemented water (supplied through a ROL or major instream water infrastructure) and unsupplemented water (not supplied through a ROL or related to major instream water infrastructure), including water in a watercourse, lake or spring and underground water.

The Water Plans impacting the Study region are the:

- Water Plan (Gulf) 2007 (the Gulf Water Plan);
- Water Plan (Barron) 2002 (the Barron Water Plan);
- Water Plan (Burdekin Basin) 2007 (the Burdekin Basin Water Plan);
- Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017 (the GAB Water Plan).

Due to the GAB Water Plan extending beyond the boundaries of North Queensland Study Region, it has not been considered in detail as part of this Study.

Gulf Water Plan

The river catchments included within the Gulf Water Plan are identified in Figure 11. This Study specifically considers two catchments within this plan, being the Flinders River catchment and the Gilbert River Catchment.

Implementation of the Gulf Water Plan is managed by the Gulf Resource Operations Plan 2010 (Gulf Water ROPs) which sets out the specific rules and requirements for water use and water management in the plan area to meet the overarching objectives defined in the Gulf Water Plan.

Figure 11 Gulf Water Plan Area Map [17]

Barron Water Plan

The Barron Water Plan consists of the Barron River catchment and the upper reaches of the Walsh and Mitchell Rivers. The plan area covers most of the Atherton Tablelands region and includes the Mareeba Dimbulah Water Supply Scheme (MDWSS). [18]

For the purposes of the Study, the main consideration within the Barron Water Plan is the MDWSS, which covers the agricultural land specific to the Mareeba-Dimbulah study area. The scheme operates under a Resource Operations Licence (ROL) held by Sunwater.

It should be noted that the Barron Water Plan also covers the use of unsupplemented surface water and groundwater within the plan area and specifically for the Mareeba-Dimbulah region. However, the volumes allocated under these areas are minor.

[17] Minister's Performance Assessment Report, Water Plan (Gulf) 2007, Department of Natural Resources, Mines and Energy, 2018
[18] https://www.sunwater.com.au/projects/mareeba-dimbulah-wss-efficiency-improvement-project/

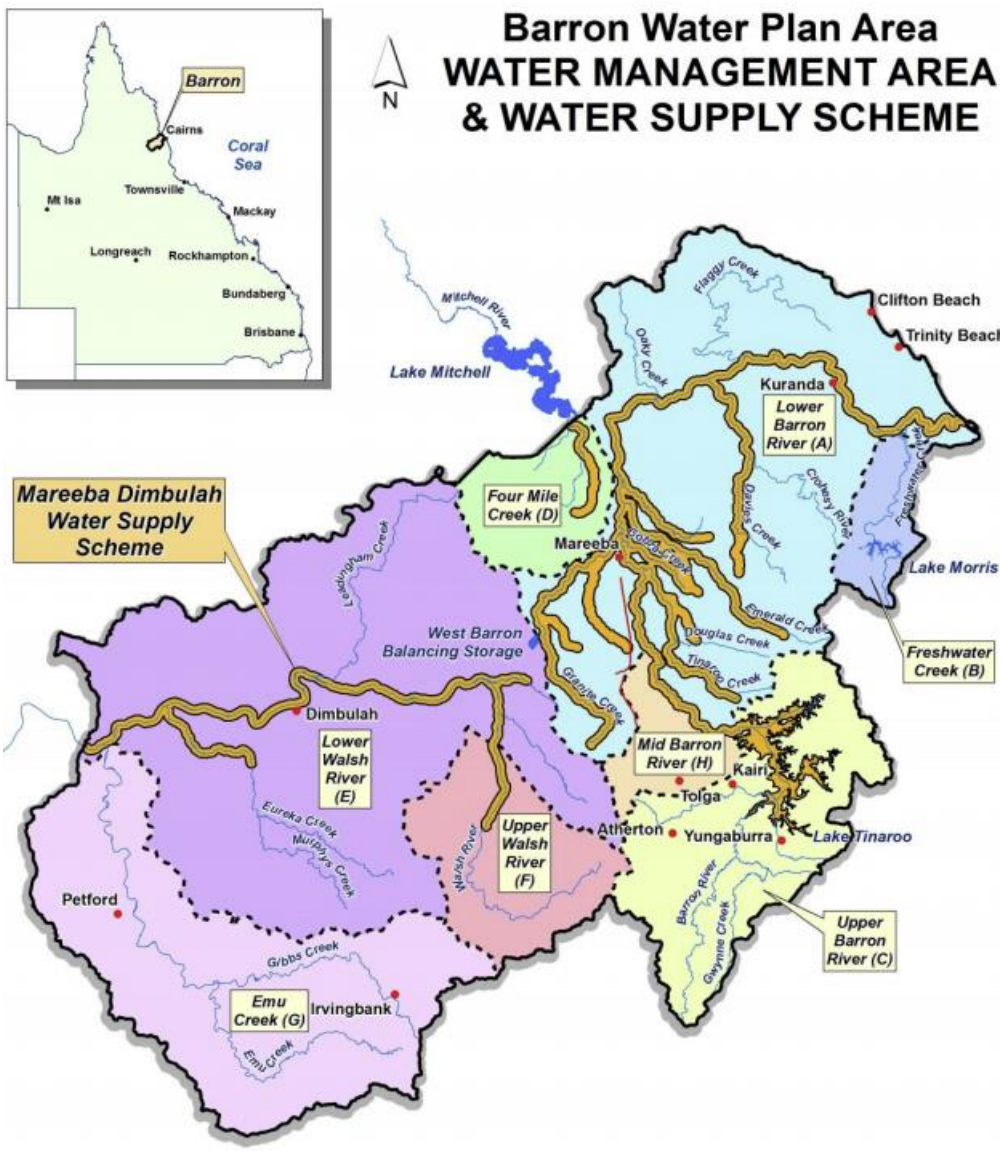


Figure 12 Barron Water Management Area and MDWSS [19]

Burdekin Basin Water Plan

The Burdekin Basin Water Plan extends from Alpha in the south to Greenvale in the north. The plan area is divided into seven sub-catchment areas (Figure 13). The Burdekin Falls Dam is the largest water storage in the plan area and supplies the Burdekin Haughton Water Supply Scheme (BHWSS) (supplemented surface water).

The BHWSS is a supplemented surface water scheme managed by Sunwater that supplies water for irrigation to customers located in the lower Burdekin region. The scheme includes the Burdekin Falls Dam, several weirs and a large expanse of channels and drain systems. It is estimated that the scheme supports up to 50,000ha of farmland in the region [20].

[19] Minister's Performance Assessment Report, Water Plan (Barron) 2007, Department of Natural Resources, Mines and Energy, 2019.
[20] https://www.sunwater.com.au/schemes/burdekin-haughton/

Unsupplemented surface water is managed by designated water management areas (WMA), of which three main areas exist under the plan, the Haughton, Lower Burdekin and Bowen River areas.

Three underground water areas (UWA) exist within the plan area being the Highlands, Greater Western and Burdekin UWAs.

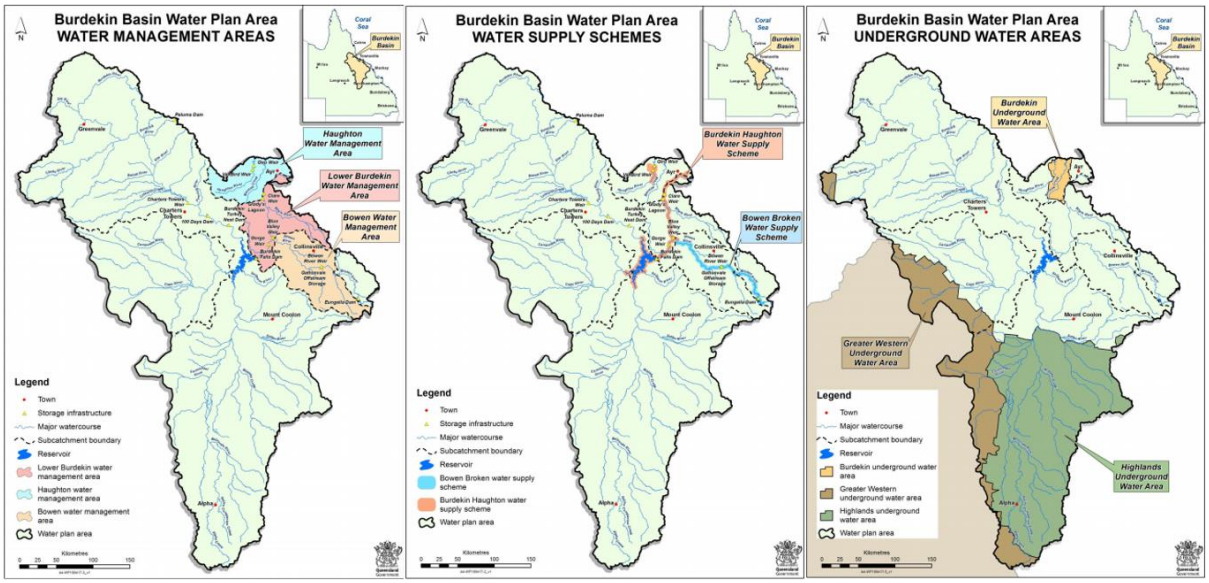


Figure 13 Burdekin Water Plan WMA, WSS and UWA [21]

For the purposes of this Study, the following are considered in relation to the Lower Burdekin region:

- BHWSS;
- Haughton WMA;
- Lower Burdekin WMA;
- Burdekin Underground Water Area (UWA).

4.6.2 Water Storage

To create a sustainable cotton industry within the Study region, it is widely regarded that greater water options for landowners are required, to allow them to choose fully or partial irrigated farming operations and therefore ensuring reliance on purely rainfall production systems is reduced.

Off Stream Water Storage

Off stream water storages are those that divert water from natural water courses, or capture rainfall, in separately established storage infrastructure. On farm (small off stream) water storage is an effective means by which landholders can manage water availability during the year. Storages of this type are typically landowner built and do not significantly impact the flow of natural watercourses. As these storages are located on the existing property of the landholder, they are also typically cheaper and quicker to construct due to lower environmental and regulatory considerations.

[21] Minister's Performance Assessment Report, Water Plan (Burdekin Basin) 2007, Department of Natural Resources, Mines and Energy, 2019.

Notwithstanding the benefits of such storages, on farm water storage is generally limited in scale and therefore volumes able to be retained are lower than larger instream storage infrastructure. Due to the lower water volumes, the impact of evaporation and seepage is typically more significant. Soils are also a consideration when constructing these types of storages, with preferences being for these to be constructed on clay-based soils, which have a higher water retention, as compared to sandy loam soils which have a higher water permeability.

In Stream Water Storage

In stream water storage infrastructure is commonly constructed within the natural watercourse through the establishment of dams or other retention infrastructure. These projects typically have a larger community impact and provide more sustainable water outcomes. As such these are commonly employed to support major irrigation and supplemented water schemes.

In stream water storages impact the natural watercourse and have higher impact on the environment and ecosystems and are typically subject to a much broader range of legislative and regulatory requirements. As such, infrastructure of this type is commonly managed and owned by Government agencies or Departments. Due to the scale of these projects and targeted water volume they are more expensive and time consuming to establish than alternative on farm storages.

Many large scale in stream water storages have been explored or are currently being explored across the Study region, however, only few have progressed beyond conceptual studies and investigations. The main water infrastructure projects under investigation in the Study region include:

- Hughenden Irrigation Project;
- Richmond Agriculture Project;
- Gilbert River Irrigation Project;
- Cave Hill Dam;
- Burdekin Falls Dam – Stage 2;
- Big Rocks Weir;
- Hells Gate Dam.

The building of major water infrastructure within the region is regarded a long-term option due to the significant environmental, regulatory, social and economic impacts that must be considered prior to any project being approved. Additionally, any sizeable water storage infrastructure is costly to construct and typically requires public funding to proceed. The ability of many of these projects to obtain access to the volume of water required has been identified as a major challenge.

A common challenge for all proposed large scale water infrastructure projects in the region is the ability to access the required volume of water to meet requirements. Currently, due to the rigidity of the regulations pertaining to the allocation of water in Queensland, many of these projects are not supported by the existing Water Plans.

4.6.3 Cotton Production Systems

Due to the highly seasonal and severe climatic conditions across much of the North Queensland region, for successful year on year cotton yields, a fully irrigated production system is regarded to be optimal. Studies into irrigated cotton production have concluded that such systems will typically yield between 5 and 12 bales per hectare [22]. In contrast, the CSIRO identified that rain grown production systems will typically only yield between 2 and 5 bales per hectare [23]. Considering the outcome of these studies and based on agronomic feedback, for the purposes of this Study the following yields have been assumed for the assessment of cotton production potential:

- Irrigated production – 9 bales per hectare.
- Rain grown production – 4 bales per hectare.

Irrigated Cotton Production

With advances in cotton technology and farming methods, Australia has developed a reputation as one of the most water efficient cotton industries globally, through increased yields and reduced water inputs. The CSIRO identified that cotton crops in existing growing regions in Australia utilise between 6 and 7 ML per hectare of water for irrigation, this however is impacted by the amount of seasonal rainfall, evaporation rates and growing seasons for the relevant area [24]. Based on agronomic feedback in relation to cotton production in North Queensland, 9ML of water per hectare for irrigation purposes has been relied upon for assessments completed in this Study.

The most common irrigation systems used for cotton production include:

- Furrow Irrigation - surface irrigation by applying water down a furrow from siphon tubes or flooding a basin;
- Sprinkler Irrigation – mechanical irrigation with centre pivots, dispersing water across a crop;
- Drip Irrigation – with water applied on the surface or underground.

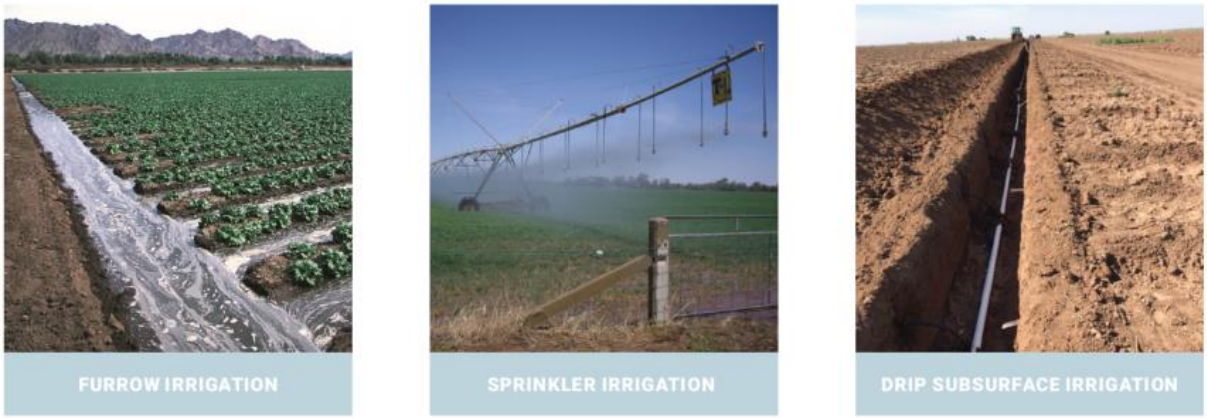


Figure 14 Irrigation Systems

[22] Brennan McKellar L, Monjardino M, Bark R, Wittwer G, Banerjee O, Higgins A, MacLeod N, Crossman N, Prestwidge D and Laredo L (2013) Irrigation Costs and Benefits: A Technical Report to the Australian Government form the CSIRO Flinders and Gilbert Agricultural Resource Assessment, part of the North Queensland Irrigated Agriculture Strategy. CSIRO
[23] Roth G, Harris G, Gillies M, Montgomery J, Wigginton D (2013) Water-Use Efficiency and Productivity Trends in Australian Irrigated Cotton: A Review. Crop & Pasture Science Journal, 2013, pp 1033 – 1048. CSIRO Publishing
[24] Roth G, Harris G, Gillies M, Montgomery J, Wigginton D (2013) Water-Use Efficiency and Productivity Trends in Australian Irrigated Cotton: A Review. Crop & Pasture Science Journal, 2013, pp 1033 – 1048. CSIRO Publishing

Rain Grown Cotton Production

Rain grown cotton relies solely on rainfall and soil moisture content to meet crop water requirements. The high cost of irrigation, water availability constraints and high seasonal rainfall has resulted in some growers shifting towards purely rain grown production. However, in areas with high variability in annual and year on year rainfall, and where little water storage infrastructure exists, pure rain grown systems are regarded as opportunistic [25].

4.7 Farm Inputs, Labour & Expertise

The farm inputs required in broadacre cotton cropping will vary depending on the location, land and other seasonal and environmental factors. In addition to sourcing direct inputs such as seeds, fertiliser, herbicides and insecticides, factors that are critical to effectively grow cotton at scale may include:

- Upfront and ongoing capital investment into irrigation and on farm infrastructure and machinery.
- Access to specialised farm and harvesting machinery. While readily available in southern cotton growing areas, the equipment is expensive to acquire and similarly costly to temporarily relocate, particularly to locations such as North Queensland. Contract harvesters may be an option for growers in the region, noting these organisations will require large scale production in the region to ensure this is economically viable.
- Access to on farm skilled labour to operate farm machinery, manage farm operations and to service equipment. The broader agricultural industry faces challenges with skilled labour and often rely on a seasonal under qualified workforce to manage farm requirements.
- Access to agronomy expertise to optimise cropping outcomes and yields. Expertise revolves around navigating regulation / legislation, irrigation management, soil / weed management, seed selection, pest management and research and development options.
- Ongoing research by agencies such as the CSIRO to collate best practices and complete research and development. Access to global specialists through agencies such as the CSIRO, using digital technology, has also opened selection to a broader range of resources.

4.8 Biosecurity

North Queensland has known weed and pest management issues in broad acre cropping, which will require ongoing coordinated management. Research and development in cotton production has seen an improvement in pest and weed resistance. Some pests, weeds and disease will differ in the northern regions in comparision to southern regions, for example the potential impact of Alternaria leaf spot (leaf disease) on cotton. The placement of a cotton gin in the region will also need to consider State biosecurity regulations, as some States and Territories do not permitted the transfer of seeds or grains [26].

[25] Petheram C, Watson I and Stone P (eds) (2013) Agricultural resource assessment for the Gilbert catchment. A report to the Australian Government from the CSIRO Flinders and Gilbert Agricultural Resource Assessment, part of the North Queensland Irrigated Agriculture Strategy. CSIRO Water for a Healthy Country and Sustainable Agriculture flagships, Australia. © CSIRO 2013

[26] Grundy P, Yeates S, Grundy T (2012) NORpak: Cotton production and management guidelines for the Burdekin and north Queensland coastal dry tropics region 2012. Australia. CSIRO 2013

4.9 By-Products

Through the cotton ginning process three items are delivered, lint, cotton seed and waste material. Cotton Australia identifies that "*42% cotton lint by weight, contributes 85% of total income and the other 15% of income comes from seed*". [27] Based on an industry averages, for every 227kg lint bale approximately 250kg of cotton seed is produced. Cotton seed sells for an average range of AUD$250 - AUD$400/ tonne.

Cotton seed is a valuable by-product of the ginning process that is used as annual supplement feed and can be further processed into oil, meal or hull. During recent drought in Australia, cotton seed has been actively sought by graziers as a feed supplement for animals due to its high protein content. Stakeholders engaged during the Study noted that some graziers in Central and North Queensland sourced cotton seed from as far away as Southern NSW. The high costs associated with transporting seed has been identified as an impediment to some graziers when considering alternate feed options for their herd.

4.9.1 Fodder Crop and Mixed Operations

To mitigate risks associated with feed availability for livestock, there exists an opportunity for graziers to diversify their existing operations to include fodder cropping. Fodder crop farming has been trialled by some graziers in the Study region and has yielded positive outcomes.

An example is Lorraine Station located 250km north of Cloncurry. Lorraine Station is a mixed farming operation comprising of beef cattle production (pasture and feedlot) supported by irrigated and rain grown fodder cropping. The 240,000-hectare property, owned by Lorraine Pastoral Company, have historically relied on a corn silage-based ration for cattle with a mix of molasses, cotton seed and hay. In recent years, Lorraine Station have reverted to hay production to support their cattle business [28].

Based on discussions with graziers as part of this Study, it was determined that while many graziers are considering integrating fodder cropping into their operations (such as sorghum, cotton – for cotton seed and other grains) the high cost, uncertainty of access to water, lack of processing facilities and limited access to expertise and equipment are regularly raised as impediments.

Furthermore, many graziers will only expand into this area to utilise the crop outputs (such as cotton seed) for their own operations rather than for sale on the open market. Notwithstanding, market, climate and supply factors may offer opportunities for such producers to offer produce into the open market where this will yield a greater financial benefit than for internal use.

[27] https://cottonaustralia.com.au/the-cotton-plant
[28] https://www.queenslandcountrylife.com.au/story/5029431/freight-a-killer-for-northern-feedlot/

5 STUDY AREA PRODUCTION POTENTIAL

5.1 Study Areas Overview

This section of the Report specifically considers the cotton production potential of each of the five defined Study Areas included within the scope of the Study, these areas being:

- Flinders River Catchment;
- Gilbert River Catchment;
- Mount Surprise Region;
- Mareeba-Dimbulah Region;
- Lower Burdekin Region.

The characteristics of each of these areas have been assessed individually below.

5.2 Methodology

For each Study Area, the following scope items were considered in assessing the potential for cotton production:

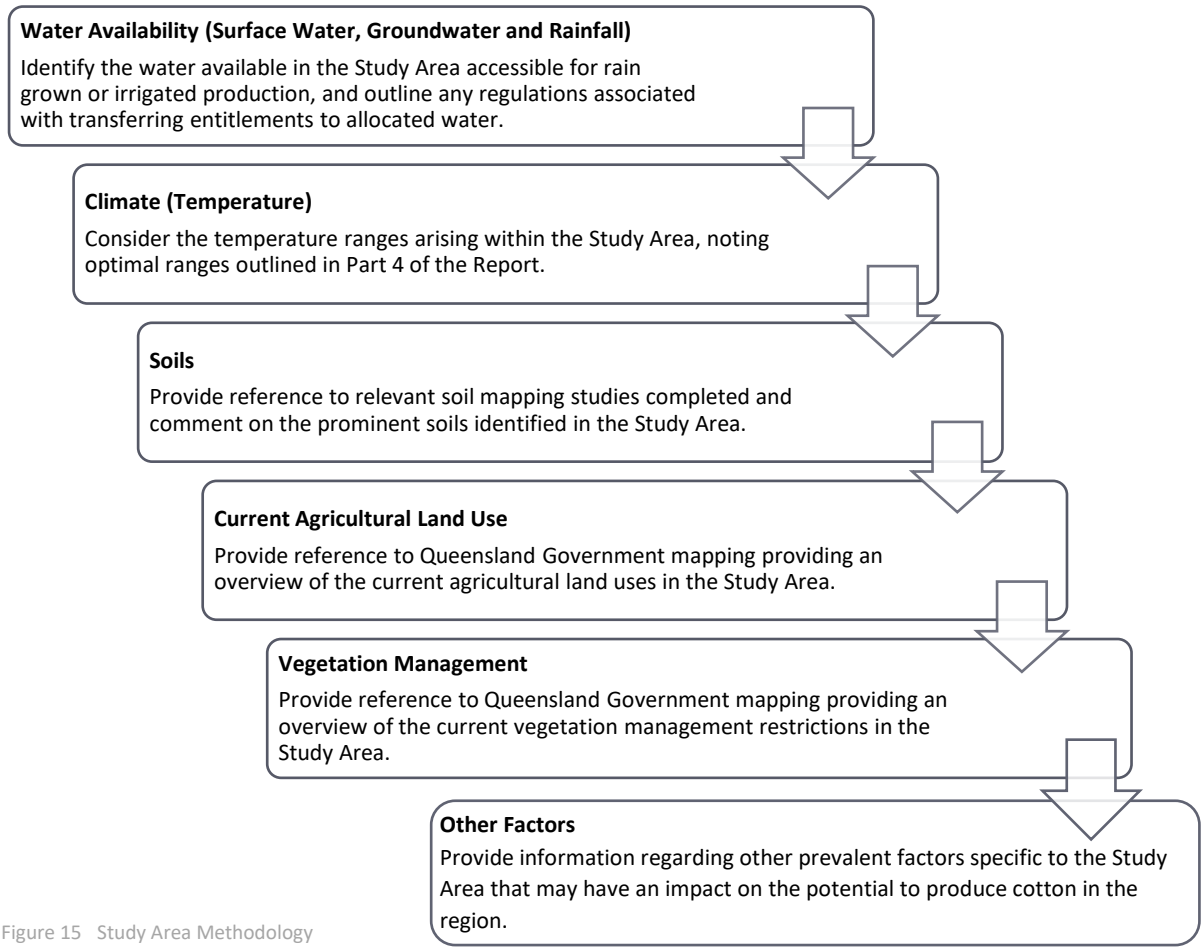


Figure 15 Study Area Methodology

In assessing the five Study Areas a desktop review of available information sources was completed. Our findings were validated through the stakeholder engagement process whereby we engaged with various growers, advisors, Government officials and other experts in the industry.

5.2.1 Mapping

As part of the assessment of Study Areas, mapping was completed by the project team for the following categories:

- Study Area Definition;
- Current Agricultural Land Use;
- Vegetation Management;
- Potential Cropping Precincts.

The mapping was completed with reference to open source datasets for physical, geographical and spatial data as provided by the Queensland Government Department of Natural Resources, Mines and Energy (DNRME). These data sets were accessed through the Queensland Globe interactive tool, applying various layers of refinement. The layers utilised for each category have been outlined below.

Category	Information Source
Study Area Definition	• Flinders River, Gilbert River and Lower Burdekin – Inland Waters>Water Management Information>Water Plans and Other Items • Mount Surprise and Mareeba-Dimbulah – Boundaries>Locality
Current Agricultural Land Use	• Farming>Agricultural Land Audit>Current Agriculture
Vegetation Management	• BIOTA>Vegetation Management Information>Regulated Vegetation Management Map
Potential Cropping Precincts	• Farming>Agricultural Land Audit>Potential Agriculture

Table 5 Mapping Sources

5.2.2 Potential Cropping Precincts

For each Study Area an indication of the potential cropping precinct for cotton has been provided. These precincts have been supplied by DNRME through Queensland Globe and indicate those areas potentially suitable for broadacre cropping and horticulture. The precincts were defined as part of the Agricultural Land Audit completed by DAF in 2013. The audit identified land that was used, or may potentially be used, for agriculture. It is noted, however, that legislation and regulations regarding land use, vegetation clearing and environmental management have since been amended and now apply more strictly. As such, consideration regarding the implications of current vegetation management, land use and environmental management requirements must be had prior to deciding to proceed with cropping operations.

The datasets and maps provided for the Study Areas outline areas that have biophysical potential for annual horticulture and broadacre cropping. The assessment completed by DAF considers factors such as rainfall, agricultural land class and land characteristics. While it is generally accepted that the precincts identified by DAF may be suitable representations of those that would support cotton production, they are only indicative, and landholders or growers must complete their own investigations regarding land suitability for cropping.

5.3 Flinders River Catchment

The Flinders River catchment is defined in accordance with the boundaries provided under the Gulf Water Plan. The Flinders River catchment comprises of an area of approximately 109,000 km2 stretching from the Gulf of Carpentaria in the north, Cloncurry in the south and Hughenden in the east. The region supports a population of approximately 6,000 people.

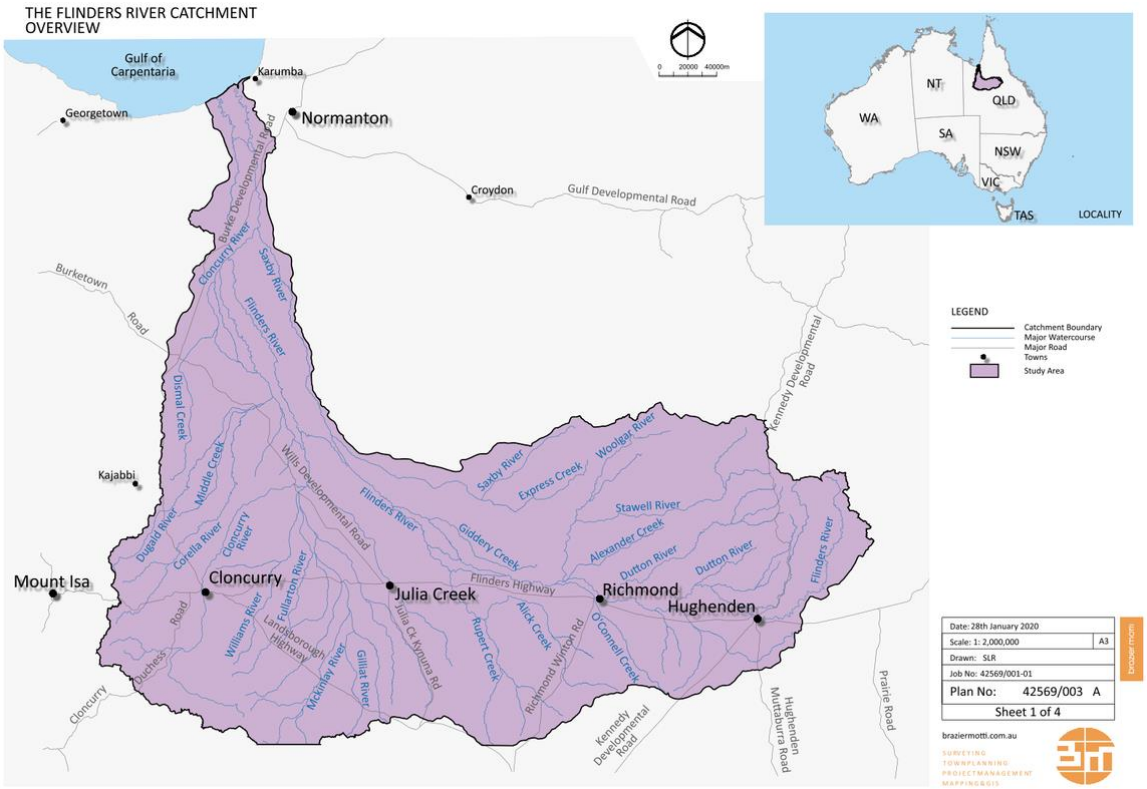


Figure 16 Flinders River Catchment Map

5.3.1 Flinders River Catchment - Water Availability

The Flinders River catchment is currently supplied by both surface and groundwater. The primary surface water source is the Flinders Rivers and its five major tributaries. The river is ephemeral and flows less than 30% of the year. The majority of the rainfall runoff replenishing the river occurs during the wet season (November to April). Due to its expanse, mean annual rainfall varies between northern (Normanton) and southern (Richmond, Julia Creek and Hughenden) regions. The southern region experiences a mean annual rainfall of 475mm compared to 789mm in the northern region.

The main ground water systems are contained within the Carpentaria Basin, part of the Great Artesian Basin. Some local scale groundwater systems also exist within the catchment, however, these have not been studied in detail. According to Queensland DNRME ground water database (accessed December 2020), there are more than 3,000 registered groundwater bores in the Flinders River catchment. Most of these bores supply water for domestic purposes or for cattle and stock watering.

Based on the Gulf Water Plan, the following unsupplemented water reserve volumes have been identified in the Flinders River catchment:

	Indigenous	Strategic	General	Total
Reserve Volume (ML)	8,500	17,850	239,650	266,000

Table 6 Flinders River Catchment – Gulf Water Plan [29]

Based on advice from the Queensland Government Department of Regional Development, Manufacturing and Water on 24 February 2021, it was confirmed that 100,000ML of the total General Reserve volume (total of 239,650ML) has been released to water licence holders and a remaining 139,650ML of General Reserve water remains unallocated.

Based on information contained on the Business Queensland website (accessed in January 2021) there is currently no unallocated water available in the Flinders River catchment. While no formal announcements regarding future water releases in the catchment have been made, a note on the Business Queensland website states that "*water is not being made available from the Flinders River to allow time for proponents to develop and submit large-scale infrastructure proposals. We will evaluate these proposals and consider whether to release unallocated water for large-scale projects in the Flinders catchment in early 2021.*" [30]

A review of water allocations through the Queensland Government Water Entitlement Viewer identified a further 91,168ML of unzoned surface water (being surface water that may be taken that is not in, or adjacent to, a water licence zone) has been allocated to licence holders.

Under the Gulf Water Plan in the Flinders River catchment, the following water transfer limits have been identified for specific zones:

Zone	Maximum Annual Volumetric Limit (ML)
Flinders River Zone 7	10,000
Flinders River Zone 8	17,500
Flinders River Zone 9	50,000
Flinders River Zone 10	40,000
Cloncurry River Zone 11	20,000
Saxby River Zone 12	10,000

Table 7 Flinders River Catchment - Water Trading Zones [31]

Specific guidelines and regulations are provided relating to the transfer of water allocations in the catchment.

Future Water Projects

Water access and availability is considered to be the major limiting factor for agricultural expansion in the Flinders River catchment. There is currently limited water infrastructure providing reliable water access for irrigated agriculture and allocations of water from river systems are difficult to obtain.

[29] Water Plan (Gulf) 2007
[30] https://www.business.qld.gov.au/industries/mining-energy-water/water/catchments-planning/unallocated-water/gulf
[31] Queensland Government Department of Natural Resources and Mines. Gulf Resource Operations Plan June 2010, Amendment August 2015

To address this, major water and irrigation projects have been proposed for the catchment, including:

- Cave Hill Dam (Cloncurry);
- Richmond Agriculture Project (Richmond);
- Hughenden Irrigation Project (Hughenden).

All projects are currently in the concept or business case phase and therefore are considered a moderate likelihood of progressing and will have significant lead times to development. Access to the required volume of water allocations to support the projects has been identified as a key challenge by project proponents

5.3.2 Flinders River Catchment - Climate (Temperature)

The Flinders River Catchment has a hot and dry semi-arid climate. Due to its expanse, temperatures vary between northern (Normanton) and southern (Richmond, Julia Creek and Hughenden) regions.

For cotton production assessment purposes, two points of reference have been utilised for temperatures. The southern region experiences an average temperature range of between 9 to 41 degrees Celsius throughout a 12 month period, compared to a range of between 16 to 37 degrees Celsius in the northern region.

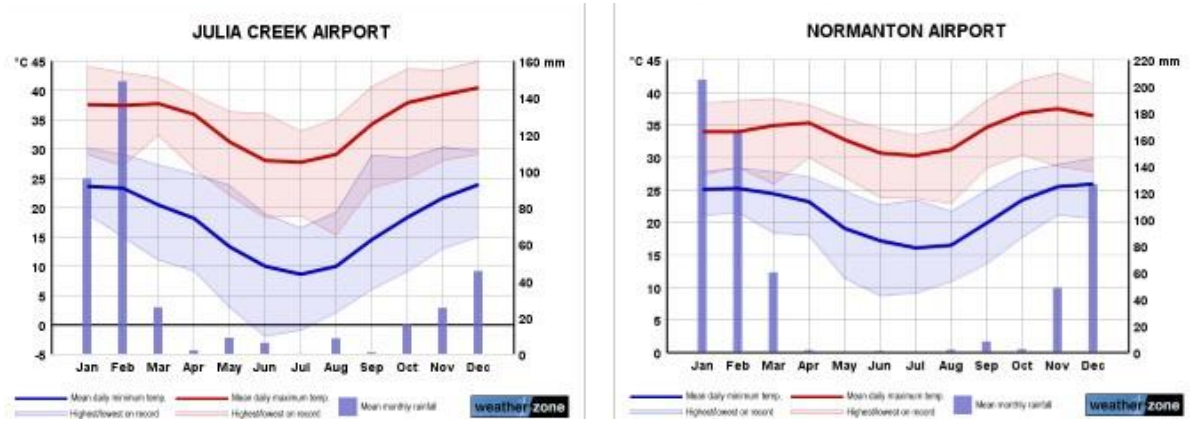


Figure 17 Flinders River Catchment Temperature Ranges [32]

5.3.3 Flinders River Catchment - Soils

Based on a study completed by CSIRO in 2013, cracking clay soils have been identified as the dominant soil type in the catchment (refer Figure 18). These soils are at a minimum moderately suitable for broadacre cropping. The land at the mouth of the Flinders River catchment is dominated by seasonally and permanently wet soils due to extensive flooding during, and around, the wet season. These soils are generally considered as not suited for cropping.

[32] https://www.weatherzone.com.au/

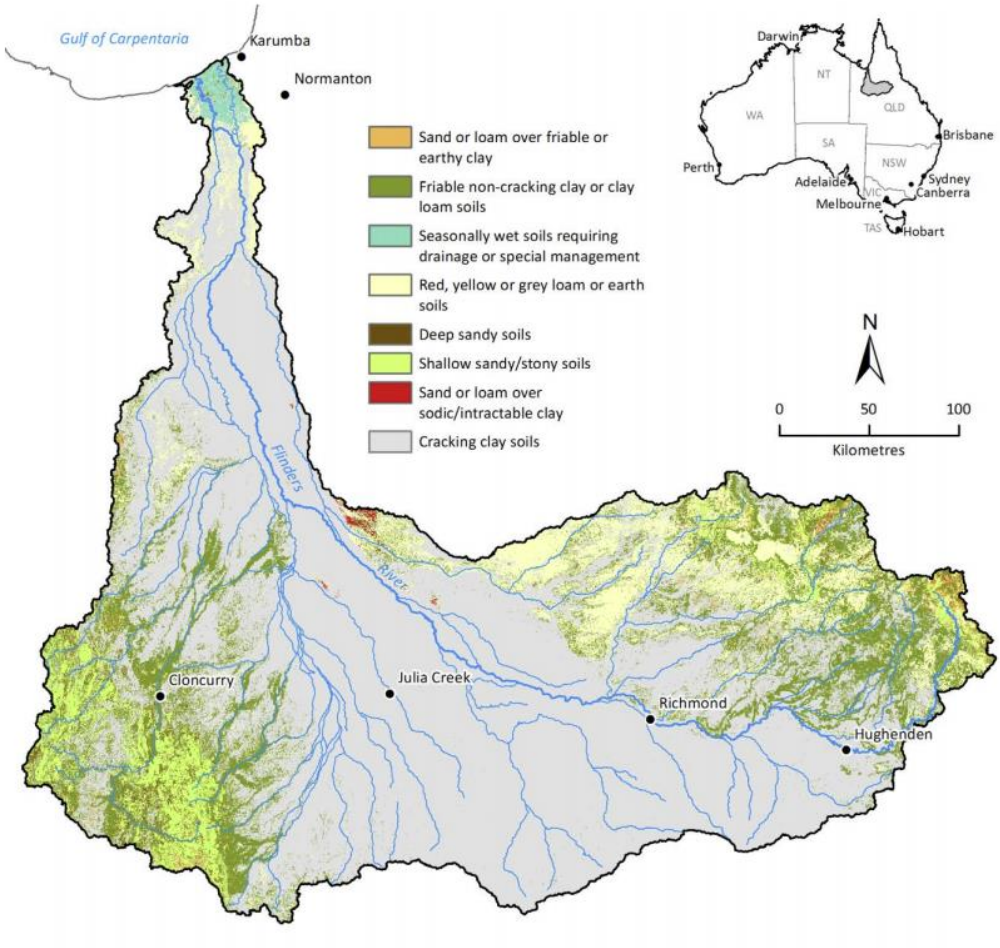


Figure 18 Flinders River Catchment Soil Group Map [33]

The soils adjacent to the Flinders and Cloncurry Rivers are considered to be the most suitable for agricultural production.

5.3.4 Flinders River Catchment - Current Agricultural Land Use

The agricultural landscape in the Flinders River catchment is dominated by the cattle industry, which uses extensive natural pasture grazing to supply beef cattle. Several landholders have been trialling and producing irrigated and rain grown crops (including cotton) successfully over an extended period, such as at Silver Hills in the Richmond Shire where cotton has been grown since 2008. Currently, rain grown cotton production is the primary production system utilised in the region due to the limited access and availability of water for irrigation.

[33] Petheram C, Watson I and Stone P (eds) (2013) Agricultural resource assessment for the Flinders catchment. A report to the Australian Government from the CSIRO Flinders and Gilbert Agricultural Resource Assessment, part of the North Queensland Irrigated Agriculture Strategy. CSIRO Water for a Healthy Country and Sustainable Agriculture flagships, Australia. CSIRO 2013

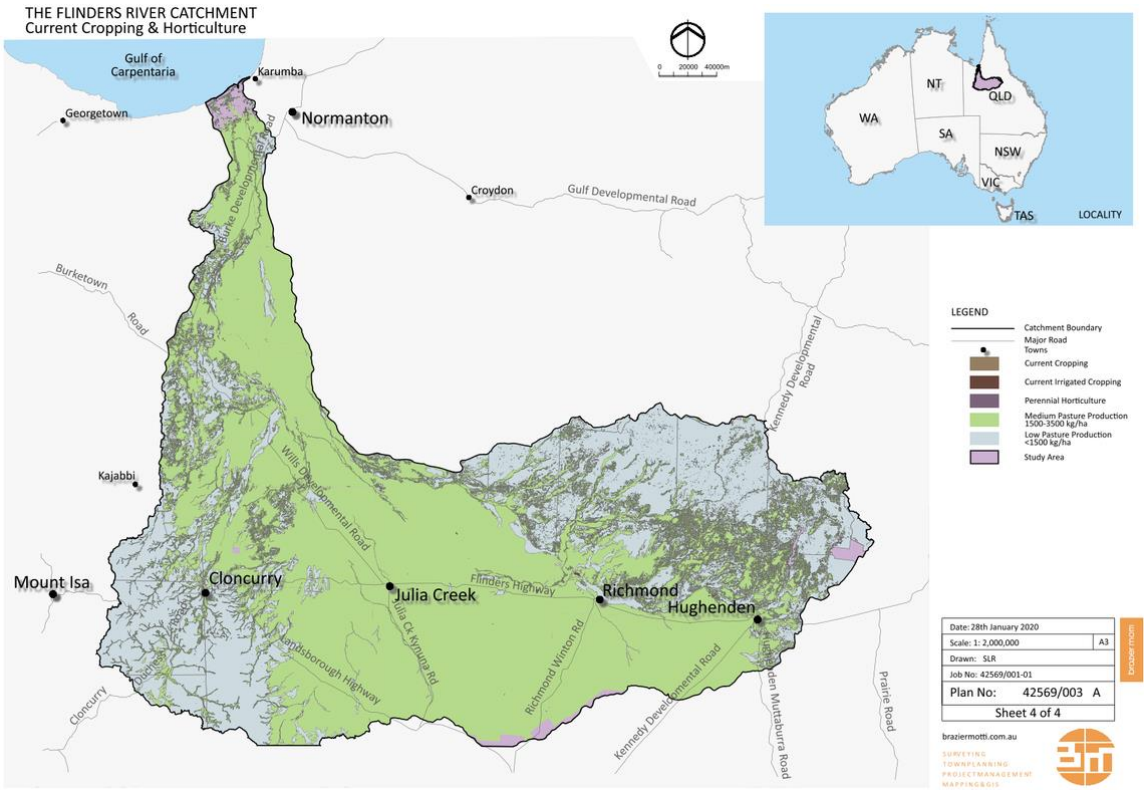


Figure 19 Flinders River Catchment Current Cropping and Horticulture Map

Feedback from stakeholders confirmed that trials of cotton have been completed in the past. At the time of completing this assessment, approximately 1,100 hectares was planted to cotton for the current season. Recent land acquisitions by established cotton producers from southern regions (for example, Etta Plains and Woodlands) has prompted increased grower interest in cotton production in the region and forecast production is high relative to other Study Areas.

Figure 19 provides an overview of the current agricultural land uses currently engaged in the catchment.

5.3.5 Flinders River Catchment - Vegetation Management

The Flinders River catchment is comprised primarily of open grasslands, with some woodland areas located in the eastern and northern parts of the region. Based on a search, as provided in Figure 20, the majority of Flinders River catchment is classified as category B (remnant vegetation) and clearing of native vegetation may require approval before cropping can be undertaken.

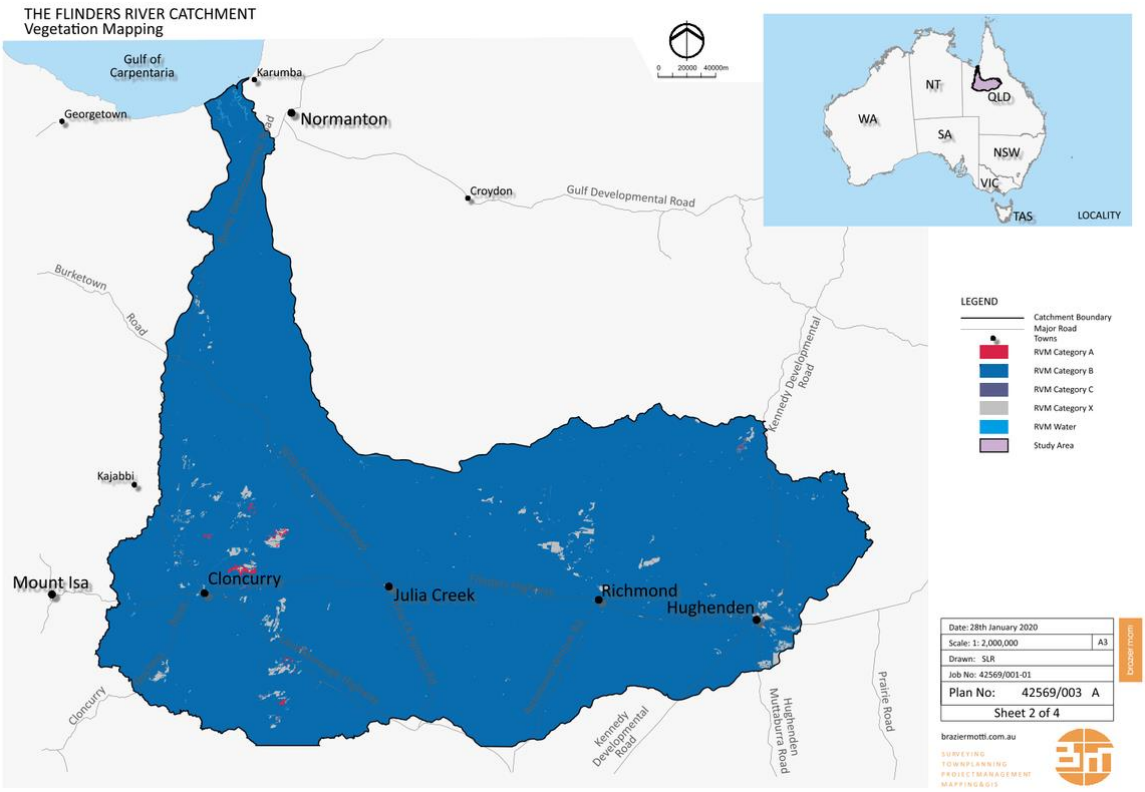


Figure 20 Flinders River Catchment Vegetation Map

5.3.6 Flinders River Catchment - Other Considerations

Agronomic expertise in relation to cotton production does exist within the region due to past trials of cotton and other broad acre crops. Supplementation of this expertise will be required to support expansion of cotton production in the region.

Major transport arterials (Flinders Highway, Burke Development Road and Wills Development Road) are located in the region. Rail infrastructure is situated adjacent to the Flinders Highway running from Mount Isa to Townsville. Major roads and rail infrastructure can be impacted annually by rainfall and flooding.

Telecommunications infrastructure and networks are also a noted challenge for the region. While this is a common concern for many rural areas in Queensland, it does present as an impediment to adoption of technology as a means of enhancing productivity in agricultural operations.

5.3.7 Flinders River Catchment - Cropping Precincts

Based on a search for areas suitable for broadacre cropping and horticulture (in accordance with the Agricultural Land Audit (DAF Qld 2013)) the following cropping precincts were identified for the Flinders River catchment which have the potential to support cotton production.

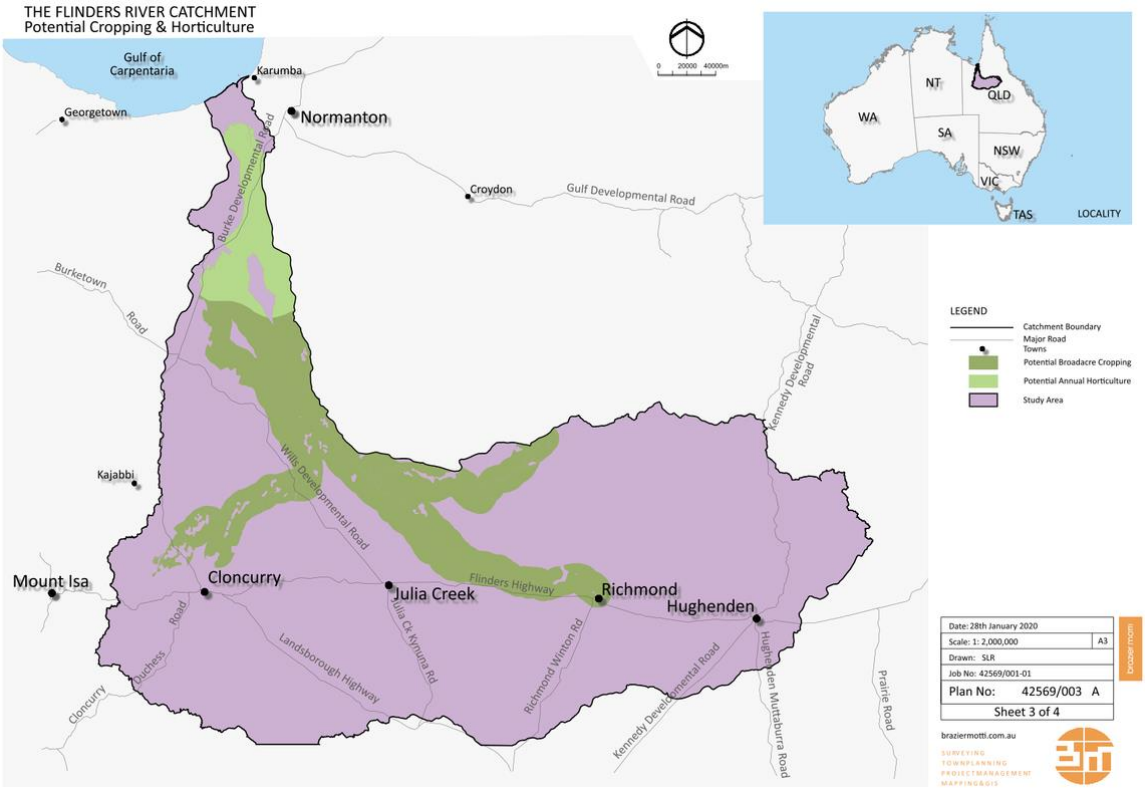


Figure 21 Flinders River Catchment Potential Cropping Areas

5.4 Gilbert River Catchment

The Gilbert River catchment is defined in accordance with the boundaries provided under the Gulf Water Plan. The Gilbert River catchment comprises of an area of approximately 46,000 km2 extending from south east of Georgetown to north of Kurumba. The Gilbert River drains into the southern Gulf of Carpentaria.

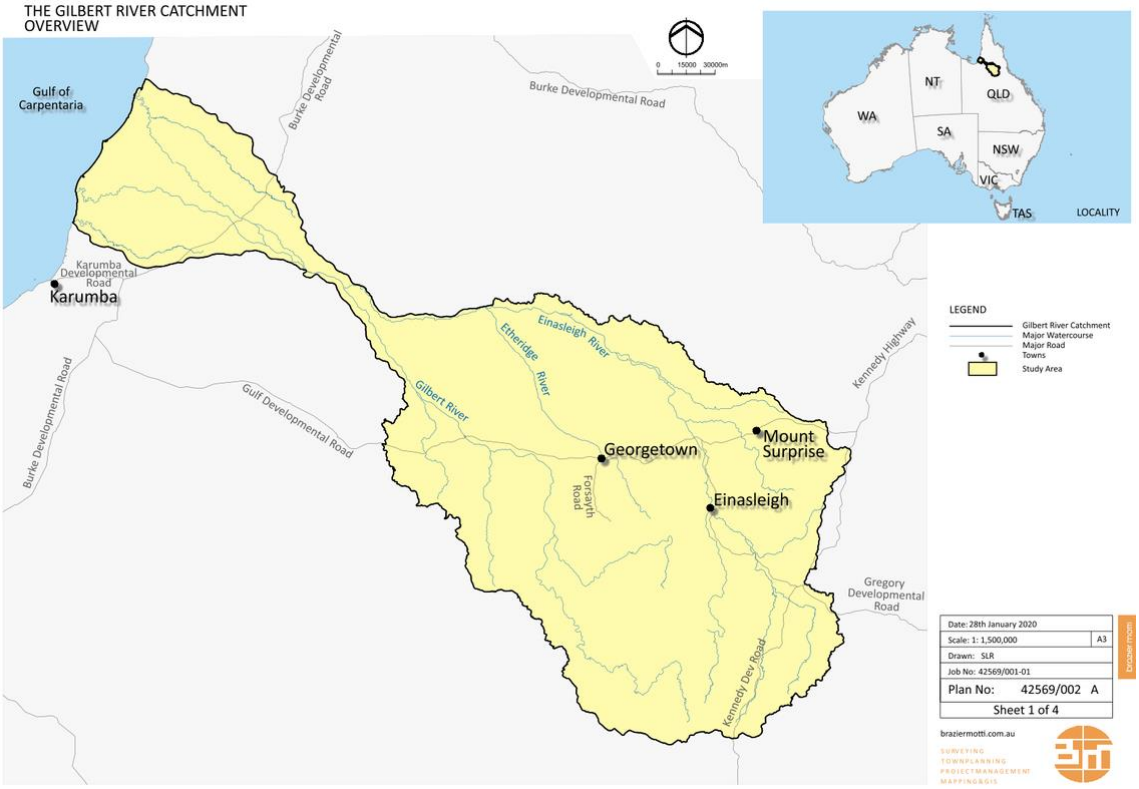


Figure 22 Gilbert River Catchment Map

5.4.1 Gilbert River Catchment - Water Availability

The Gilbert River catchment is currently supplied by both surface and groundwater. The primary surface water sources are the Gilbert River and the Einasleigh River and their associated tributaries. The rivers are ephemeral and flow less than 50% of the year.

The majority of the runoff replenishing these rivers occurs during the wet season (November to April). The Gilbert River catchment experiences a highly seasonal climate with an extended dry season. Due to the expanse of the catchment, mean rainfall varies between western (Karumba) and eastern (Georgetown) regions. The western region experiences a mean annual rainfall of 905mm compared to 791mm in the eastern region. Rainfall within the catchment also has high variability year on year, which makes continuity and reliability of water supply a challenge for the region.

The main ground water system supplying the Gilbert River catchment is through the Carpentaria Basin, part of the Great Artesian Basin. Some local scale groundwater systems also exist within the catchment, however, these have not been studied in detail. According to Queensland DNRME ground water database (accessed December 2020), there are more than 400 registered groundwater

bores in the Gilbert River catchment. Most of these bores supply water for domestic purposes or for cattle and stock watering.

Based on the Gulf Water Plan, the following water reserve volumes have been identified in the Gilbert River catchment:

	Indigenous	Strategic	General	Total
Reserve Volume (ML)	17,000	5,000	467,000	489,000

Table 8 Gilbert River Catchment – Gulf Water Plan [34]

Based on the Queensland Government Water Entitlement Viewer, 28,995 ML of surface water entitlements were identified. Of this amount 23,315ML was identified as held for irrigation purposes.

There is currently up to 85,000ML of unallocated water available in the Gilbert River catchment (Table 9).

Location	Annual Volume Available (ML/ annum)	Rate of Take (ML/ Day)	Volumetric Limit
Zone 6	Up to 75,000	5% of Annual Volume	Up to 25,000ML per Property
Zone 6 or Unzoned	Up to 10,000	10% of Annual Volume	Up to 2,000ML per Property

Table 9 Gilbert River Catchment - Unallocated Water [35]

Under the Gulf Water Plan, the following water transfer limits apply within the Gilbert River catchment for specific zones:

Zone	Maximum Annual Volumetric Limit (ML)
Gilbert River Zone 3	1,800
Gilbert River Zone 4	600
Gilbert River Zone 5	2,682
Gilbert River Zone 6	25,242

Table 10 Gilbert River Catchment - Water Trading Zones [36]

Specific guidelines and regulations are provided relating to the transfer of water allocations in the catchment.

Future Water Projects

Water access is a major limiting factor for agricultural expansion in the Gilbert River catchment. There is currently limited water infrastructure providing reliable water access for irrigated agriculture and allocations of water from river systems are difficult to obtain. The primary water infrastructure project announced for the region is the Greenhills Dam (Gilbert River Irrigation Project).

[34] Water Plan (Gulf) 2007
[35] https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0008/1486601/gulf-water-availability-map.pdf
[36] Queensland Government Department of Natural Resources and Mines. Gulf Resource Operations Plan June 2010, Amendment August 2015

The Gilbert River Irrigation Project has completed a detailed business case and is awaiting funding to commence with further investigation and construction. If successful, the project will yield significant benefit for the catchment, potentially initiating approximately 17,000 hectares of irrigated agriculture around Georgetown.

5.4.2 Gilbert River Catchment - Climate (Temperature)

The Gilbert River Catchment has a hot and dry semi-arid climate. Due to the expanse of the catchment, mean annual temperatures vary between western (Karumba) and eastern (Georgetown) regions. The western region experiences a mean annual temperature range of 14 to 33 degrees Celsius compared to 12 to 36 degrees Celsius in the eastern region. Mean daily temperatures across the catchment are considered high relative to other parts of Australia.

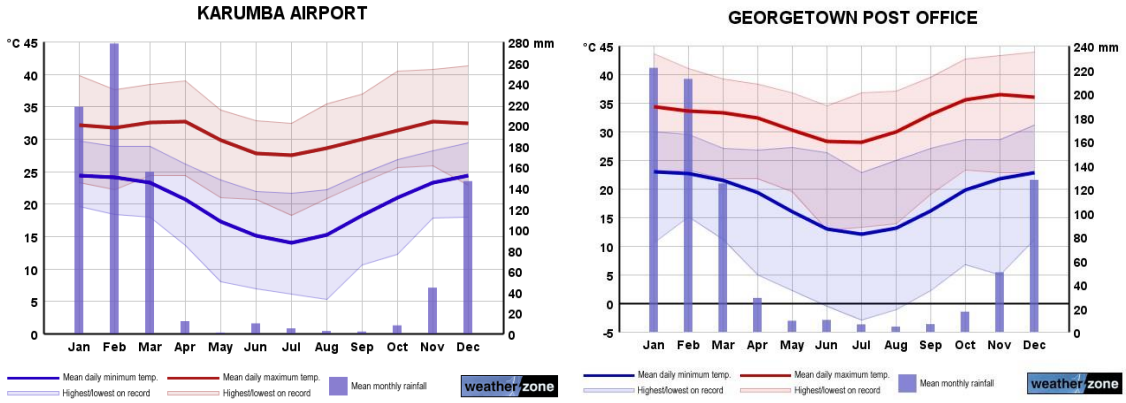


Figure 23 Gilbert River Catchment Temperature Ranges [37]

5.4.3 Gilbert River Catchment - Soils

As identified in Figure 24, a broad range of soil groups are present within the Gilbert River catchment. These groups are predominantly sandy loams, sandy loam over clay and cracking clay soils. It is held that most soils in the catchment are at least moderately suitable for broadacre cropping, except for those soils located at the mouth of the Gilbert River and the adjacent areas. These areas are comprised of soils that are seasonally or permanently wet, due to annual flooding, and have high soil salinity levels.

[37] https://www.weatherzone.com.au/

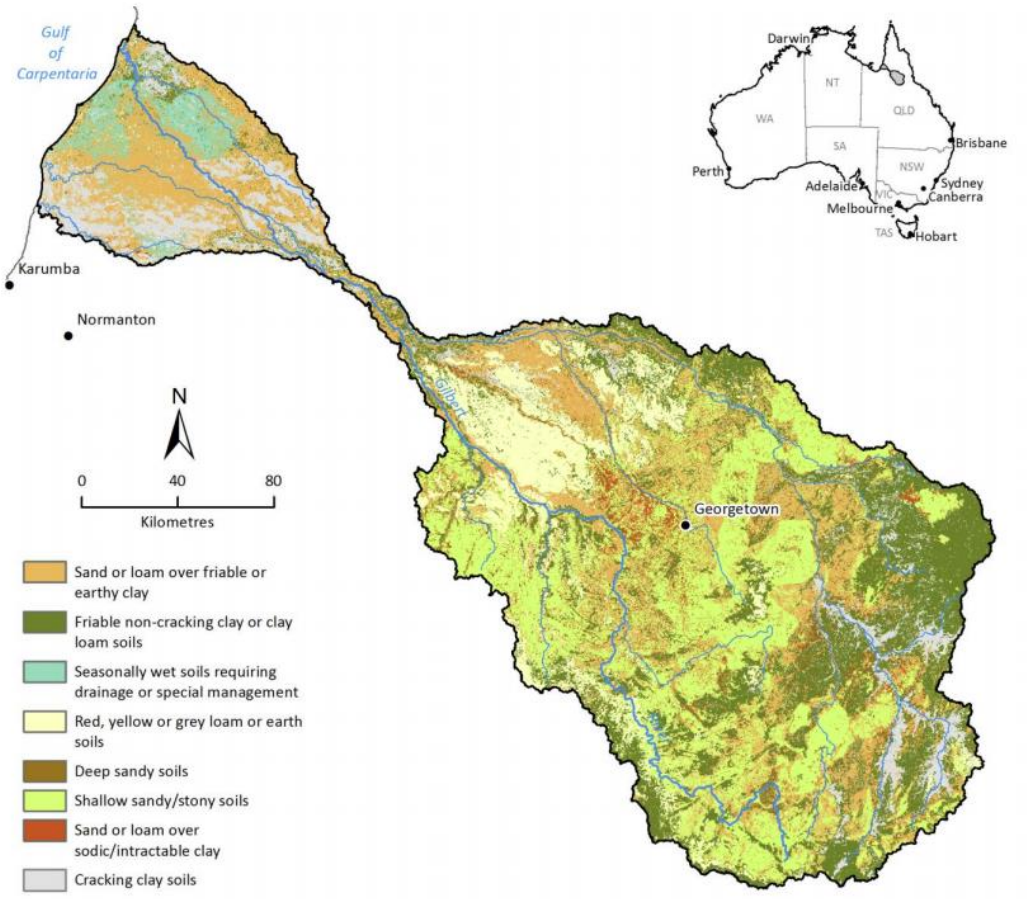


Figure 24 Gilbert River Catchment Soil Group Map [38]

Specifically, the study identified approximately 20% of the Gilbert River catchment contained soils that would be suitable for irrigated agriculture. These soils are located adjacent to the Gilbert and Einasleigh Rivers upstream of their confluence, and around Georgetown.

5.4.4 Gilbert River Catchment - Current Agricultural Land Use

Based on mapping (Figure 25), most of the land in the Gilbert River catchment is used for pasture production. Beef cattle production is the primary industry within the region. Cropping currently occupies less than 0.02% of the landscape and is generally constrained to rain grown production.

[38]Petheram C, Watson I and Stone P (eds) (2013) Agricultural resource assessment for the Flinders catchment. A report to the Australian Government from the CSIRO Flinders and Gilbert Agricultural Resource Assessment, part of the North Queensland Irrigated Agriculture Strategy. CSIRO Water for a Healthy Country and Sustainable Agriculture flagships, Australia. CSIRO 2013

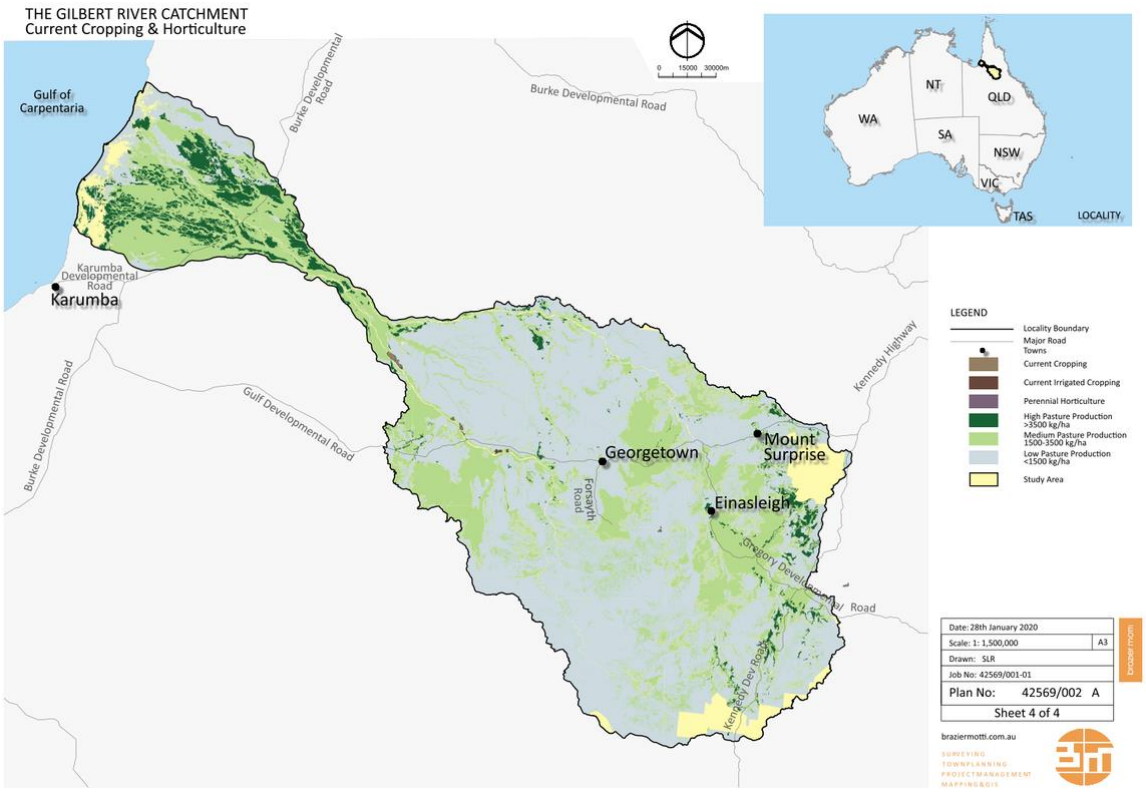


Figure 25 Gilbert River Catchment Current Cropping and Horticulture Map

Based on stakeholder discussions, it was confirmed that various small scale cotton trials at Tonks Camp and Forest Home have been completed within the catchment in conjunction with DAF and other research agencies and organisations. Significant cotton trials at the Strathmore Station (north west of Georgetown) were completed in 2019, with approximately 6,000 hectares of cotton planted. Unfortunately, these trials were only partially successful, with climatic conditions impacting outcomes.

5.4.5 Gilbert River Catchment - Vegetation Management

Searches of the maps (Figure 26) identifies that the majority of land in the Gilbert River catchment is classified as category B, remnant vegetation, being an area to which restrictions to clearing exist. Some parcels of Category X (exempt from clearing regulations) land do exist within the catchment and these are located to the west of Georgetown.

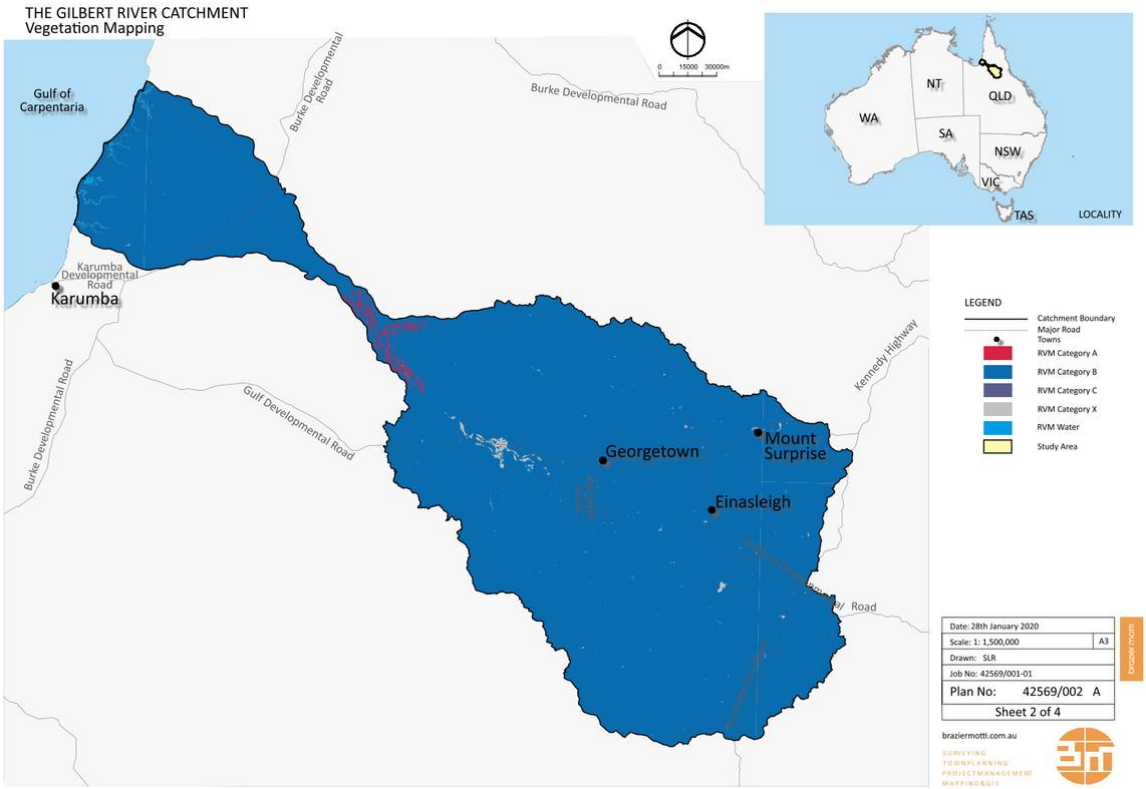


Figure 26 Gilbert River Catchment Vegetation Map

5.4.6 Gilbert River Catchment - Other Considerations

In consultation with landholders and potential broadacre cropping farmers, vegetation management and environmental protection legislation have been raised as the major impediments to further development of the land for agriculture in the region. Furthermore, these have been identified as impediments to obtaining and using water currently available within the Gilbert River system.

Road infrastructure located within the region can support road train and B-double access, however, the main arterials do succumb to annual flooding and damage during the wet season.

Telecommunications infrastructure and networks are also a noted challenge for the region. While this is a common concern for many rural areas in Queensland, it does present as an impediment to adoption of technology as a means of enhancing productivity in agricultural operations.

5.4.7 Gilbert River Catchment - Cropping Precincts

Based on a search for areas suitable for broadacre cropping and horticulture (in accordance with the Agricultural Land Audit (DAF Qld 2013)) the following cropping precincts were identified for the Gilbert River catchment (Figure 27).

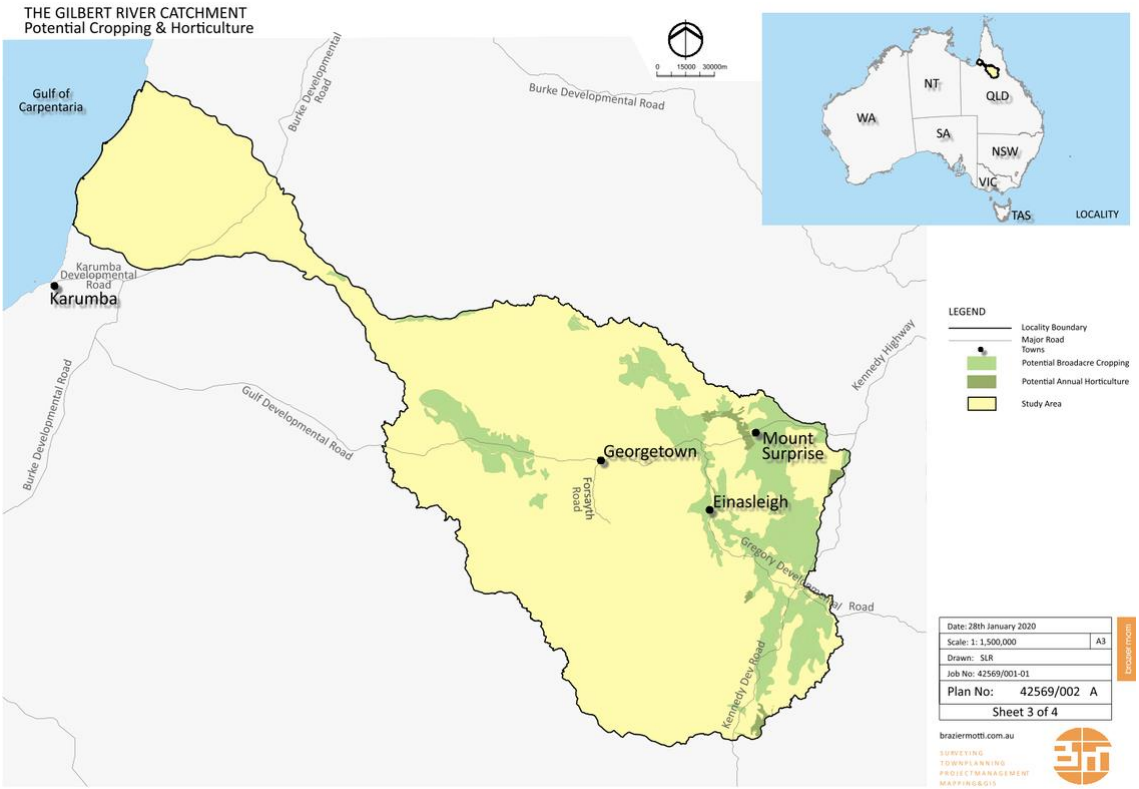


Figure 27 Gilbert River Catchment Potential Cropping Areas

The CSIRO suggests that a potential of 20,000 hectares of year-round rain grown and irrigated cropping could be possible in the catchment with appropriate water source [39]. To the extent the Gilbert River Irrigation Project was to progress to development, this would potentially result in over 17,000 hectares of cropping land being established in the catchment in areas surrounding Georgetown.

[39] Petheram C, Watson I and Stone P (eds) (2013) Agricultural resource assessment for the Flinders catchment. A report to the Australian Government from the CSIRO Flinders and Gilbert Agricultural Resource Assessment, part of the North Queensland Irrigated Agriculture Strategy. CSIRO Water for a Healthy Country and Sustainable Agriculture flagships, Australia. CSIRO 2013

5.5 Mount Surprise

For the purposes of this Study, Mount Surprise is defined in accordance with the town locality boundaries of Mount Surprise. The town is in the Shire of Etheridge and is located 96km to the East of Georgetown.

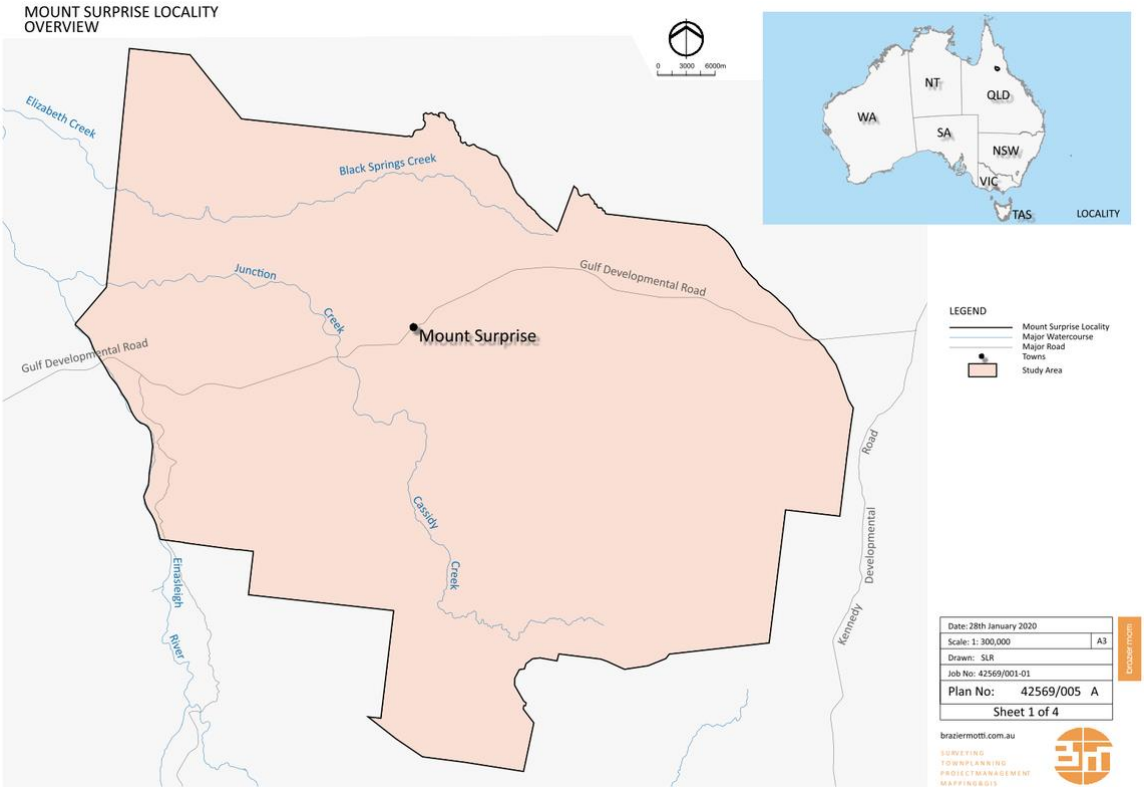


Figure 28 Mount Surprise Map

While our assessment specifically considers only the defined locality, we have also provided some commentary regarding current and proposed farming operations located in the adjacent and surrounding localities of Forty Mile, Gunnawarra, Innot Hot Springs and Minnamooka. It is also noted that Mount Surprise is located within the Gilbert River catchment boundaries, discussed in section 5.4 above.

5.5.1 Mount Surprise - Water Availability

Mount Surprise is in the eastern part of the Gilbert River catchment. Due to proximity from the active river systems, Mount Surprise does not have readily available access to reliable surface water. River systems do exist in the regions north of Mount Surprise (Herbert and Millstream Rivers), however, these similarly are not readily accessible to Mount Surprise or adjacent localities.

Some local groundwater systems do exist within the Mount Surprise area, however, these have not been studied in detail and therefore the extent of these systems is unclear. According to the Queensland DNRME ground water database (accessed December 2020), there are more than 60 registered groundwater bores in the Mount Surprise locality. Most of these bores supply water for domestic purposes or for stock watering. It is estimated 2,000ML from bore water availability could be allocated to crop irrigation.

Rainfall in the region is concentrated during the summer months of the year, with between 80 and 90 percent of rain falling between November and April. The average annual rainfall in Mount Surprise is 780mm. Similarly, to other areas in the Gilbert River catchment, year on year rainfall may also vary significantly with continuous years of below average rainfall not uncommon.

No major water infrastructure projects have been proposed for the Mount Surprise region.

5.5.2 Mount Surprise - Climate (Temperature)

Mount Surprise has a hot and dry semi-arid climate. The mean annual temperature range for Mount Surprise extends from 10 to 35 degrees Celsius. The mean daily temperatures across the catchment are considered high relative to other parts of Australia.

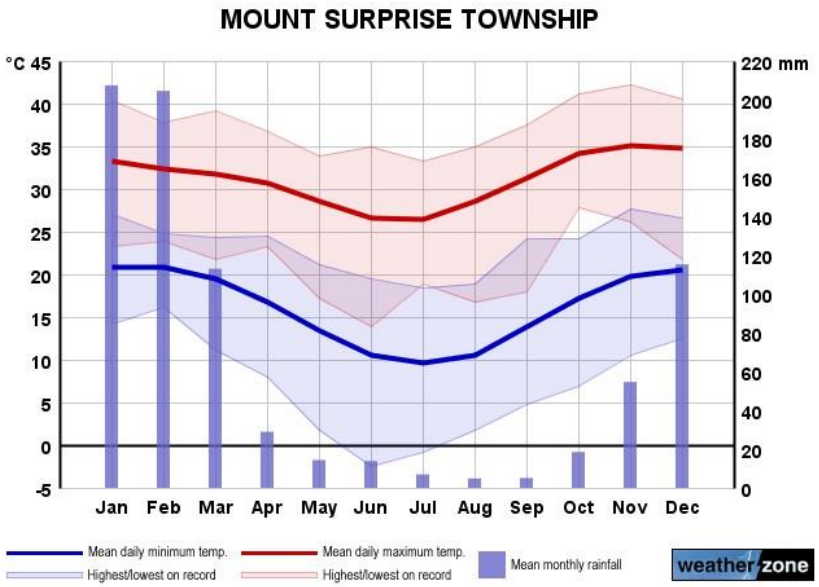


Figure 29 Mount Surprise Temperature Ranges [40]

5.5.3 Mount Surprise - Soils

Soil mapping for part of the Mount Surprise area was included as part of the CSIRO study in 2013 for the Gilbert River catchment. Figure 30 identifies various soil groups as being present in the Mount Surprise area, with the primary soil group being the friable non-cracking clay or clay loam soils. These soils are regarded as having high agricultural potential due to their chemical composition and water holding capacity. Second to these soils, however, are extensive areas of shallow sandy and stony soils, which have little or no agricultural value.

A land resources study of the Einasleigh-Atherton Dry Tropics was completed in 1989 by the Department of Primary Industries (DPI) to map land suitability for the expansion of agricultural development in the Mount Surprise region. The study confirmed similar variation in soil profiles in Mount Surprise as well as in surrounding areas, such as St Ronan's (located within the Forty Mile locality).

[40] https://www.weatherzone.com.au/

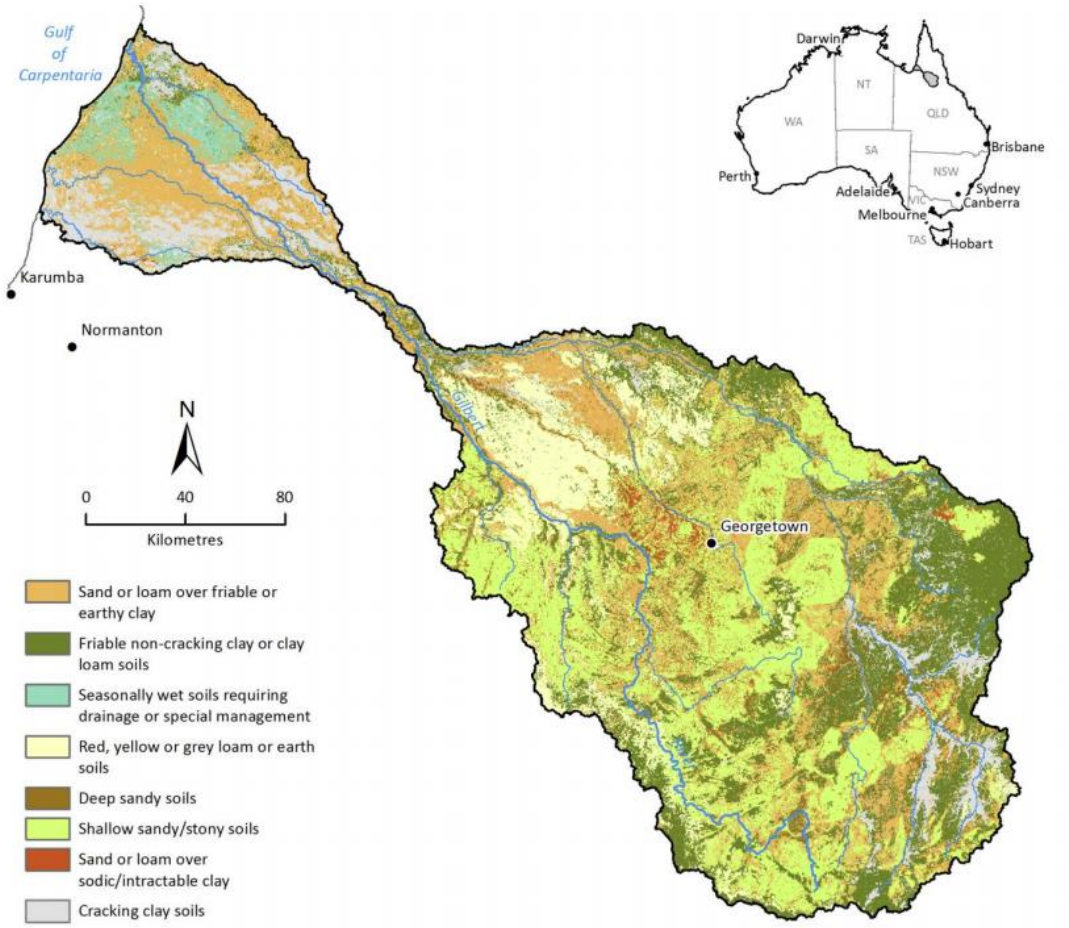


Figure 30 Mount Surprise Soil Group Map [41]

5.5.4 Mount Surprise - Current Agricultural Land Use

Figure 31 identifies that the land in Mount Surprise is used primarily for pasture production. Beef cattle production is the primary industry within the region.

A significant parcel of land located east of Mount Surprise, on the St Ronan's station, has been identified as existing intensive horticulture. Through stakeholder discussions, it has been confirmed that this land has been used for cotton production in current and past years. Similarly, smaller operations in the Innot Hot Springs, Gunnawarra and Minnamooka localities were confirmed to have previously grown cotton or be trialling it currently.

[41] Petheram C, Watson I and Stone P (eds) (2013) Agricultural resource assessment for the Flinders catchment. A report to the Australian Government from the CSIRO Flinders and Gilbert Agricultural Resource Assessment, part of the North Queensland Irrigated Agriculture Strategy. CSIRO Water for a Healthy Country and Sustainable Agriculture flagships, Australia. CSIRO 2013

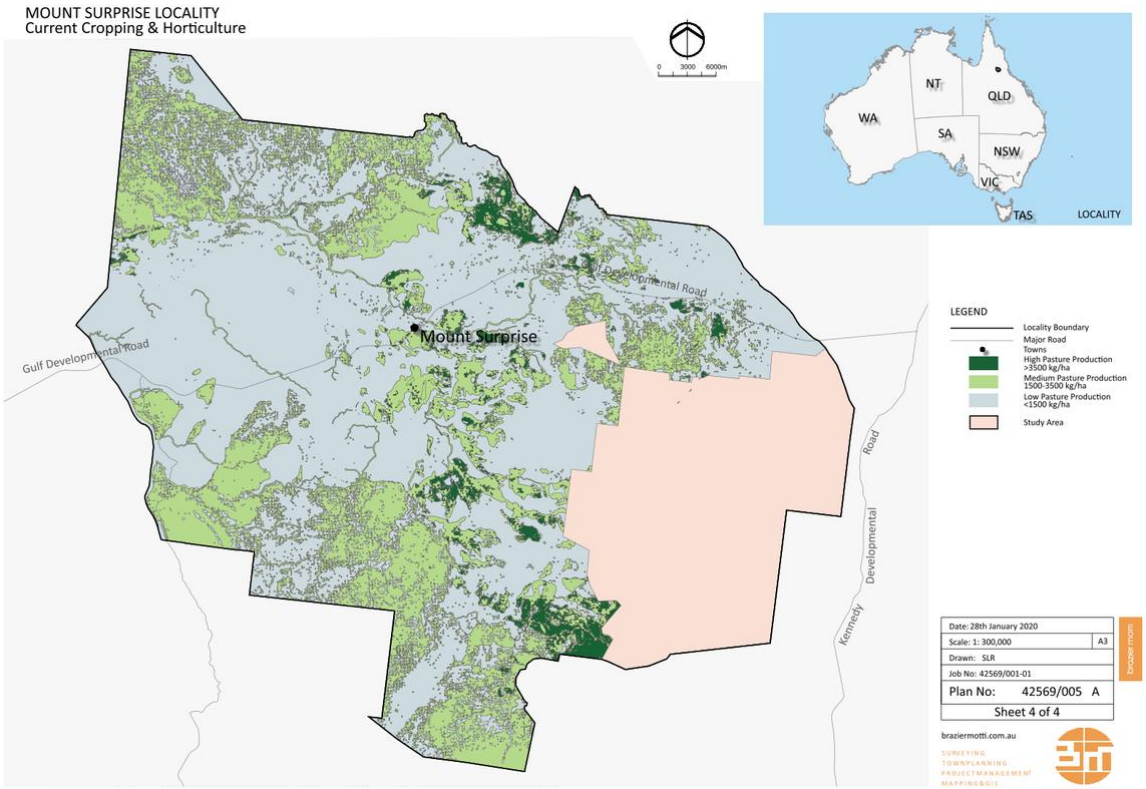


Figure 31 Mount Surprise Current Cropping and Horticulture Map

5.5.5 Mount Surprise - Vegetation Management Considerations

Figure 32 identifies that most land in the area is classified as category B, remnant vegetation, to which strict restrictions to clearing exist. Most of the study area is currently uncleared woodland. Clearing in the region has been limited to the Mount Surprise town area and around existing agricultural operations, such as St Ronan's station (classified as Category X – exempt clearing work).

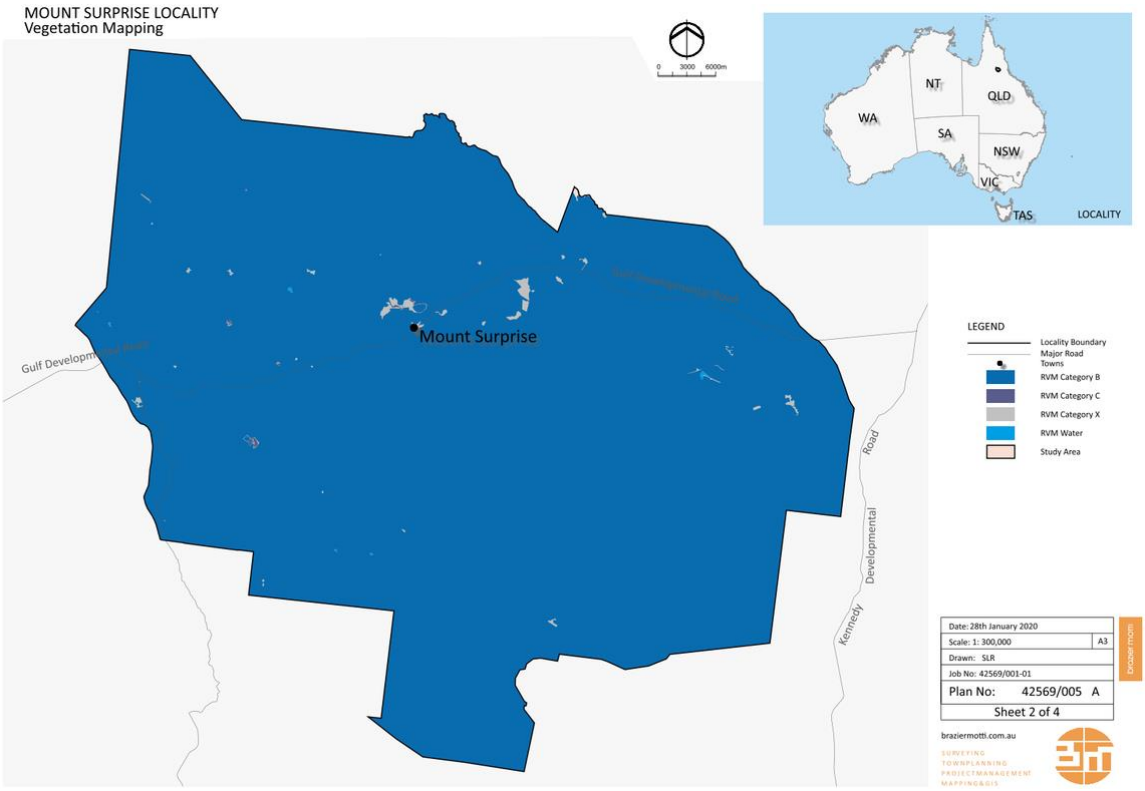


Figure 32 Mount Surprise Vegetation Map

5.5.6 Mount Surprise - Other Considerations

Mount Surprise maintains a population of only 300 people. Much of the labour, machinery and agronomy expertise that may be required for agricultural operations in Mount Surprise would be sourced from surrounding centres such as the Atherton Tablelands.

Telecommunications infrastructure and networks are also a noted challenge for the region. While this is a common concern for many rural areas in Queensland, it does present as an impediment to adoption of technology as a means of enhancing productivity in agricultural operations.

The town is situated on major road transport arterials and is in close proximity to the Mareeba-Dimbulah agricultural precinct, Atherton Tablelands, Georgetown and Cairns. Similarly, Mount Surprise is located on major road arterials connecting directly into Charters Towers and Townsville.

5.5.7 Mount Surprise Region - Cropping Precincts

Based on a search, areas suitable for broadacre cropping and horticulture (in accordance with the Agricultural Land Audit (DAF Qld 2013)) the following cropping precincts were identified for Mount Surprise (Figure 33).

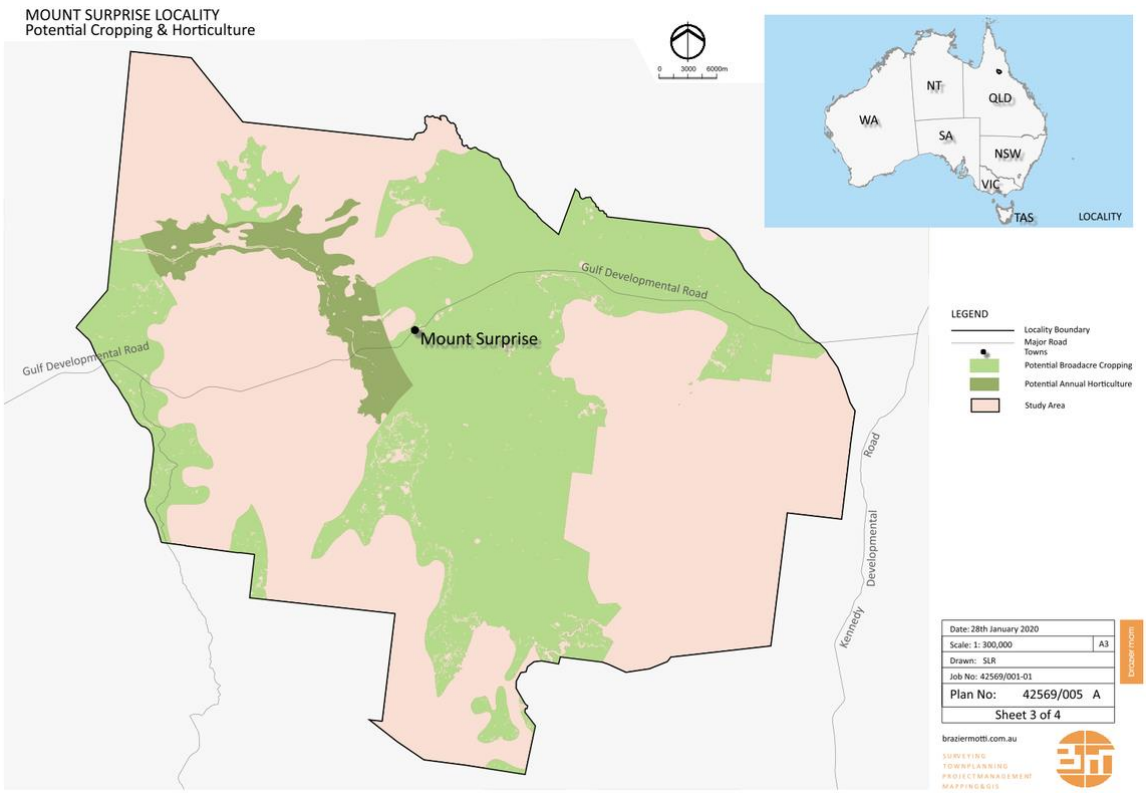


Figure 33 Mount Surprise Potential Cropping Areas

5.6 Mareeba-Dimbulah Region

The Mareeba-Dimbulah study area covers the region comprised of the following localities:

- Mareeba;
- Mutchilba;
- Arriga;
- Chewko; and
- Dimbulah.

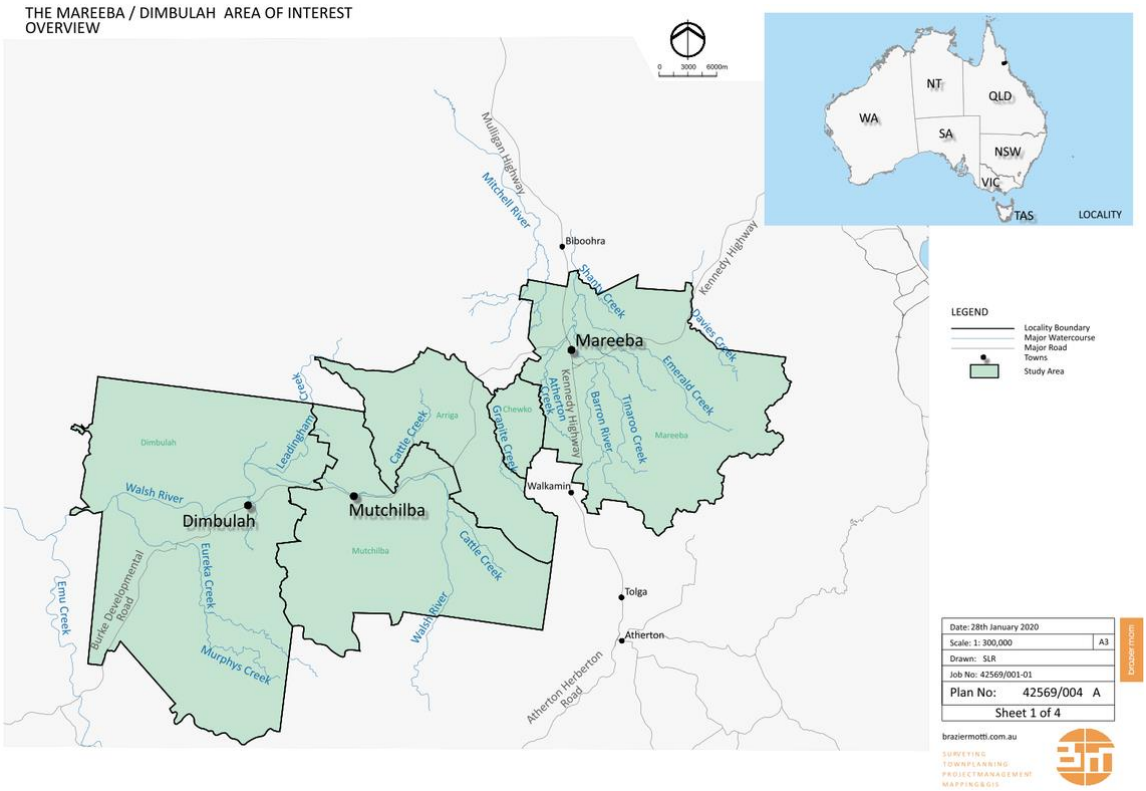


Figure 34 Mareeba - Dimbulah Region Map

The Mareeba-Dimbulah region covers an area of over approximately 1,000 square kilometres. The region is also commonly referred to as the Mareeba-Dimbulah Irrigation Area and it forms part of the broader MDWSS area.

5.6.1 Mareeba-Dimbulah - Water Availability

The Mareeba-Dimbulah area is supplied by both surface and groundwater. The primary surface water source is through the MDWSS from Tinaroo Dam. The MDWSS is a supplemented water scheme operated by Sunwater in accordance with the Barron Water Plan.

The Mareeba-Dimbulah region experiences some variability in rainfall with Mareeba (Mareeba Airport) averaging 832mm of rainfall annually compared to 775mm in Dimbulah. While lower than southern areas of the Atherton Tablelands, this still represents a high rainfall volume compared to other areas within this Study.

The surface water supplied by the MDWSS is supplemented water with a total of 191,957 ML in water entitlements, as follows:

	Industrial	Irrigation	Urban	Distribution Losses	Total
Reserve Volume (ML)	1,243	144,548	1,167	45,000	191,957

Table 11 MDWSS Water Entitlements, 2021 [42]

Sunwater Reports that for the five-year period from 2013 to 2018, on average greater than 65% of available water entitlements were used by entitlement holders annually. Supplemented water allocations may be traded in the MDWSS and must be in accordance with the operation's manual protocols for the plan area. Sunwater must also consent to the seasonal assignment of water held under a water allocation.

Some local groundwater systems do exist within the Mareeba-Dimbulah area, however, the extent and capacity of these systems is unclear. According to the Queensland DNRME ground water database (accessed December 2020), there are more than 300 registered groundwater bores in the Mareeba-Dimbulah area. Most of these bores are used for irrigation or to supply water for domestic purposes or for stock watering. While a groundwater management plan does exist for the Atherton region, this does not cover the Mareeba-Dimbulah area, and therefore all unsupplemented groundwater use is in accordance with the Barron Water Plan.

5.6.2 Mareeba-Dimbulah - Climate (Temperature)

The Mareeba-Dimbulah region has a hot and dry semi-arid climate. Temperature ranges across the Study Area are reasonably consistent and therefore a single reference point, Mareeba, has been used for assessment purposes. The mean annual temperature range for Mareeba extends from 13 to 32 degrees Celsius. The mean daily temperatures across the catchment are considered high relative to other parts of Australia.

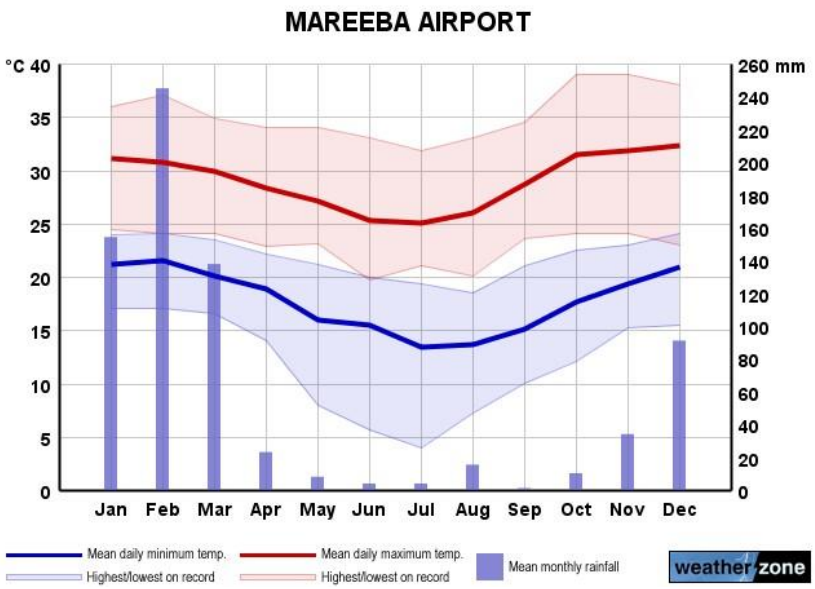


Figure 35 Mareeba - Dimbulah Region Temperature Ranges [43]

[42] https://www.sunwater.com.au/wp-content/uploads/Home/Schemes/Mareeba-Dimbulah/2022_Draft_Service_and_Performance_Plan_Mareeba_Distribution_Service_Contract.pdf
[43] https://www.weatherzone.com.au/

5.6.3 Mareeba-Dimbulah - Soils

A typical agricultural soil in the Mareeba-Dimbulah area is derived from granite and has inherent low fertility. A study completed in relation to the soil profile of the Mareeba Dimbulah Irrigation Area [44] confirmed a broad range of soil groups exist within the region. However, the study indicated that most soils in the catchment are at least moderately suitable for broadacre cropping or horticulture, with the predominant profile comprising of a sandy loam or sandy clay loam soil.

Given the extensive amount of agriculture that is currently being undertaken within the region, predominantly sugar cane production, it is evident that irrigated broadacre cropping is suited to the region based on soil profiles.

5.6.4 Mareeba-Dimbulah - Current Agricultural Land Use

Based on mapping, the land in the Mareeba-Dimbulah area is used for pasture production, irrigated and rain grown broadacre cropping and annual and perennial horticulture (Figure 36). Irrigated sugar production has significant prevalence in the area surrounding Arriga, located between Mareeba and Dimbulah.

Sugar cane production is the main crop for the region. Beef cattle production, bananas, mangoes, avocados, citrus and hay production are other leading agricultural land uses for the area.

Through stakeholder discussions, it has been confirmed that some cotton trials and small-scale cotton crops have been grown in the region in past years. Small scale cotton crops are being grown currently and it is expected other farmers will include cotton as a rotational crop in the coming years.

[44] Enderlin NG (1997) Soil Fact Sheets: Mareeba Dimbulah Irrigation Area, Mareeba. Department of Natural Resources and Mines

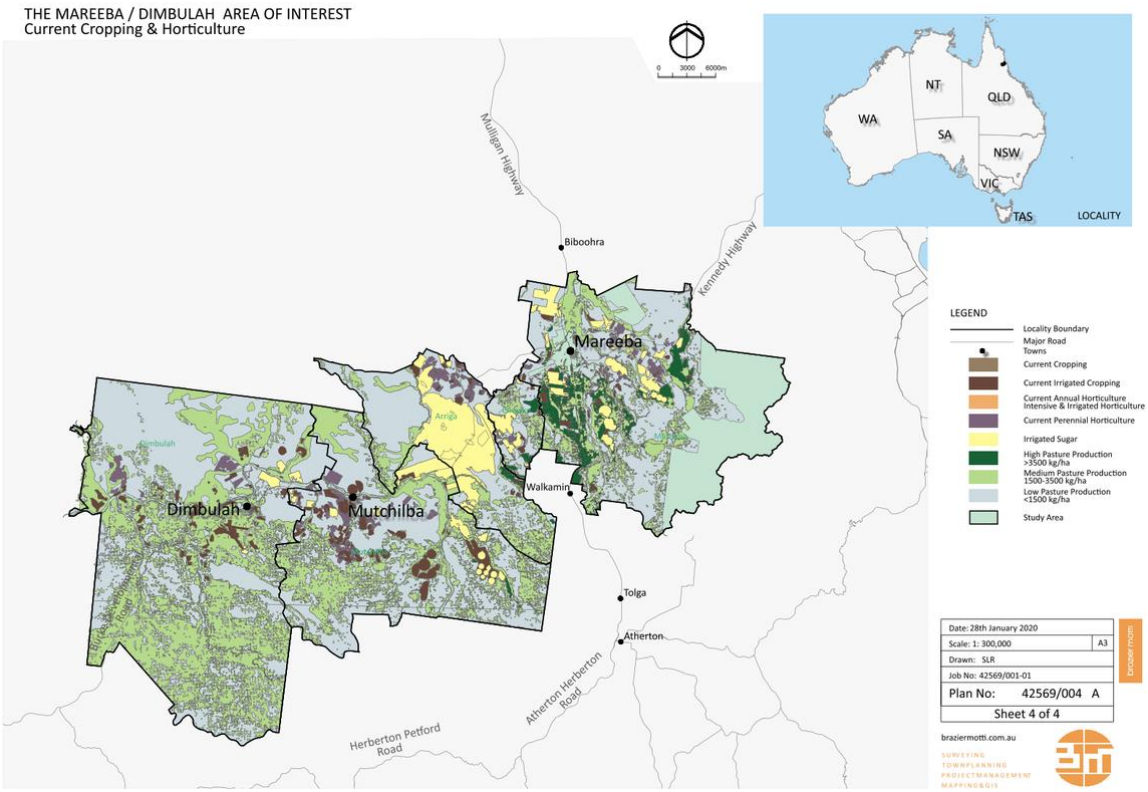


Figure 36 Mareeba - Dimbulah Region Current Cropping and Horticulture Map

5.6.5 Mareeba-Dimbulah - Vegetation Management Considerations

A substantial amount of land in the Mareeba-Dimbulah area is classified as Category X, being land that is exempt clearing and vegetation management restrictions. The majority of the remainder of land in the region is classified as Category B, remnant vegetation, to which restrictions on clearing exist.

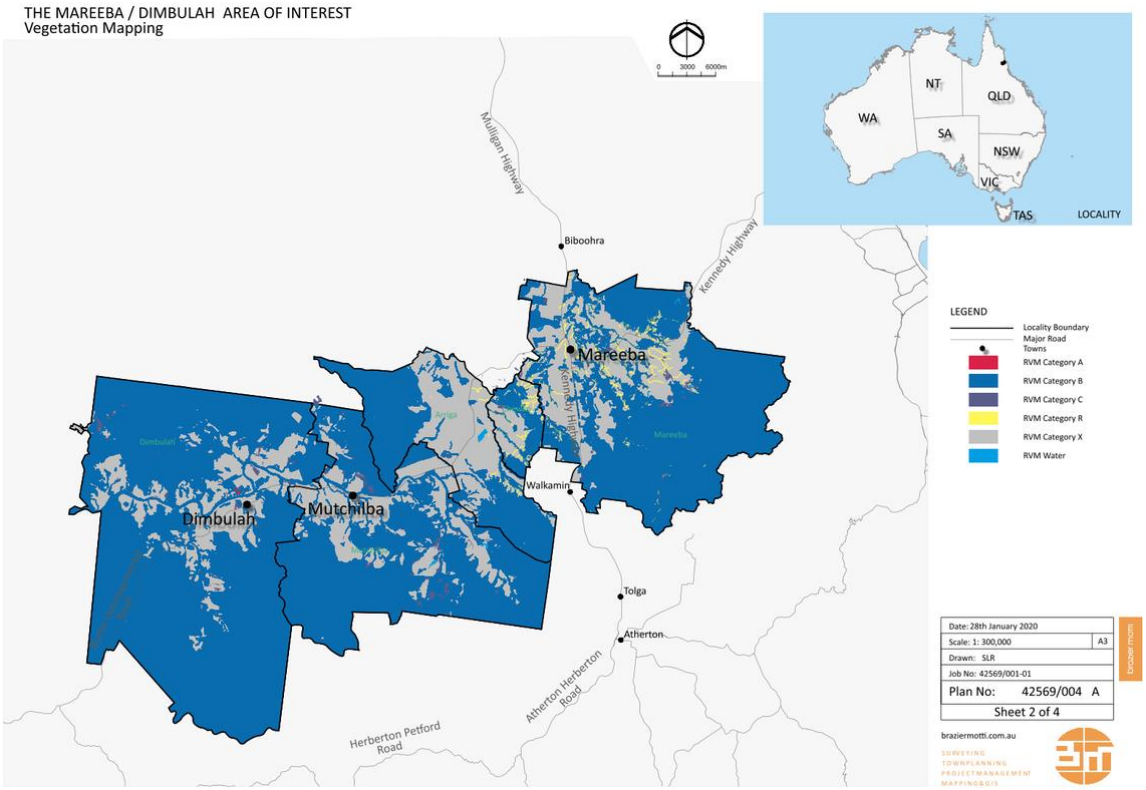


Figure 37 Mareeba - Dimbulah Region Vegetation Map

5.6.6 Mareeba-Dimbulah - Other Considerations

The Mareeba-Dimbulah area is a well-established agricultural region, with a long history of cropping and horticulture production. The MDWSS is a sophisticated irrigation scheme that has enabled significant expansion of production across the Tablelands region. Sugar cane production is the dominant crop in the area but is centred mainly around the Arriga region where a sugar mill has been constructed.

Horticulture dominates the region in terms of the dollar value of production. In terms of perennial horticulture, bananas, mangoes, citrus and avocados are the main crops grown in the region. In recent years, there has been a gradual trend towards permanent plantings of high value crops. Such crops require more water as they mature so their demand for allocation will continue to grow.

5.6.7 Mareeba-Dimbulah Region - Cropping Precincts

Areas suitable for broadacre cropping and horticulture (in accordance with the Agricultural Land Audit (DAF Qld 2013)) the following cropping precincts were identified for the Mareeba-Dimbulah area (Figure 38). Currently much of the land within the region would be suitable for cotton production.

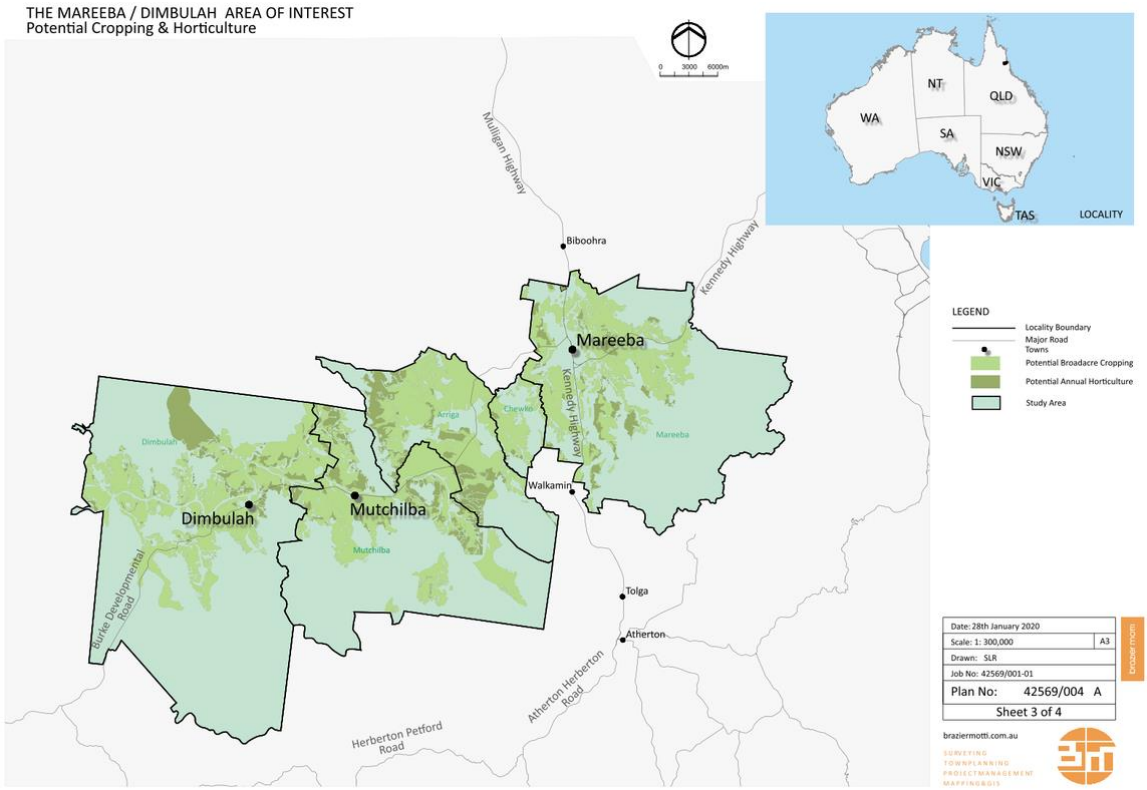


Figure 38 Mareeba - Dimbulah Region Potential Cropping Areas

5.7 Lower Burdekin Region

For the purposes of the Study, the Lower Burdekin region is defined in accordance with the boundaries of the Haughton and Lower Burdekin sub catchments as identified under the Burdekin Basin Water Plan. The region extends from a northern point of Giru, south of Dalbeg and east to Mingela. The main population centre within the region is Ayr.

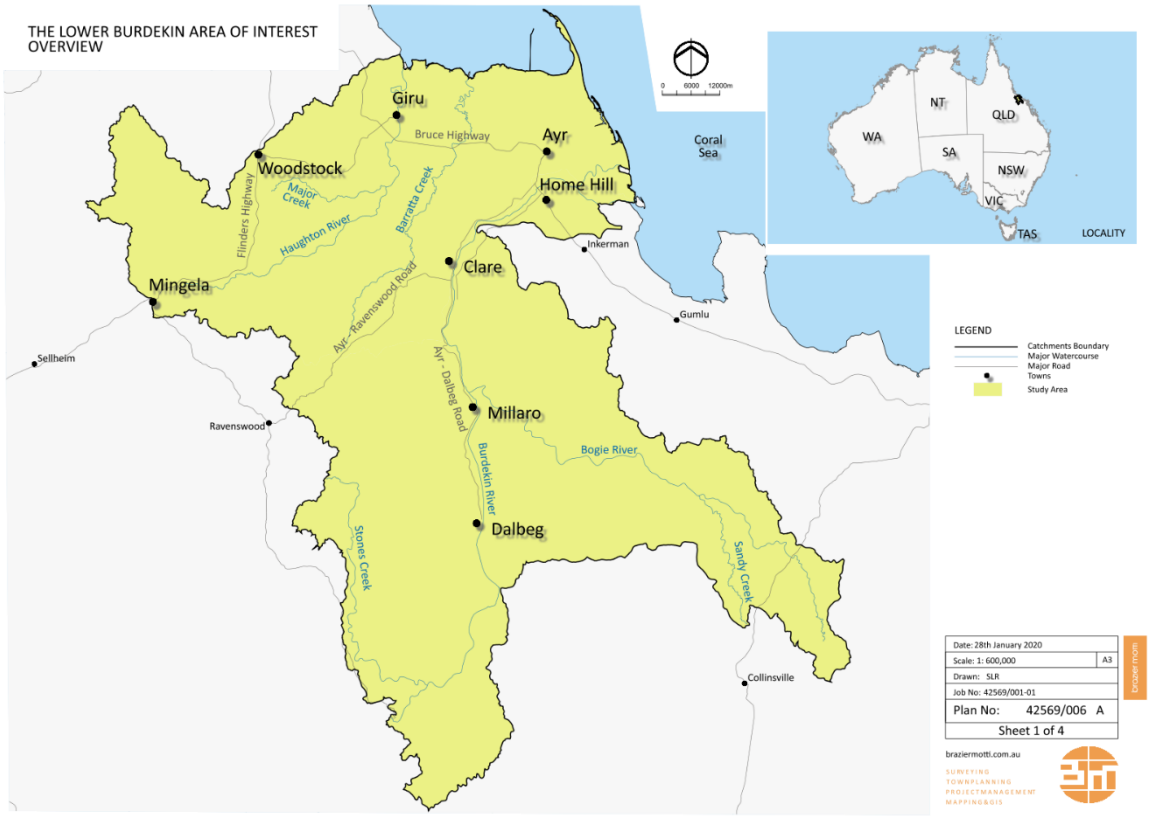


Figure 39 Lower Burdekin Region Map

The Lower Burdekin is comprised of two broad agricultural regions, the Delta region (Burdekin River Delta) and the BHWSS, a surface water scheme on the floodplains of the Burdekin River, below the Burdekin Falls Dam. The region is dominated by sugar cane production, supported by the BHWSS.

The Lower Burdekin is an established agricultural region and has been subject to many studies and trials. Specifically, in 2012 extensive cotton production studies were completed by the Cotton Catchment Communities CRC, DAFF and CSIRO [45].

[45] Grundy P, Yeates S and Grundy T (2012) NORpak: Cotton production and management guidelines for the Burdekin and north Queensland coastal dry tropics region 2012. CSIRO 2012

5.7.1 Lower Burdekin - Water Availability

The Lower Burdekin area is supplied by both surface and groundwater. Water in the region is managed primarily under three frameworks:

- Supplemented Water – BHWSS Resource Operations Licence (ROL)
- Unsupplemented Water – Haughton Water Management Area (WMA) and Lower Burdekin WMA
- Underground Water – Burdekin Underground Water Area (UWA)

The Lower Burdekin region experiences highly seasonal rainfall with some variability across the catchment, with Ayr averaging 937 mm of rainfall annually compared to 1,144 mm in Mingela and 736 mm in Dalbeg. Unlike many of the other study areas, the Lower Burdekin region does also receive some winter rainfall due to moisture carriage by easterly trade winds.

BHWSS ROL

The BHWSS is a supplemented water scheme operated by Sunwater in accordance with the Burdekin Basin Water Plan. The surface water supplied by the BHWSS is supplemented water with a total of 1,079,592ML in water entitlements, as follows:

	Industrial	Irrigation	Urban	Sunwater	Distribution Losses	Total
Reserve Volume (ML)	23,049	636,664	10,537	202,605	206,737	1,079,592

Table 12 BHWSS Water Entitlements, 2021 [46]

The above water allocations are split into High Priority (99,998ML) and Medium Priority (979,594ML).

Sunwater Reports that for 2019/20 only 663,465ML of water was delivered under the BHWSS to allocation holders, which is slightly higher than the 18-year average of 600,384ML annually [47]. Supplemented water allocations may be traded in the BHWSS and must be in accordance with the ROL. Sunwater must also consent to the seasonal assignment of water held under a water allocation.

Haughton WMA and Lower Burdekin WMA

There exists a total of 45 unsupplemented water allocations with a total of 38,903 ML within the Haughton and Lower Burdekin WMAs[48]. Over the last five years a maximum of 40% of this volume has been used in any one year (2017/18).

The water plan provides reserves of unallocated water that is comprised of general and strategic reserves. 50,000ML/ year of general reserve relates to the Lower Burdekin WMA and 5,000ML relates to the Haughton WMA. An additional 150,000ML/ year exists within the Strategic Reserve allocated to the Burdekin and Haughton sub catchments as allowance for raising the Burdekin Falls Dam[49].

[46] https://www.sunwater.com.au/wp-content/uploads/Home/Schemes/Burdekin-Haughton/2022_Draft_Service_and_Performance_Plan_Burdekin_Haughton_Bulk_Water_Service_Contract
[47] https://www.sunwater.com.au/wp-content/uploads/Home/Schemes/Burdekin-Haughton/2022_Draft_Service_and_Performance_Plan_Burdekin_Haughton_Bulk_Water_Service_Contract
[48] Minister's Performance Assessment Report Water Plan (Burdekin Basin) 2007. June 2019
[49] https://nrm.nqdrytropics.com.au/water/water-use-water-allocation/

Water from the General reserve is released under an open tender process and strategic reserve volumes are allocated via an approved application from the Queensland Government. Water allocations may also be traded in some WMAs where allocations are established with trading rules.

Burdekin UWA

The Burdekin UWA is managed by Lower Burdekin Water (LBW). One role of the LWB is to utilise the flow of the Burdekin River to replenish the subterranean water supplies of the Burdekin Delta, with the view to increasing the quantity of water available for irrigation and other uses. Extraction of groundwater for purposes other than stock, domestic and other prescribed activities is required to be metered.

In 2019/20 LBW confirmed 219,283ML of water was diverted from the Burdekin River to replenish subterranean supplies[50]. For 2020/21 the allocation of water by LBW is 156,000ML for the northern division (100% allocation) and 99,000ML for the southern division (100% allocation)[51]

Groundwater quality has been identified as a key concern for the region, with salinity levels increasing in prevalence. Due to the proximity of water extraction points being near to the coast, sea water intrusion into the ground water system is an ongoing concern[52].

5.7.2 Lower Burdekin - Climate (Temperature)

The Lower Burdekin region has a sub-tropical climate. Temperature ranges across the Study Area vary, however, a single reference point of Ayr has been used for assessment purposes. The mean annual temperature range for Ayr extends from 12 to 32 degrees Celsius. In southern parts of the Lower Burdekin region, frosts and lower minimum temperatures are possible. The mean daily temperatures across the region are considered milder relative to other parts of the North Queensland Study region.

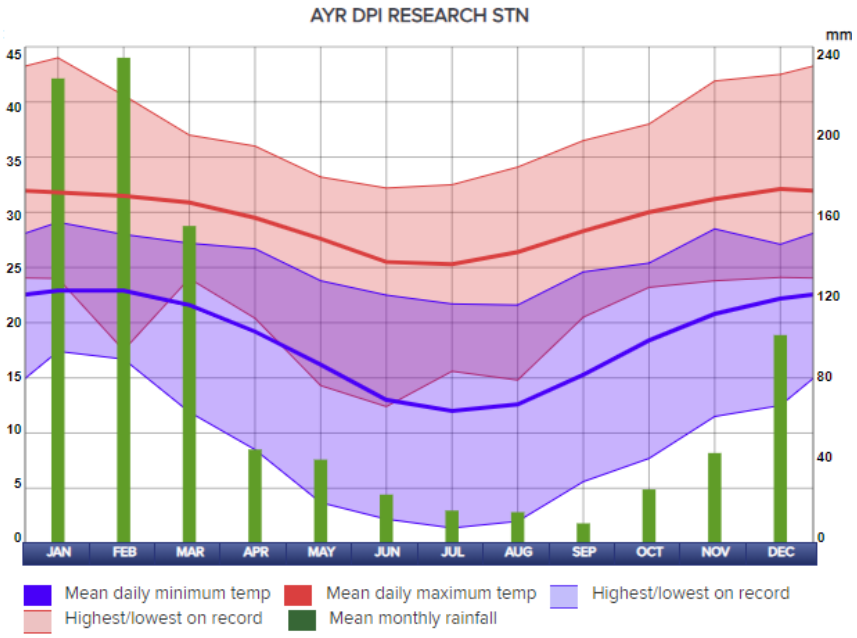


Figure 40 Lower Burdekin Region Temperature Range [53]

[50] http://lowerburdekinwater.com.au/wp-content/uploads/2021/02/2019-2020-LBW-Year-in-Review
[51] http://lowerburdekinwater.com.au/usage/
[52] Petheram C, Tickell S, O'Gara F, Bristow KL, Smith A and Jolly P (2008) Analysis of the lower Burdekin, Ord and Katherine-Douglas Daly Irrigation are: Implications to the future design and management of tropical irrigation. CRC for Irrigation Future Technical report 05/08.
[53] https://www.weatherzone.com.au/

5.7.3 Lower Burdekin - Soils

The dominant soils of the BHWSS area are cracking grey clays and black earths (Vertosols and Dermosols), although a wide range of soils are present throughout the region.

Soils in the Burdekin Delta include black and grey cracking clays and sandy soils (Kandosols) [54].

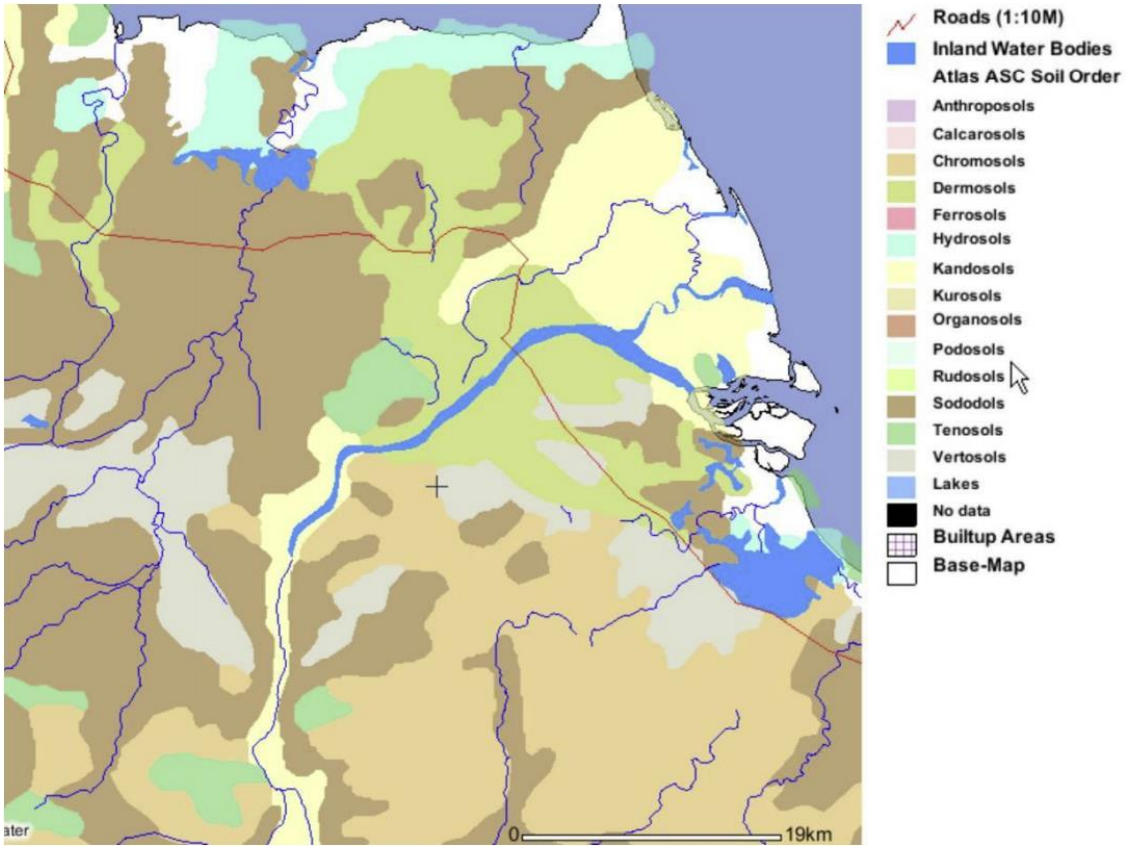


Figure 41 Lower Burdekin Region Soils [55]

Given the extensive amount of agriculture that is currently being undertaken within the region, predominantly sugar cane production, it is evident that irrigated broadacre cropping is suited to the region based on the soil profiles that exist.

5.7.4 Lower Burdekin - Current Agriculture Land Use

The region has approximately 80,000 hectares of irrigated land supported by the BHWSS[56]. The irrigation area is dominated by sugar cane production. The current crop rotation strategy results in land left fallow or planted to legumes, soybeans or other cereal crops 1 in every 5 years. Other uses of land areas in the Lower Burdekin region are for cattle grazing and other annual and perennial horticulture. Currently there are no cotton growers located in the Lower Burdekin region.

[54] Petheram C, Tickell S, O'Gara F, Bristow KL, Smith A and Jolly P (2008) Analysis of the lower Burdekin, Ord and Katherine-Douglas Daly Irrigation are: Implications to the future design and management of tropical irrigation. CRC for Irrigation Future Technical report 05/08.
[55] Australian Soil Resource Information System (ASRIS)
[56] Petheram C, Tickell S, O'Gara F, Bristow KL, Smith A and Jolly P (2008) Analysis of the lower Burdekin, Ord and Katherine-Douglas Daly Irrigation are: Implications to the future design and management of tropical irrigation. CRC for Irrigation Future Technical report 05/08.

Cotton trials have been completed in the region, with the primary trials occurring between 2008 and 2012 run by the Queensland Department of Agriculture, Fisheries & Forestry (DAFF), the Cotton Catchment Communities CRC, CSIRO, CRDC and the Cotton CRC. Several growers were supported in growing cotton as a potential rotational crop for sugarcane with mixed successes. Lower lint bale pricing, high cost of transport to gin and unseasonal climatic conditions impacting crop yields were the primary reasons identified for unfavourable trial outcomes. These factors impacted grower appetite to introduce cotton as a rotational crop and saw growers reverting back to traditional sugar cane production methods.

Notwithstanding, it is estimated that in the future approximately one third of the current sugarcane area may be able to be rotated under cotton (up to approximately 5,000 hectares) each year. Based on an irrigated yield rate of 9 bales per hectare, this may result in a total of 45,000 bales able to be produced under this arrangement. However, the likelihood of this would be heavily predicated on the appetite of growers to convert growing areas to cotton.

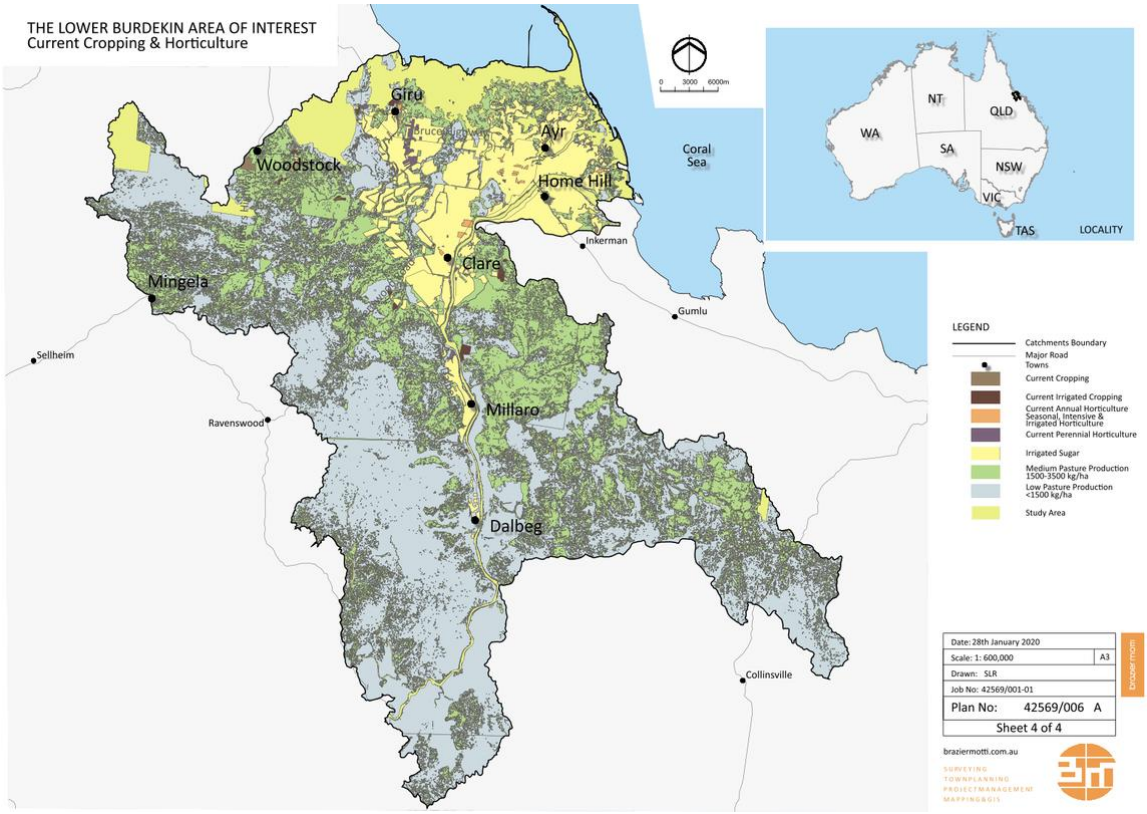


Figure 42 Lower Burdekin Region Current Cropping and Horticulture Map

5.7.5 Lower Burdekin - Vegetation Management Considerations

A substantial amount of land in the Lower Burdekin irrigation area is classified as Category X, being land that is exempt clearing and vegetation management restrictions. The majority of the remainder of land, outside of the primary irrigation areas, is classified as Category B, remnant vegetation, to which restrictions on clearing exist.

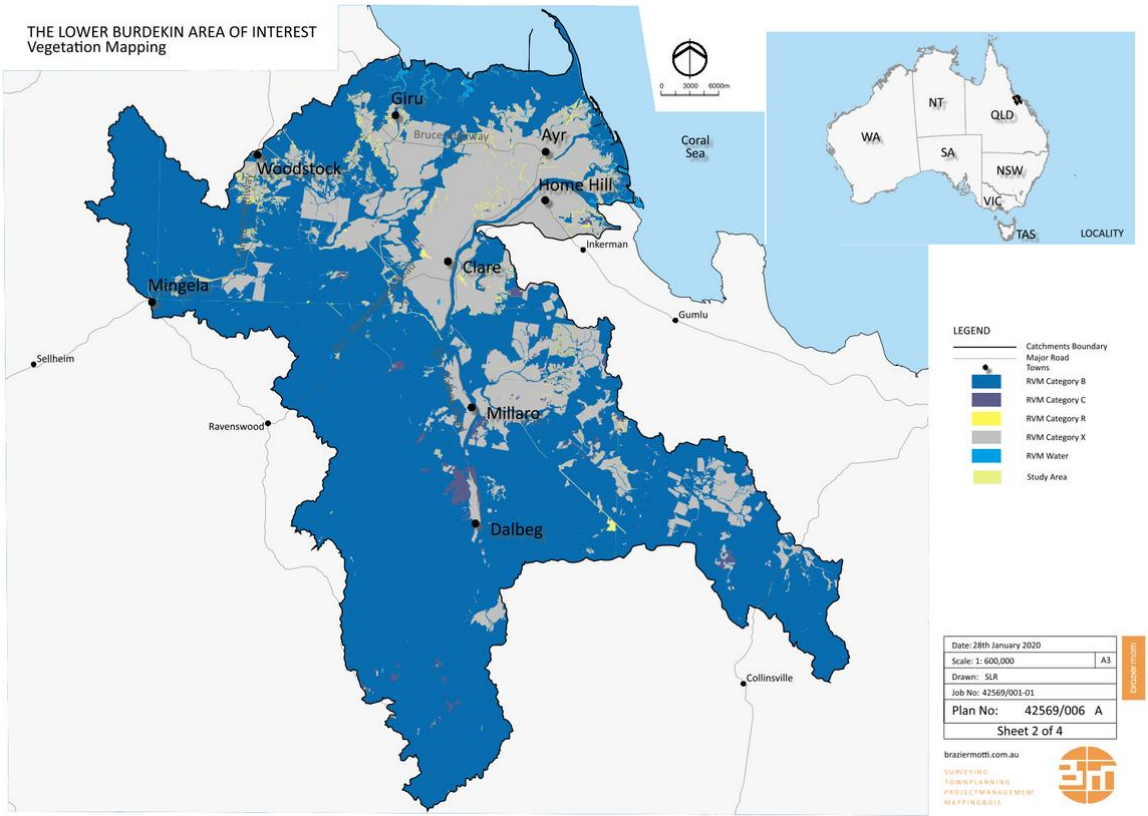


Figure 43 Lower Burdekin Region Vegetation Map

5.7.6 Lower Burdekin - Other Considerations

The Lower Burdekin region is a well-established agricultural precinct with access to sufficient and reliable water reserves. Due to the long history of sugarcane production in the region, access to machinery, agronomy expertise and industry support services is available. The region also has very close proximity to major centres of Townsville (80km) and Charters Towers (135km) permitting high accessibility of skilled labour and other support services.

The fall army worm is currently having an impact on current sugar cane rotational crops such as corn, mungbeans, sorghum and soybean. As a result interest in cotton, has increased due to the technology advancements with Bollgard 3 providing some resistance against other common pests.

5.7.7 Lower Burdekin Region - Cropping Precincts

Figure 44 illustrates those precincts identified as having the highest potential for cropping, in accordance with the DAF Agricultural Land Audit.

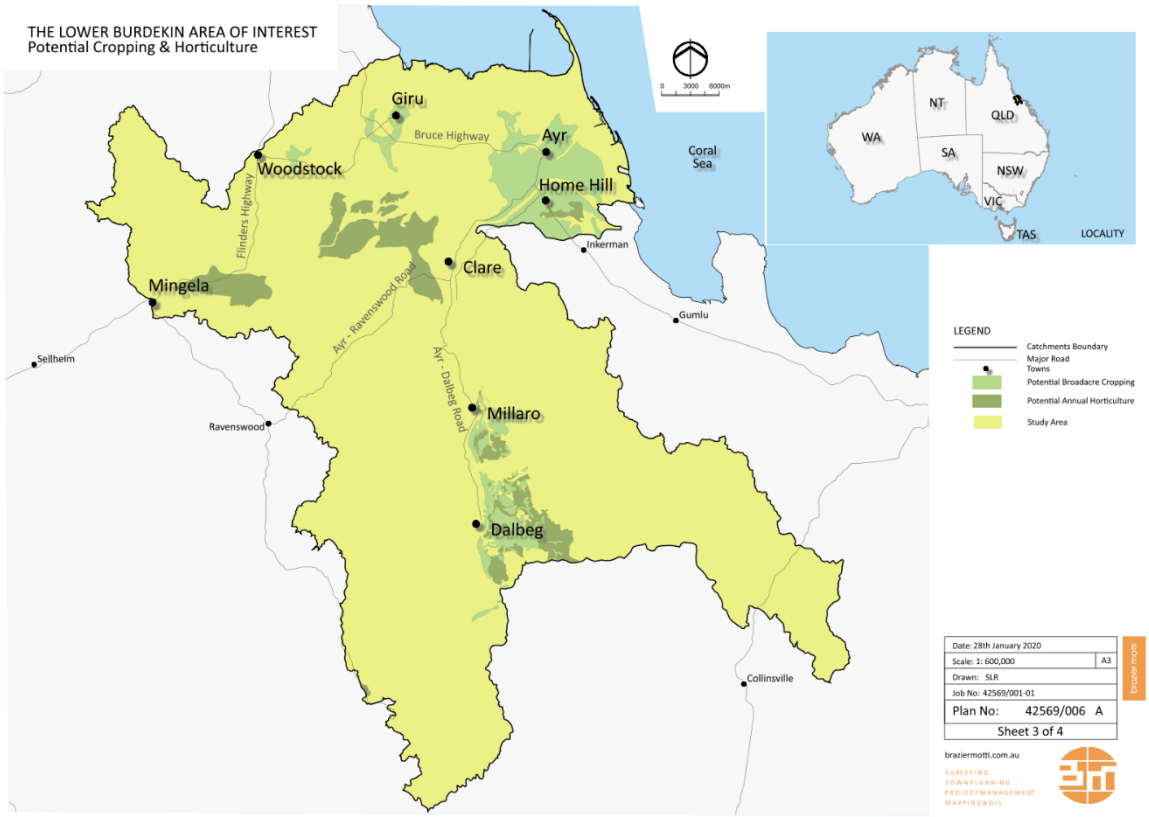


Figure 44 Lower Burdekin Region Potential Cropping Areas

5.8 Summary of Cotton Production Considerations

The relative strengths and risks associated with each of the five Study Areas, outlined above, have been summarised in the Table 13.

Study Area	Opportunities	Risks
Flinders River Catchment	• Expansive grasslands with limited vegetation • Large land area with suitability for immediate broadacre cropping expansion • Soil profiles suitable for variety of water storage solutions and irrigation options • Migration of southern cotton growers to the region has buoyed grower interest • Major transport arterials are of high standard • Successful cotton trials have been completed • Access to various population centres for labour, equipment and materials	• Uncertainty regarding future water allocations • High reliance on rain grown methods to establish farms • Sustainable production scenario is predicated on large water infrastructure and irrigation projects being established • Lowest mean annual rainfall volumes of all Study Areas
Gilbert River Catchment	• Unallocated water available in the system and high mean annual rainfall • High climate suitability for cotton production • Successful cotton trails have been completed • Soil profiles are generally suitable for cotton production • Gilbert River Irrigation Project has progressed to detailed business case and is awaiting final funding to proceed. • Migration of southern cotton growers to the region has buoyed grower interest	• Significant vegetation and land use restriction issues • Access to available water limited due to land restrictions • High year on year rainfall variability reducing opportunities for rain grown cotton options • Soil profiles not optimal for all irrigation options • Sustainable production scenario is predicated on large water infrastructure and irrigation projects being established • Transport infrastructure connecting to western areas of catchment is not optimal
Mount Surprise Region	• High mean annual rainfall • High climate suitability for cotton production • Successful cotton trails have been completed • Soil profiles are generally suitable for cotton production • Close proximity to major arterials connecting from Mareeba to the south	• Limited access to surface or groundwater sources for broadacre irrigation • Significant vegetation and land use restriction issues • Soil profiles not optimal for all irrigation options
Mareeba – Dimbulah Region	• Well established agricultural precinct with diversity of production • Sophisticated supplemented water scheme • High mean annual rainfall volumes • Close proximity to Cairns to access labour, machinery and services • High suitability of soils for cotton production • Cotton trials and small scale production underway	• Expansion of cotton production predicated on conversion of existing crops to cotton or integration into crop rotation • Cost of water is high compared to other Study Areas due to allocation to high value horticulture such as avocados and sugar cane • Crop yields not optimal due to climatic conditions
Lower Burdekin Region	• Well established agricultural precinct • Sophisticated supplemented water scheme and additional groundwater and surface water availability • High mean annual rainfall volumes • Close proximity to Townsville to access labour, machinery and services • High suitability of soils for cotton production • Previous DAF trials have been completed	• Expansion of cotton production predicated on conversion of existing crops to cotton or integrating into crop rotation • Crop yields not optimal due to climatic conditions • No current growers in the region • Trial outcomes were unfavourable and have deterred some growers

Table 13 Study Area Cotton Production Insights

6 COTTON PRODUCTION ASSESSMENT

This section of the Report provides a forecast of cotton production across three timeline scenarios for the Study Region. The three defined timeline scenarios are:

1. **Current** – the expected annual volume of cotton determined based on current plantings or commitments by growers

2. **Indicative 5 Year Horizon** – the expected annual forecast volume of cotton at a 5-year Horizon (expected future state) as advised by current growers, or as determined based on evaluation of production potential. This estimate **excludes** the impacts of proposed major water and irrigation projects

3. **Indicative 10 Year Horizon** – the optimal annual forecast volume of cotton at a 10-year Horizon (aspirational future state) as advised by current growers, or as determined based on evaluation of production potential. This estimate **includes** the impacts of proposed major water and irrigation projects

Due to the preliminary nature of this Study, the early stage of industry establishment and varying farmer preferences for future cotton production, it was considered that an extrapolation of forecast volume data for year-on-year production was unlikely to provide an appropriate degree of accuracy. As such only point in time estimates were developed and reported.

To conclusively determine accurate production forecasts, confirmation of grower supply contracts would be required. While out of the scope of this Study, further consideration of such contracts should be included in a detailed business case for a preferred cotton gin site.

6.1 Forecast Cotton Production Volume Assessment Methodology

An assessment of each Study Area was completed to establish a forecast cotton production volume across the three defined scenarios. The following methodology was adopted for determining the production volume forecasts:

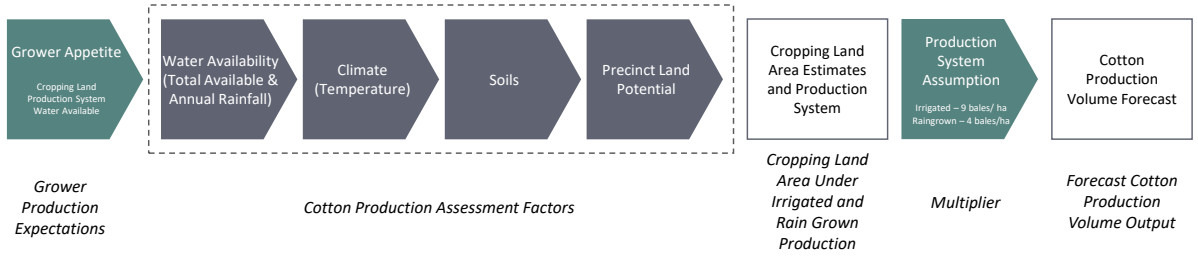


Figure 45 Cotton Production Volume Forecast Methodology

The assessment initially considered the appetite of growers and landholders to produce cotton. This was determined through the stakeholder engagement process whereby growers were requested to provide information regarding estimates of cropping land, production systems and yields. This information was subsequently validated considering those factors critical for cotton production and the characteristics of each Study Area (outlined in Part 5), such as water availability and land use restrictions.

The outcome of this process gave rise to a final cropping land estimate for irrigated and rain grown production. Applying the yield assumptions for each production system type, a final cotton production volume forecast was determined.

6.1.1 Grower Appetite

As part of the stakeholder engagement process, growers and landholders were specifically requested to provide information related to the following items:

- Assessment of their potential to grow cotton now and into the future;
- Land area expected to be planted to cotton now, 5 years and 10 years;
- Crop rotation/s adopted;
- Production system utilised;
- Expected yield of crop/s;
- Expected water requirements;
- Notable impediments, challenges, or considerations.

This information was requested from stakeholders at their respective farm or property level. The information obtained was validated against known attributes and constraints specific to the production of cotton, and was collated and a forecast cotton production volume was recorded for each farm or property. This information was subsequently consolidated into the total volumes for the relevant Study Area and growing region.

Grower appetite data for the Lower Burdekin was sourced through a desktop analysis considering publicly available information related to irrigation areas in the region. Industry representatives for the Lower Burdekin region provided insights regarding the expected land areas that may be suitable for cotton production, potential crop rotation options and the yields to be expected.

6.1.2 Water Availability

A major factor considered in determining the cotton production forecasts was the amount of water available to support irrigated production (primarily surface water). Allocatable surface water volumes provided under the Queensland Government Water Plans were outlined in Part 5 and have been summarised below:

Study Area	Surface Water Reserve	Total Water Reserve Volume* (ML)	Allocated Water Reserve Volume (ML)	Unallocated Water Reserve Volume (ML)	Remaining Water Reserve Volume (ML)
Flinders River Catchment	Unsupplemented	239,650	100,000	-	139,650
Gilbert River Catchment	Unsupplemented	467,000	28,995	85,000	353,005
Mount Surprise Region	Unsupplemented	-	-	-	-
Mareeba – Dimbulah	MDWSS	144,588	144,588	-	-
Lower Burdekin Region	BHWSS	636,664	636,664	-	-

** Unsupplemented general reserve volumes or volumes identified for irrigation under a relevant ROL*

Table 14 Summary of Surface Water Reserves

Currently, only the Gilbert River catchment has unallocated water (85,000ML), however, restrictions do apply to this volume. There is currently no unallocated water in the Flinders River catchment, BHWSS or MDWSS, however, water allocation transfers may be available.

The Queensland Government has indicated that the remaining 139,650ML of general reserve water in the Flinders River is currently being considered in relation to future water requirements for large scale water infrastructure projects. No announcement has yet been made regarding when this water may be available for allocation.

For the purposes of the assessment, it was assumed that no further water allocations would be available in either the current scenario (Scenario 1) or 5-Year Horizon (Scenario 2), except within the Gilbert River catchment, and that the growth in irrigated production would arise from landholders applying unused water allocations to cotton production, or through existing growers integrating cotton into cropping rotations.

6.1.3 Major Water Infrastructure Projects

Data was also collated in relation to major water infrastructure projects. Specifically, the Richmond Agriculture Project, the Hughenden Irrigation Project and the Gilbert River Irrigation Project were considered as part of this assessment.

In determining forecast cotton production volumes for these projects, an assessment of total available land, available water and potential cotton crop rotations was completed. Due to the scale of these projects and the time required to establish, finance and construct, it was considered that the majority of cotton production was likely to arise between the 5 and 10 year Horizons, and therefore forecast cotton volumes were only included in the 10 Year Horizon (Scenario 3).

As noted in previous sections of this Report, the success of these projects is predicated on accessing sufficient water volumes from the river catchments. Based on the current Queensland Government Water Plans, proponents have identified this as a major impediment to each project advancing.

To the extent that these projects do not proceed, it is still expected that any available water in the respective river systems may be utilised by individual growers, and therefore the assessed cotton production volumes are not expected to be materially impacted.

6.1.4 Production System Assumptions

As outlined previously in this Report, for the purposes of this Study the following yields have been assumed for the assessment of cotton production volumes:

- Irrigated production – 9 bales per hectare.
- Rain grown production – 4 bales per hectare.

It is noted that these yields will vary between Study Areas and growing regions, however, they are considered to be reasonable estimates of the average across the Study Region.

6.2 Forecast Cotton Production Volumes

A final forecast cotton production volume was estimated for all five Study Areas and across the three defined timeline scenarios. Table 15 outlines the respective cotton production forecasts determined as part of the assessment.

Study Area	Scenario 1 Current Production (bales)	Scenario 2 5 Year Production Horizon (bales)	Scenario 3 10 Year Production Horizon (bales)
Flinders River Catchment	6,200	99,800	192,500
Gilbert River Catchment	5,350	44,800	111,075
Mount Surprise Region	8,000	26,650	36,550
Mareeba – Dimbulah Region	7,200	7,560	19,800
Lower Burdekin Region	-	24,000	48,000
Total North Queensland	**26,750**	**202,810**	**407,925**

Table 15 Estimated Cotton Production Volume Forecast by Study Area

For the purposes of further analyses completed in this Report (Part 8 and Part 9), **Scenario 2 - Indicative 5 Year Horizon** production forecasts have been utilised. This timeline was selected having regard to the construction time to establish a cotton gin and lead time to establish grower cropping arrangements.

Detailed assessments and the outcomes for each of the three scenarios and across all five Study Areas have been attached at Appendix A.

6.2.1 Forecast Cotton Production Volumes by Growing Region

Due to the geographical expanse of the Study Areas, to enable a detailed assessment of potential gin locations in Part 8 of this Report, the above production volume forecasts have been further dissected to show those volumes attributable to growing regions within each of the Study Areas. The allocation was completed based on an assessment of the relative proximity of the individual farm or property to one of a set of defined growing regions.

The summary of forecast cotton production volumes against each growing region has been outlined in Table 16.

Growing Region	Study Area	Scenario 1 Current (bales)	Scenario 2 5 Year Horizon (bales)	Scenario 3 10 Year Horizon (bales)
Cloncurry	Flinders River Catchment	-	-	-
Julia Creek	Flinders River Catchment	5,800	52,800	60,000
Richmond	Flinders River Catchment	400	38,000	65,000
Hughenden	Flinders River Catchment	-	-	18,000
Normanton	Flinders River Catchment	-	9,000	49,500
Mount Surprise	Mount Surprise Region	8,000	26,650	36,550
Georgetown	Gilbert River Catchment	5,350	44,800	111,075
Ayr	Lower Burdekin Region	-	24,000	48,000
Mareeba	Mareeba - Dimbulah	7,200	7,560	19,800
Total North Queensland		**26,750**	**202,810**	**407,925**

Table 16 Estimated Cotton Production Volume Forecast by Growing Region

7 COTTON PROCESSING OVERVIEW

The industrialisation of cotton processing was a significant milestone in advancing the growth of the cotton industry, yielding productivity and profitability improvements for growers.

In this Report, we have highlighted the interest of growers and other industry stakeholders in developing a sustainable cotton industry in North Queensland. A critical factor to ensuring this occurs is the establishment of one or more cotton processing facilities (cotton gin) in the region.

This section of the Report explores the core elements of cotton processing and identifies the key considerations for the establishment of a viable cotton gin. In addition, information necessary for consideration in determining the optimal location for such a facility has been outlined.

7.1 Cotton Processing Overview

Cotton processing typically occurs through a mechanical cotton gin. The primary goal of the cotton ginning process is to separate the raw cotton fibre (lint) from seed and waste material. The lint, once separated, is then pressed into standardised rectangular bales (weighing 227 kilograms) and is warehoused in preparation for sale. The cotton seed is sold separately for use as animal feed or for processing into oils, meal or other products.

Figure 46 outlines the main stages in in the cotton ginning process and Figure 47 illustrates the elements within a modern cotton gin.

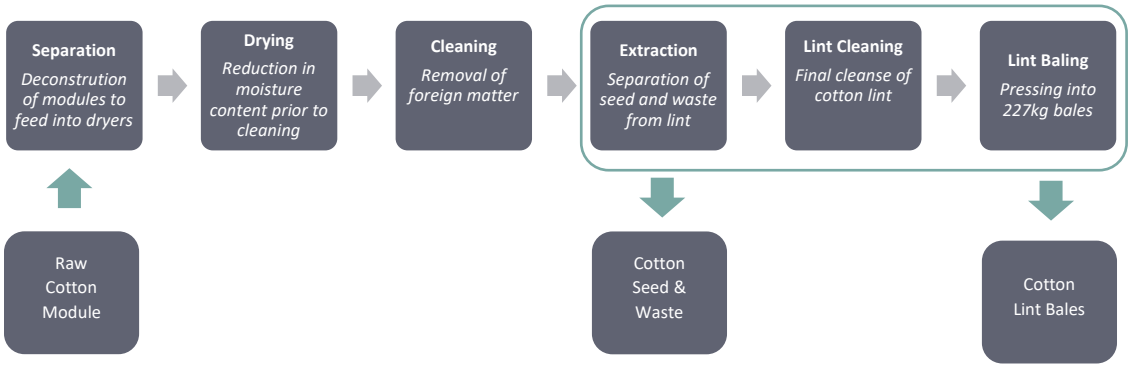


Figure 46 Cotton Ginning Process

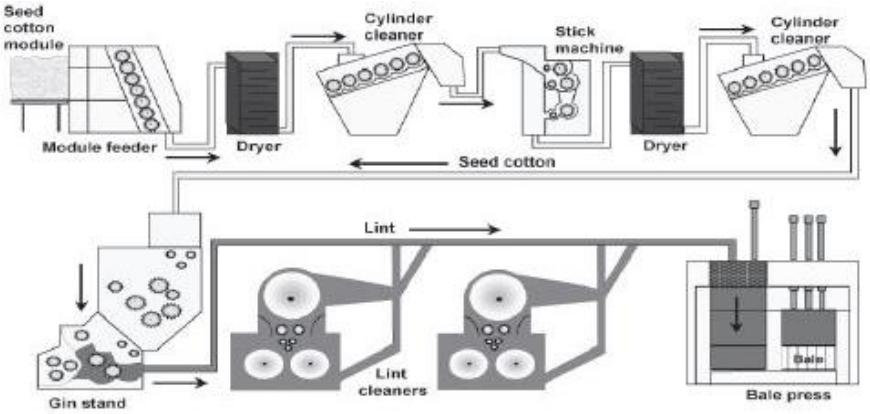


Figure 47 Cotton Gin Design

In Australia, cotton gins are located in Southern Queensland and New South Wales near the major cotton growing regions. With ongoing technology advancements, newer cotton gins typically have improved energy efficiency and higher productivity rate, compared to older gins. Current day cotton gins have the capacity to process between 600 and 1,300 bales in a 24-hour period.

Current gin equipment is designed in sections or as a complete solution with computerised control rooms, managing energy efficiency, safety, moisture/ humidity, and improved baling times thereby collectively improving processing turnarounds and the quality of the end baled lint and seed product.

7.2 Cotton Gin - Site and Infrastructure Establishment

The establishment of a cotton gin requires contemplation of various factors, including:

- Site specifications, design and capital improvements
- Environmental and community impacts
- Financial considerations
- Operational requirements

These have been discussed in further detail in the following sections.

7.2.1 Site Specifications, Design and Capital Improvements

The physical infrastructure associated with a cotton gin (buildings, machinery, hard stand, storage yards) is typically sustained for a period of up to 30 years, as such careful consideration must be given to the site upon which the facility is constructed. The specific design adopted for the site must also consider the logistics requirements for access to/ from, and movements within, the site. The primary elements for a cotton gin site location may include:

- Land area of approximately 80 to 100 hectares (with appropriate land zoning) to adequately cater for cotton module storage, processing and service infrastructure and buildings and bulk warehousing and storage for processed outputs.
- Flat and elevated acreage on hard formed base with flood and water inundation protection.
- Proximity of greater than 10km from population centres to mitigate against environmental impacts (noise and dust).
- Proximity to primary growing regions (optimally less than 350km), with appropriate site access for heavy vehicles and connection to major transport routes for inbound and outbound logistics.
- Proximity to export facilities (optimally less than 500km).
- Proximity to major population centre/s for ready access to supply of labour, goods, materials and services.
- Water, gas, power and sewerage service connections to support operational requirements.

The primary elements of a cotton gin site design may include:

- **Cotton module storage** – extensive open yards used to store and manage raw cotton modules received from growers. Yards are constructed to prevent water inundation and to allow ease of access for machinery to loading and moving modules. Cotton module storage yards may extend for up to 70 hectares.
- **Cotton gin** – commonly centrally located within the site, the cotton gin is housed in an appropriately sized building with ready access to utility infrastructure. Appropriate access to and from the shed is required to allow for transport of modules in and bales and seed out.
- **Machinery, maintenance and services sheds** – adjacent to the cotton gin and with access to utility infrastructure are sheds for housing equipment and for providing support services to the broader site.
- **Utility infrastructure (water, electricity**, sewerage and gas) – connections may be to town supplies or site services. Typically, these are located on boundaries with close proximity to major transport routes or access points to the site.
- **Bulk seed and bale storage** – bulk warehousing is commonly employed for the storage of cotton seed and lint bales. These facilities are located with appropriate access to site weighbridges and entry points to main transport arterials.
- **Offices and parking facilities** – buildings and infrastructure to support administrative and operational staff.

Figure 48 illustrates a typical cotton gin site design.

Figure 48 Queensland Cotton Gin Dalby Site [57]

[57] https://www.metroll.com.au/case_study/queensland-cotton-dalby-gin-storage-sheds/

7.2.2 Environmental and Community Impacts

In assessing a suitable cotton gin site, environmental and community impacts must be considered. Typically, these requirements are referenced as part of general town planning determinations, however, failure to manage adverse outcomes can have financial and reputational consequences for the gin owner or operator.

Following completion of town planning and construction approvals, the two main environmental risks commonly faced by cotton gin owners and operators are:

- **Noise** – cotton gins may operate on extended shifts during peak processing seasons. While technology advancements have reduced the overall noise outputs of cotton gin equipment, noise pollution has been identified as a constraint for such facilities.
- **Dust** – due to the expansive cotton module storage yards and the movement of heavy machinery around the site, also the cotton ginning processes, dust generation is a common occurrence at cotton gin site. Dust suppression and management are critical in managing the impacts.

In addition to localised mitigation strategies, the location of cotton gin site is recommended to be outside of population centre boundaries, to further mitigate the impact on communities. Regular risk and compliance assessments are also imperative to monitor and control the impacts and to meet regulatory requirements.

7.2.3 Financial Considerations

To establish a cotton gin site for operation, the following elements are considered in determining the financial requirements for the project:

- **Preliminary Planning and Project Management** – governance, investment strategy, project planning and financing
- **Land Acquisition** – purchase of site, town planning and community engagement
- **Pre-Construction** – Site and equipment design, applications and approvals, pre-construction works (e.g. utility connections and infrastructure)
- **Capital Infrastructure and Equipment** – acquisition and construction of cotton gin equipment, machinery and establishment of infrastructure

A cost estimate for equipment and infrastructure associated with the establishment of a cotton gin site was supplied by Lummus Australia (subsidiary of Lummus Corporation). The design specified is a three stand cotton gin with the ability to process 60 bales per hour (1,440 bales per day).

An indicative capital cost estimate for the establishment of a cotton gin site has been outlined in Table 17. The estimate is specific to the establishment of a cotton gin in North Queensland and includes costs associated with the preliminary works, project management and land acquisition.

Part 9 of this Report provides a detailed analysis of the ongoing financial performance of a cotton processing facility based on viable production volumes for selected cotton gin locations. These calculations also provide reference to the fixed operational expenditure associated with operating the facility.

Item	Estimated Capital Cost ($)
Land Acquisition	**465,000**
Civil Works	
Gin Building (Shed)	1,500,000
Floor & Foundations	2,000,000
Bale Storage	600,000
Seed Storage	800,000
Weighbridge & Office	350,000
Plumbing & Water Connection	100,000
Gin Yard & Gravelling	5,000,000
Sub Total	**10,350,000**
Gin Equipment	
Gin Machinery	8,000,000
Piping & Ducting	2,200,000
Cyclones	2,000,000
Bale Strapper	250,000
Moisture Restoration & Drying	600,000
Hydraulic, Air & Water Piping	500,000
International Freight	700,000
Sub Total	**14,250,000**
Electrical	
Electrical Connection	4,000,000
Motors & MCC	260,000
Electrical Wiring LV	20,000
Sub Total	**4,280,000**
Miscellaneous	
Fire Fighting Equipment	150,000
LP Gas Tank & Plumbing	150,000
Workshop (Equipped)	150,000
Mobile Plant	3,000,000
Approvals	600,000
Sub Total	**4,050,000**
Project Management & Preliminary Works	**2,000,000**
Total Capital Cost Estimate	**35,395,000**

Table 17 Estimated Capital Cost of a New Cotton Gin Facility

7.2.4 Operational Requirements

The operational phase of a cotton gin commences immediately after the construction phase is completed. The capital cost estimate provided above is indicative of a cost to produce an operation ready site.

During the operational phase of a cotton gin site, the following are key considerations for a potential gin operator and owner:

- Skilled personnel and labour
- Seasonal workforce
- Access to maintenance suppliers and replacements parts
- Regulatory management of environmental impacts for employees, communities and natural resources

Personnel and Labour

A site leadership team, office administration and permanent gin/ facility operators are the foundation skilled workforce for a cotton ginning business. A cotton gin has an operational cycle linked to the cotton production season, thereby requiring seasonal labourers, machine operators and shift leaders during the peak periods, once growers have completed the harvest. Supplementary labour may be engaged on a temporary or casual basis to meet the requirements of the seasonal processing period.

North Queensland's cotton harvest season is unlikely to directly conflict with the southern cotton growing regions, therefore attracting talent from outside the region, to supplement the local workforce, may be possible. For cotton gin site location assessment purposes, proximity to population centres with suitable skilled labour, or to transport infrastructure allowing for the import of skilled labour, is important (for example, commercial airports).

Table 18 outlines the expected labour requirements for a cotton gin.

Role	Estimated FTE Requirements
Management & Administration	6
Operational Staff - Permanent	10
Operational Staff - Supplementary	10 to 15

Table 18 Cotton Gin Commercial Skills and Roles

7.3 Cotton Gin - Transport and Logistics

In North Queensland, agricultural produce is commonly transported from growing regions to processing facilities, or export terminals, by road. The cotton supply chain in Australia is currently dominated by road transport, with only very small proportions of produce being transported by rail.

Although rail infrastructure is available in North Queensland (for example the Mount Isa to Townsville rail line), the limited expanse of the network, irregularity of services, limited access to loading infrastructure and limited or no direct connections into port facilities present challenges for rail being a reliable mode of transport to support the cotton industry in the region.

For the purposes of this Study, road transport has been analysed as the primary transport method used for transporting cotton from growing regions to gin and onto port terminals. It is recommended that rail options are further investigated as part of detailed Business Case assessment into preferred gin sites.

The cost of transport of cotton from the growing area to the cotton gin is typically borne by the grower. Conversely, the cost of transporting processed cotton bales from the gin to port, and to the end customer, is typically a cost borne by the merchant or end customer.

Transport of cotton is mostly undertaken by long distance haulers, such as road trains, B-Doubles or semi-trailers. To understand road transport costs associated with the cotton supply chain the following areas have been explored:

- Growing Areas to Cotton Gin
- Cotton Gin to Port Terminal
- Port Terminals

7.3.1 Growing Areas to Cotton Gin

Once harvested, raw cotton is baled into round modules of two sizes, large and small, weighing up to 2,500kg. Modules are packaged in plastic wrap and loaded onto trucks, directly from the field, for transport to the cotton gin.

The key cost elements to be considered in transporting cotton from the growing area to the gin include:

- **Transport cost** – an average one way rate of $8.50 per kilometre, based on a three-trailer road train configuration or $7.50 per kilometre based on a two-trailer road train configuration have been relied upon for the purposes of this Study. In some instances, vehicle restrictions on certain routes may require a smaller truck combination, which may result in a higher cost to the grower.

- **Module Size** – the size of the modules will impact the number able to be loaded per trailer. It has been assumed that fifteen small modules or six large modules may be loaded per trailer. In terms of a final volume of processed lint under each scenario, small module configurations will yield approximately 42 processed lint bales per trailer and large module configurations will yield approximately 26.6 processed lint bales per trailer.

- **Plastic Wrap** – plastic wrap is used to package the modules for transport - $44 per module has been assumed for the purposes of the assessment, equating to $660 per trailer ($1,980 for three trailers) for small modules and $264 per trailer ($792 for three trailers) for large modules.

- **Module Loading** – modules are loaded onto trucks in the field by forklifts, telehandlers or front-end loaders. A cost of $15 per module has been assumed for the assessment, equating to $225 per trailer ($675 for three trailers) for small modules and $90 per trailer ($270 for three trailers) for large modules.

Based on feedback from industry stakeholders, optimal transport costs are achieved by utilising a three-trailer road train configuration with fifteen small modules per trailer. This configuration improves stacking efficiency and permits a higher volume of cotton for processing compared to the larger module configuration. Although the small module configuration does incur additional upfront expense in terms of packaging and module loading, it does permit a greater volume of processed lint per trailer than large modules, therefore achieving a more cost-effective outcome per processed lint bale for the grower. Table 19 outlines the total transport costs based on distance for a three trailer road train combination.

Distance Grower to Gin (km)	Total Transport Cost (Three Trailer Road Train Configuration)	
	Small Modules ($)	Large Modules ($)
150	3,930	2,337
250	4,780	3,187
350	5,630	4,037
500	6,905	5,312
750	9,030	7,437
1,000	11,155	9,562
1,250	13,280	11,687

Table 19 Road Train Transport Cost Comparison

For reference, Table 20 provides an indication of road transport distances from potential gin locations to primary cotton growing areas. Stakeholder feedback confirmed that the **optimal distance for a cotton gin to be located compared to growing areas is a maximum of 350km**. Locations highlighted indicate those below the 350km distance.

	Primary Cotton Growing Regions (km)						
Cotton Gin Location	Normanton (Gulf of Carpentaria)	Julia Creek	Richmond	Mount Surprise	Georgetown	Mareeba/ Dimbulah	Lower Burdekin
Emerald	1,280	870	830	830	985	1,030	640
Cloncurry	450	140	285	760	660	960	810
Julia Creek	440	-	150	625	480	820	675
Richmond	585	150	-	480	475	670	525
Hughenden	700	265	115	365	520	560	410
Mount Surprise	520	625	480	-	225	350	475
Georgetown	295	480	475	225	-	350	630
Charters Towers	800	515	365	355	510	520	165

Table 20 Transport Distance – Growing Region to Cotton Gin Location

Based on a road transport distance of 350km, the total cost per processed bale would be $44.68 for the small module configuration (126 equivalent bales per trip) and $50.46 for the large module configuration (80 equivalent bales per trip). As a comparison, for cotton currently transported from Richmond to Emerald (830km distance), the transport cost per bale would be $77.06 (small module configuration) or $101.46 (large module configuration). Based on an average market price of A$500 per bale, this represents up to 20% of the value.

7.3.2 Cotton Gin to Port Terminal

Once processed, cotton lint bales are warehoused at the cotton gin site prior to transporting onto the relevant port terminal. Cotton bales are commonly warehoused at the port terminal prior to export. The cost of transporting processed cotton bales from the cotton gin site to the port is borne by the merchant or end customer.

Transport of processed cotton from the gin to port is commonly achieved via direct loading of processed bales onto road trains (approximately 330 bales for three trailer configuration) or B-

doubles (approximately 266 bales). Cotton bales may alternatively be loaded directly into shipping containers for transport to the port, however, this often results in double handling with the bales subsequently unloaded at the port warehousing facility.

Transport of processed cotton to the port is determined based on a rate per kilometre specific to truck and trailer configurations. For the purposes of this Study, two options have been provided, for consideration:

- Three trailer road train - $5.00 per km
- B-Double - $4.50 per km

It is noted that these rates represent a one-way charge. Backloading rates may be available depending on port location and upon negotiation with transport providers. Table 21 illustrates the total transport trip cost for a road train or B-Double combination by distance.

Distance Gin to Port (km)	Total Trip Cost 3 Trailer Road Train ($)	Total Trip Cost B-Double ($)
350	1,750	1,575
500	2,500	2,250
750	3,750	3,375
1,000	5,000	4,500
1,250	6,250	5,625
1,500	7,500	6,750

Table 21 Transport Cost – Road Train Versus B-Double

In Australia, cotton gins are typically located between 300km and 700km from the port terminal. Industry stakeholders have confirmed that for assessment purposes the **optimal distance for a cotton gin to be located to a port terminal is a maximum of 500km**. Based on this distance, the total cost would be $7.58 per processed bale for road train configuration and $8.46 per processed bale for B-double configurations.

7.3.3 Port Terminals

Currently all cotton exported from Australia is managed through major ports of Brisbane, Sydney and Melbourne, due to the location of existing warehousing infrastructure, regularity of shipping services and alignment of shipping services to key export markets.

With Brisbane as the closest port to the Study Region, this would involve a journey of between 1,300km and 2,000km. In the short to medium term, it is likely that any cotton produced in North Queensland will be transported to Brisbane for export. However, as production in the region expands, opportunities will arise to utilise existing port capacity and infrastructure in the region to export processed cotton to market.

Port of Cairns, Port of Townsville and Port of Karumba have been identified as potential export terminals for cotton produced in North Queensland. An overview of each has been provided below.

Port of Townsville

Port Description	Port Facilities	Commodities and Services
• Port of Townsville is a government-owned Corporation and seaport in Townsville, Queensland, Australia. • It is the third largest seaport in Queensland after Port of Brisbane and the Central Queensland Port in Gladstone • Largest container and automotive port in Northern Australia	• 8 operational berths • 300 hectares of surrounding land • 3 permanent full-time stevedoring services with associated berth facilities and backing land storage • Warehousing facilities located on and around port land available prior to shipment • Established shipping services to some Asian markets, with trans shipping opportunities • Supports direct road train access into port berths	• Import and export of more than 30 different commodity types, including dry bulk agriculture and mining products, liquids, containerised cargo, project (or oversized) cargo, refrigerated cargo (such as horticulture and food stuffs), motor vehicles and live cattle exports. • Strategic growth opportunities to support cotton exports and container shipping

Table 22 Townsville Port Analysis [58]

Port of Cairns

Port Description	Port Facilities	Commodities and Services
• Port of Cairns is managed by Ports North, a government-owned Corporation and is a seaport in Cairns, Queensland, Australia. • Located on Trinity Inlet, the port handles cargo and passenger vessels.	• 10 operational berths • Part-time stevedoring services • Limited storage warehousing facilities • Some established shipping services to Asian markets • Limitations on heavy vehicle and road train access to berths or port land	• Cargo Hub – importing project cargo for large infrastructure and mining projects in Far North Queensland • Exports petroleum, molasses, fertiliser, LPG and sugar • Strategic growth to support the Gulf region and land available to expand warehousing • Strategic Master Plan review, in progress

Table 23 Cairns Port Analysis [59]

Port of Karumba

Port Description	Port Facilities	Commodities and Services
• Port of Karumba is managed by Ports North, a government-owned Corporation. • Located in the south east corner of the Gulf of Carpentaria at Karumba, Queensland. • Shallow harbour and ferry services to exports ships	• No operating berths • Part-time stevedoring services • Limited storage warehousing facilities • Road access problematic due to seasonal weather impacts and quality of routes	• Trans-shipment operations for Zinc • General cargo supporting Gulf communities and cattle exports • Strategic focus to continue supporting Gulf communities

Table 24 Karumba Port Analysis [60]

Table 25 outlines the distances from potential gin locations in North Queensland to the primary port terminals. The locations highlighted are those that are within the optimal 500km distance identified.

[58] https://www.townsville-port.com.au/about/about-potl/
[59] https://www.portsnorth.com.au/cairns/
[60] https://www.portsnorth.com.au/karumba/

	Potential Cotton Gin Location (Km)						
Port Location	Cloncurry	Julia Creek	Richmond	Hughenden	Mount Surprise	Georgetown	Charters Towers
Brisbane	1700	1630	1550	1435	1700	1815	1310
Townsville	780	645	495	385	400	555	140
Cairns	990	850	845	730	380	385	480
Karumba	450	510	660	670	670	366	870

Table 25 Transport Distance - Cotton Gin Location to Port Terminal

In completing the assessments related to preferred gin location in Part 8, the Port of Townsville has been included as the key reference export port terminal. As part of detailed business case investigations, the ability of the Port of Townsville to be positioned as the primary export terminal for cotton grown in the region should be explored further.

7.4 Cotton Gin – Cotton Supply Volumes

The viability of a cotton gin is intrinsically linked to the volume of cotton available to be processed. This in turn has a direct connection to many of the cotton production considerations previously discussed in this Report (Parts 4 and 5), such as farmer appetites, water availability, selected production systems, climate conditions, available cropping land and crop rotation cycles.

Research indicates that an estimated minimum of 7,500 hectares of irrigated cotton yielding an average of 9 bales per hectare is required to sustain a commercially viable gin [61]. This equates to a total of 67,500 bales per annum. While this estimate is a reasonable guideline for assessing gin viability, commercial considerations such as investment structure, investor motivations and economic climate may impact expectations on the minimum bales required for commercial viability. Some identified examples of where alternative benchmarks may be appropriate, include:

- In regions with less reliable production due to variable water supply (e.g. Bourke and Dirranbandi) an estimate of approximately 100,000 bales per gin per annum is expected in seasons when water allocations are adequate[62];
- Namoi Cotton, a leading Australian cotton processing organisation operating 11 cotton gins produces on average of 1.6 million bales per annum. Namoi Cotton's average gin capacity equates to approximately 145,000 bales per annum[63];
- Grower owned cooperatives are also regarded to have a lower production expectation due to the facility being an integral element of the respective owner supply chain.

For the purposes of this Study, **a benchmark of 70,000 bales per annum has been determined as the minimum volume of cotton production that would give rise to a viable gin in North Queensland**.

[61] Ash A and Gleeson T (2014) Northern Australia: Food and Fibre Supply Chain Synthesis Study. CSIRO/ ABARES Australia
[62] Petheram C, Watson I and Stone P (eds) (2013) Agricultural resource assessment for the Flinders catchment. A report to the Australian Government from the CSIRO Flinders and Gilbert Agricultural Resource Assessment, part of the North Queensland Irrigated Agriculture Strategy. CSIRO Water for a Healthy Country and Sustainable Agriculture flagships, Australia. CSIRO 2013
[63] https://www.namoicotton.com.au/growers/cotton-ginning/

This benchmark has been determined on the assumption that a gin in the region is likely to be established through grower or grower-corporate investment, where investment objectives are likely to be weighted towards industry sustainability rather than solely investment returns.

It should be noted, that this level indicates the minimum volume required, with the expectation that volumes produced in the region will continue to grow beyond this level and a shift towards predominantly irrigated production will occur as major water and irrigation projects come on line.

8 COTTON GIN LOCATION ASSESSMENT

The purpose of this section of the Report is to assess the preferred location for a cotton gin in the Study Region. The assessment relies upon information contained in Part 7 of the Report which outlines the key considerations necessary in determining the viability of a cotton gin and for identifying the optimal location/s to situate such a facility.

An assessment was completed to evaluate each of a long list of locations with the objective of identifying the preferred locations within the Study Region. Specific land areas or sites within each of these preferred locations were subsequently assessed to consider the potential for the future establishment of a cotton gin.

8.1 Cotton Gin Long List Locations

The long list of location options adopted for this assessment, included:

- Cloncurry
- Julia Creek
- Charters Towers
- Richmond
- Hughenden
- Mount Surprise
- Georgetown

Figure 49 Cotton Gin Long List Locations Map

The long list was determined based on feedback from stakeholders and key industry participants, and by considering the following factors:

- Forecast cotton production volumes (Scenario 2 - 5 Year Horizon) by growing area;
- Proximity of growing areas to the potential gin locations;
- Access to major transport arterials.

8.2 Cotton Gin Location Assessment

In determining the short list of preferred locations, each location outlined in the long list was assessed against a range of weighted criteria and was rated accordingly.

The criteria and weightings, used in the assessment were established considering the requirements outlined in Part 7 for the establishment of a cotton gin, and based on discussions with industry experts and incumbent cotton gin operators.

8.2.1 Defined Criteria, Weightings and Scoring

The following four criteria, weightings and scoring methodology were developed for assessing the potential gin locations:

Criteria Name	Criteria Description, Approach and Benchmark	Weighting	Scoring	
Proximity to Growing Region	Assessment of proximity of the gin location to the primary cotton growing regions. The assessment considers the total volume of cotton able to be produced and supplied within a 350km radius of the gin location. The cotton supply volumes are based on those volumes identified by Growing Region – Table 16. A benchmark of 70,000 bales was utilised for gin viability. A lower rating was allocated for volumes below this level on the basis that cotton may be transported beyond 350km to a cotton gin.	50%	**Rating** 1.00 0.75 0.50 0.25 0.00	**Outcome** >70,000 bales 52,500 - 70,000 bales 35,000 - 52,500 bales 17,500 - 35,000 bales <17,500 bales

Criteria Name	Criteria Description, Approach and Benchmark	Weighting	Scoring	
Road Transport Infrastructure	Assessment of the accessibility, quality and reliability of road transport infrastructure servicing the gin location. A qualitative assessment of the following key considerations was completed: • Major road transport routes connecting growing region/s to gin location • Major road transport routes connecting gin location to port terminal (Townsville) • Infrastructure of suitable standard for road trains and B-Double access between growing areas, gin location and port terminal • Reliability of access to gin location throughout the year • Quality and design of infrastructure The benchmark standard is defined as: • Minimum of B-Double and Road Train access from primary growing areas to gin location and to port terminal • Multiple major arterials (Highway or Developmental Road) directly connecting growing areas and gin location • Multiple major arterials (Highway or Developmental Road) directly connecting gin location to port terminal • High reliability of access to gin location with limited impact from annual flooding or other outages • Sealed road pavements with minimum double lane bitumen	20%	**Rating** 1.00 0.75 0.50 0.25 0.00	**Outcome** 100% of benchmark 75% of benchmark 50% of benchmark 25% of benchmark < 25% of benchmark
Proximity to Port of Townsville	Assessment of the proximity of the gin location to the Port of Townsville. A benchmark of 500km was used as the maximum distance by road from the gin location to the Port of Townsville.	20%	**Rating** 1.00 0.75 0.50 0.25 0.00	**Outcome** <500km 500km to 750km 750km to 1,000km 1,000km to 1,250km >1,250km

Criteria Name	Criteria Description, Approach and Benchmark	Weighting	Scoring	
Services	Assessment of the industry and essential services and potential skilled labour within the gin location to support the operation of a cotton gin. A qualitative assessment of the following keys considerations was completed: • Access to skilled workers within the location or access via FIFO through airport (regular commercial and chartered services) • Proximity to major population centres of Cairns and Townsville for significant services, materials and parts • Essential services (accommodation, medical, emergency services, schools) and industry support services located at the location. The benchmark standard is defined as: • Population of >5,000 people with appropriate level of employable persons • <300km to major population centre of Cairns or Townsville for access to materials, parts and services • Ready access to skilled labour via FIFO through commercial airport with regular or chartered services from Brisbane, Townsville or Cairns, or <300km driving distance from major population centre • Sufficient essential services and industry support services to support the operation of a cotton gin.	10%	**Rating** 1.00 0.75 0.50 0.25 0.00	**Outcome** 100% of benchmark 75% of benchmark 50% of benchmark 25% of benchmark < 25% of benchmark

Table 26 Cotton Gin Location Assessment Criteria

8.2.2 Assessment Outcomes

The ratings (prior to weighting application) determined for each gin location as part of the assessment are outlined in Table 27.

Gin Location	Criteria 1 Growing Region	Criteria 2 Transport Infrastructure	Criteria 3 Port Facilities	Criteria 4 Services
Cloncurry	1.00	0.75	0.50	0.75
Julia Creek	1.00	0.75	0.75	0.50
Richmond	1.00	0.75	1.00	0.50
Hughenden	1.00	0.75	1.00	0.50
Mount Surprise	1.00	0.75	1.00	0.25
Georgetown	1.00	0.50	0.75	0.50
Charters Towers	0.25	1.00	1.00	1.00

Table 27 Cotton Gin Location Assessment Ratings

A detailed summary of the assessment has been attached at Appendix B.

The outcomes for each gin location based on the assigned criteria weightings are outlined in Table 28.

Gin Location	Criteria 1 Growing Region	Criteria 2 Transport Infrastructure	Criteria 3 Port Facilities	Criteria 4 Services	Total
Criteria Weighting	50%	20%	20%	10%	100%
Cloncurry	50%	15%	10%	7.5%	82.5%
Julia Creek	50%	15%	15%	5.0%	85.0%
Richmond	50%	15%	20%	5.0%	90.0%
Hughenden	50%	15%	20%	5.0%	90.0%
Mount Surprise	50%	15%	20%	2.5%	87.5%
Georgetown	50%	10%	15%	5.0%	80.0%
Charters Towers	12.5%	20%	20%	10.0%	62.5%

Table 28 Cotton Gin Location Assessment Outcomes

Based on the outcomes of the assessment, the preferred cotton gin locations are:

- Richmond – 90%
- Hughenden – 90%
- Mount Surprise – 87.5%

A detailed assessment of specific sites within each of these three locations has been provided in the following sections.

8.3 Cotton Gin Site Assessments

Following completion of the gin location assessment, potential sites within each of the three preferred locations were considered and have been discussed below. It is noted that while the selected sites are potential options for establishing a cotton gin, a detailed site option analysis for the chosen town or gin location should be completed as part of business case investigations.

8.3.1 Richmond

An 800 hectare site has been identified on the eastern access of the Flinders Highway, approximately 10km east of Richmond (refer Figure 50). The site has the following characteristics:

- The site is located on private land and is zoned as rural (permits agricultural uses such as cotton ginning). Preliminary discussions with the landowner have resulted in an in-principle agreement for the land to be utilised for commercial purposes. Formal negotiations and acquisition are yet to be completed and conversion of zoning to industrial is yet to occur.
- The site has been identified as the location for a future inland port that is proposed to comprise of various industrial and commercial operations, such as bulk commodity storage, meat works, feedlot, cotton gin and biofuel facility.
- The site is elevated and is not subject to flooding. The land is primarily flat with limited contouring.

- Connection into Richmond township utility infrastructure is possible with gas and power available. High voltage power lines run parallel to the site. Water may be supplied through bore access.
- The site sits adjacent to the Flinders Highway and has appropriate access for heavy vehicles. Due to the large land area, this will permit road train turnaround on site.
- The Mount Isa to Townsville rail line is located adjacent to the site and preliminary discussions with Queensland Rail have highlighted a need for potential upgrades to include a rail loop and appropriate container and bulk product loading facilities.
- Further investigation on environmental impacts are required to be completed due to the close proximity (10km) from the Richmond township.

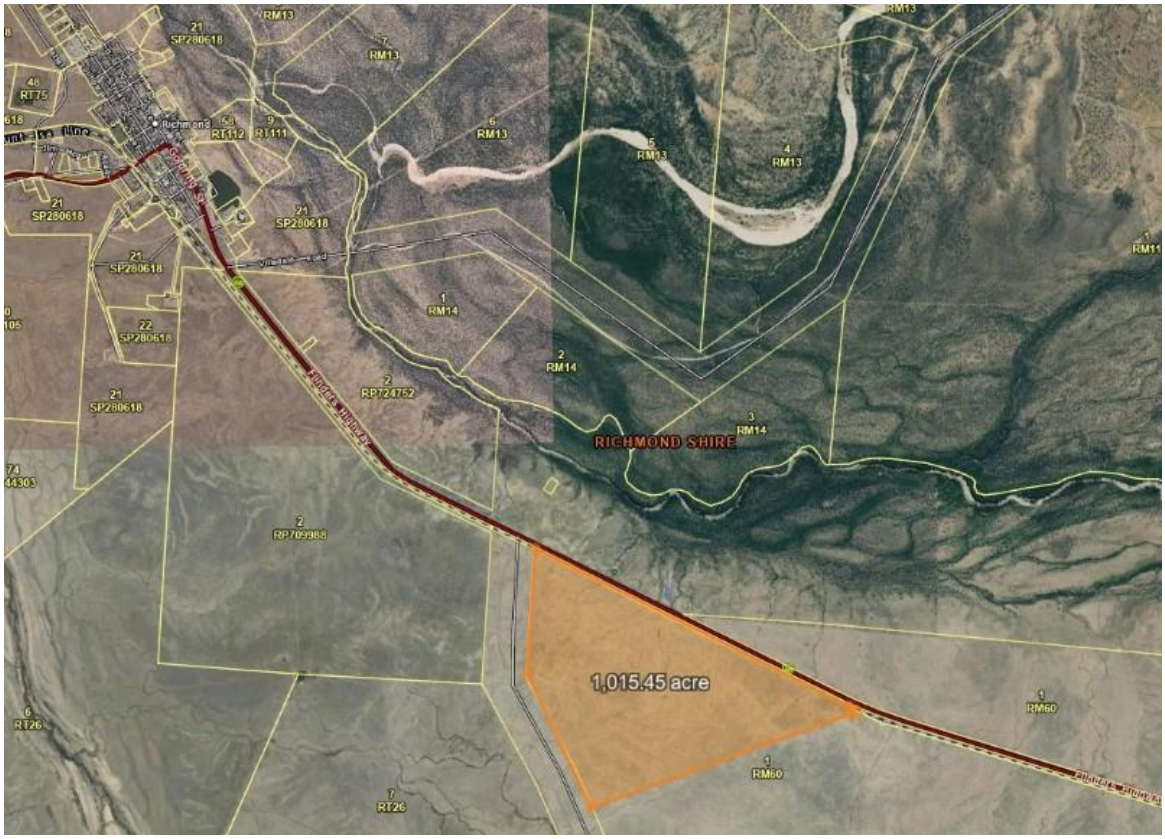


Figure 50 Richmond Cotton Gin Site

8.3.2 Hughenden

Various sites were identified in Hughenden (and surrounds) that have the potential to establish a cotton gin. These sites included Hughenden East (adjacent to the Hughenden solar farm – 3 potential sites), Fifteen Mile, Orange Tree Creek, Prairie and Torrens Creek. For the purposes of the current assessment the site at Fifteen Mile was selected for review.

The site at Fifteen Mile is a 113 hectare site located approximately 24km North West of Hughenden on the Old Richmond Road (refer Figure 51). The site has the following characteristics:

- The site is located on Queensland State Government owned land and is zoned as rural. The current zoning supports agriculture uses such as a cotton gin site.
- The site is elevated and is not subject to flooding. The land is primarily flat with limited contouring.
- Some network high voltage and low voltage lines are in proximity to the site, however, investigation regarding access to these is yet to be completed.
- The site does not have sewer reticulation and a septic system would be required to be installed.
- Water would be supplied via transport from Hughenden or sourced from groundwater bores (where available).
- The site is located adjacent to the Old Richmond Road and has appropriate access for heavy vehicles. Due to the large land area this will permit road train turnaround on site.
- Further investigation on environmental impacts is required to be completed, however, due to the distance from the Hughenden township there is unlikely to be significant impacts to the community in terms of noise or dust.
- Hughenden is well situated for transport access being a central hub with connecting arterials from the north and south via the Kennedy Development Road and east and west via the Flinders Highway.

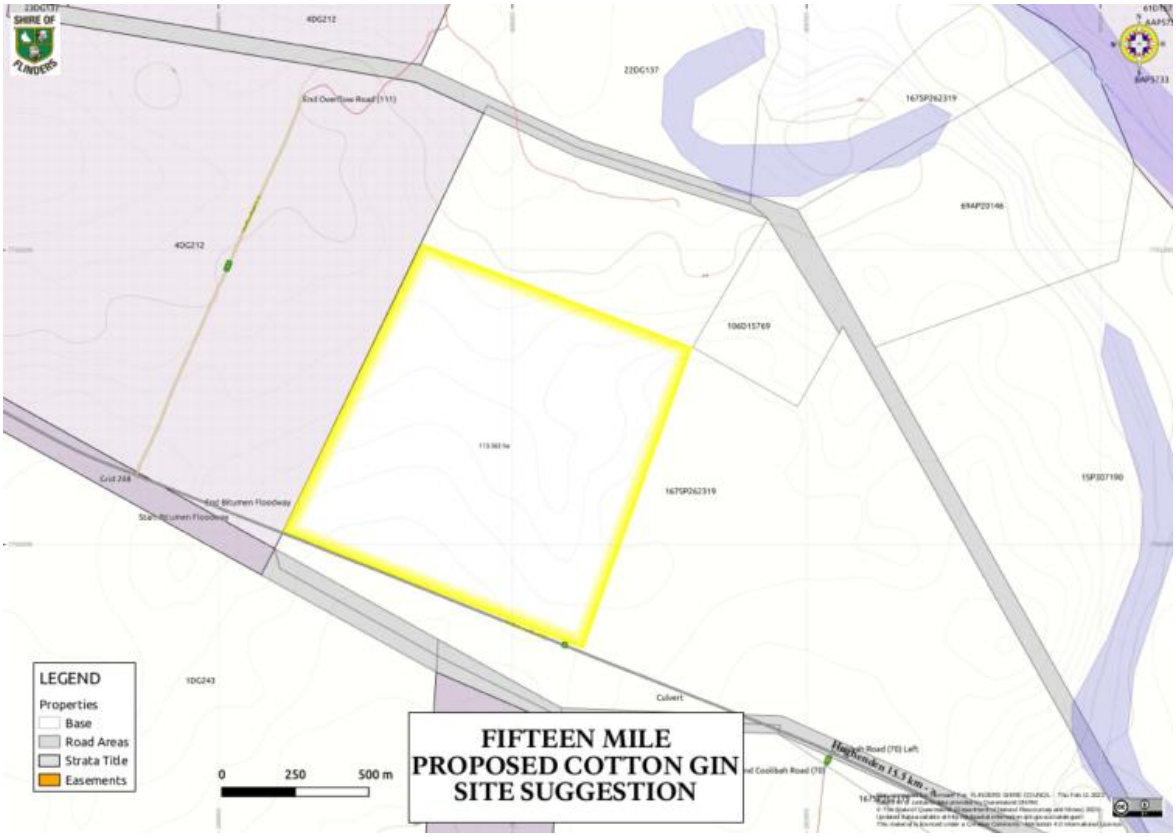


Figure 51 Hughenden Cotton Gin Site

8.3.3 Mount Surprise

A 130 hectare site has been identified located on the eastern side of Mount Surprise, approximately 3km from the Mount Surprise township (refer Figure 52). The site has the following characteristics:

- The site is located on private land and is zoned as rural (permits agricultural use such as cotton ginning). Preliminary discussions with the landowner have resulted in an in-principle agreement for the land to be utilised for commercial purposes. Formal negotiations and acquisition yet to be completed and conversion of zoning to industrial yet to occur.
- The site is primarily flat with a single hill located on the property. The site is elevated and there are no immediate concerns regarding flooding. The impacts of the hill are to be further investigated in relation to location of module storage. Levelling of elevation and contours may impact the cost of site establishment.
- The site adjoins the Gulf Development Road and has appropriate access for heavy vehicles.
- Connection to Mount Surprise township power supply is possible. Water and gas supply to occur via transport from Georgetown. Onsite sewerage treatment plant to be established for waste.
- Further investigation on environmental impacts is required to be completed due to the close proximity (3km) from the Mount Surprise township.

Figure 52 Mount Surprise Cotton Gin Site

9 FINANCIAL ASSESSMENT

Critical to assessing the viability of a cotton gin is understanding the expected financial performance of such an operation. This Part of the Report, provides the financial assessment conducted for the three preferred gin location options, identified in Part 8, being:

- Option 1: Richmond
- Option 2: Hughenden
- Option 3: Mount Surprise

A total for the North Queensland region has also been reported to provide perspective regarding the total cotton forecast in the region.

It is noted that the financial assessment considers the performance of a cotton gin from the perspective of the cotton gin operator or owner. The financial outcomes for growers are not reflected.

9.1 Financial Assessment Methodology

An income statement was prepared to report annual income, variable operating expenses and fixed operating expenses, to generate an Earnings Before Interest, Tax, Depreciation and Amortisation (EBITDA) outcome for each of the identified options.

In calculating the financial outcomes, the Indicative 5 Year Horizon volumes for each identified location have been adopted (referred to as Cotton Supply Volume). The calculation methodology for each income statement category was as follows:

Income Statement Category	Calculation Methodology
Income	$/ bale processing income x cotton supply volume
Variable Operating Costs	$/ bale operating cost x cotton supply volume
Fixed Operating Costs	Fixed annual cost

Table 29 Income Statement Category Calculation Methodology

As identified in Part 6 of this Report, a year-on-year cotton supply volume forecast for the identified location options was not determined. As such a whole of life financial assessment was not able to be completed. For such an assessment to be completed accurately, a confirmation of cotton supply volume contracts would be required, to ascertain the relevant year on year cotton supply volumes that would be processed through the gin.

This fact, coupled with the uncertainty regarding the final investment method, details and structuring options, impacts the ability to establish a valid balance sheet, cashflow statement or net present value assessment. For these reasons, these have not been provided as part of the Study. These assessments should be considered as part of detailed business case investigations in relation to a preferred cotton gin site.

9.2 Financial Assumptions

In completing the assessment, the following general assumptions were adopted:

- The financial assessment was completed in relation to the operating phase of the gin and does not include consideration of any establishment or construction activities. The capital costs associated with the establishment of the gin have been outlined in Part 7 of this Report.
- The gin operator does not take ownership of the cotton at any time during the processing cycle. The raw cotton and output lint and seed is owned by the grower. The gin operator only charges a processing fee to the grower.
- All amounts are exclusive of Australian Goods and Services Tax (GST) and are stated in real terms for 2021.

Assumptions specific to cotton supply volumes and income statement categories are detailed below.

9.2.1 Cotton Supply Volumes

As established in the assessment completed in Part 8, the production volumes adopted for this assessment are within the 350km of the gin location:

	Option 1 Richmond (Bales)	Option 2 Hughenden (Bales)	Option 3 Mount Surprise (Bales)	Total North Queensland (Bales)
Cotton Supply Volume (5 Year Horizon)	90,800	90,800	79,010	202,810

Table 30 Cotton Supply Volumes

9.2.2 Income

Income for the gin is sourced through cotton processing fees charged by the gin operator to the grower. Gin processing fees throughout Australian vary between $70 and $83 per bale. For the purposes of this assessment the following assumption has been adopted.

	Assumption Rates ($/bale)	Source of Data
Cotton Processing Income	70	Queensland Cotton

Table 31 Cotton Processing Income Rate Per Bale

It is noted that while growers own the seed and lint after processing, in some circumstances a seed contra transaction may be entered into between grower and gin operator, thereby reducing the effective processing fee charge in exchange for the seed. For the purposes of this assessment, we have assumed such arrangements have not been entered into by the gin operator.

9.2.3 Variable Operating Costs

Variable operating costs relate to those expenses directly impacted by the volume of cotton established in 9.2.1 and processed through the ginning cycle. These costs are directly influenced by increases or decreases in supply volume. The following primary variable cost categories and assumptions have been adopted:

Variable Operating Cost Category	Assumption Rates ($/ bale)	Source of Data
Direct Wages	7.50	Queensland Cotton
Supplies and Materials	6.00	Queensland Cotton
General Freight	0.50	Queensland Cotton
Miscellaneous Expenses	0.10	Queensland Cotton
Production Fuel	3.00	Queensland Cotton
Electricity	10.00	Queensland Cotton
Vehicle Expenses	0.50	Queensland Cotton
R&M Processing Cost	6.00	Queensland Cotton
Total Variable Operating Cost	**33.60**	**Queensland Cotton**

Table 32 Variable Operating Costs Per Bale

9.2.4 Fixed Operating Costs

Fixed operating costs, or direct overhead costs, are static costs that are directly related to the cotton ginning process and are incurred annually, irrespective of cotton supply volume changes. The following primary fixed operating cost categories and assumptions have been adopted:

Fixed Operating Cost Category	Assumption Rates ($)	Source of Data
Salaries	600,000	Queensland Cotton
Vehicles – Indirect Cost	40,000	Queensland Cotton
R&M – Indirect Cost	50,000	Queensland Cotton
Electricity – Indirect Cost	100,000	Queensland Cotton
General Office Expenses	20,000	Queensland Cotton
Staff Amenities	20,000	Queensland Cotton
Telecommunications	20,000	Queensland Cotton
Travel	15,000	Queensland Cotton
Workplace Health & Safety	50,000	Queensland Cotton
Management Fees*	200,000	Queensland Cotton
Insurance	33,603	Queensland Cotton
Rates and Land Tax	40,000	Queensland Cotton
Total Fixed Operating Cost	**1,188,603**	**Queensland Cotton**

**Management fees levied may vary depending on investment and management structure adopted for the gin.*

Table 33 Fixed Operating Costs Per Bale

9.3 Financial Operating Statements

Applying the listed assumptions, the following proforma income statements were determined for the locations considered.

Income Statement	Option 1 Richmond ($)	Option 2 Hughenden ($)	Option 3 Mount Surprise ($)	Total North Queensland ($)
Income				
Processing Income	6,356,000	6,356,000	5,530,700	14,196,700
Total Income	**6,356,000**	**6,356,000**	**5,530,700**	**14,196,700**
Variable Operating Costs				
Direct Wages	681,000	681,000	592,575	1,521,075
Supplies and Materials	544,800	544,800	474,060	1,216,860
General Freight	45,400	45,400	39,505	101,405
Miscellaneous Expenses	9,080	9,080	7,901	20,281
Production Fuel	272,400	272,400	237,030	608,430
Electricity	908,000	908,000	790,100	2,028,100
Vehicle Expenses	45,400	45,400	39,505	101,405
R&M Processing Cost	544,800	544,800	474,060	1,216,860
Total Variable Operating Costs	**3,050,880**	**3,050,880**	**2,654,736**	**6,814,416**
Fixed Operating Costs				
Salaries	600,000	600,000	600,000	600,000
Vehicles – Indirect Cost	40,000	40,000	40,000	40,000
R&M – Indirect Cost	50,000	50,000	50,000	50,000
Electricity – Indirect Cost	100,000	100,000	100,000	100,000
General Office Expenses	20,000	20,000	20,000	20,000
Staff Amenities	20,000	20,000	20,000	20,000
Telecommunications	20,000	20,000	20,000	20,000
Travel	15,000	15,000	15,000	15,000
Workplace Health & Safety	50,000	50,000	50,000	50,000
Management Fees	200,000	200,000	200,000	200,000
Insurance	33,603	33,603	33,603	33,603
Rates and Land Tax	40,000	40,000	40,000	40,000
Total Fixed Operating Costs	**1,188,603**	**1,188,603**	**1,188,603**	**1,188,603**
Total Operating Costs	**4,239,483**	**4,239,483**	**3,843,339**	**8,003,019**
EBITDA	**2,116,517**	**2,116,517**	**1,687,361**	**6,193,681**
EBITDA % of Income	**33%**	**33%**	**31%**	**44%**

Table 34 Income Statements

9.4 Capital Expenditure

In Part 7, an estimated capital cost of $35,395,000 was determined to establish a cotton gin site to an operational level. Ongoing capital expenditure will be required to replace, renew and expand the existing capital asset base. The level of capital expenditure required will vary depending on the level of cotton supply volumes and operating levels of the gin. For assessment purposes, based on the cotton supply volumes relied upon, the following capital expenditure assumption may be adopted.

	Assumption Rates ($)	Source of Data
Capital Expenditure – Year 1 and 2	250,000	Queensland Cotton
Capital Expenditure – Year 3 onwards	500,000	Queensland Cotton

Table 35 Capital Expenditure

It is recognised that an average cotton gin life cycle is 30 years. Notwithstanding, the rate of production of the gin is a more appropriate basis upon which to depreciate capital expenditure. As such, for depreciation purposes a units of production method is recommended.

9.5 Summary of Financial Assessment

In all scenarios presented, a positive EBITDA arises. Using EBITDA as the primary measure of financial performance, Option 1 (Richmond) and 2 (Hughenden) would be considered the more viable of the three options to proceed for further consideration and assessment. Notwithstanding, Option 3 (Mount Surprise) also presents a suitable EBITDA outcome to advance to a further level of assessment.

Additional factors to be considered in conjunction with the financial assessment, include:

- The outcomes of the assessment are strongly linked to the cotton supply volumes and therefore, delays or inability to reach the target volumes may have a significant impact on the financial performance, and viability of the gin.
- The establishment of additional gins in the region within close proximity may result in a reduction in cotton supply volumes through the identified scenarios, and therefore would impact financial outcomes.
- Financial assumptions adopted in this assessment are sourced from information specific to the Queensland Cotton operations. These may vary depending on the final gin design and operating model adopted.
- Investment structure, investor expectation for return and economic climate may impact the desired level of return. As such, while the EBITDA outcomes are suitable based on general industry standards, these may not be appropriate under different investment scenarios.
- The total North Queensland scenario was provided for context. This option was provided to demonstrate the collective region performance based on total cotton supply volumes, assuming a single gin being established. It should be noted that the placement of a single gin site, to service the entire region, is problematic in the long term due to the expanse of the region and the resultant cost of transportation for some growers.

Based on the financial assessment outcomes alone, these would support advancing all options to preliminary discussions with investors for further due diligence, and to complete detailed discussions with growers to determine expectations of cotton supply commitments.

10 COTTON GIN INVESTMENT ROADMAP

This section of the Report addresses the following elements:

- **Investment Roadmap** – the process required to assess and establish a suitable investment structure and funding source.
- **Potential Cotton Gin Ownership Structures** – determined based on expected investor profiles and attributes of the cotton industry in Australia.
- **Investment Risk Considerations** – a high level overview of investment, construction and operational level risks for a potential investor.

10.1 Investment Roadmap

A final investment structure and funding options for a cotton gin will be informed through a structured engagement process to identify interest in investment opportunities and to define likely investor groups. Initially it is important that a party, such as MITEZ or an appropriate industry advocate, leads this process to continue momentum towards the establishment of a gin.

This Study provides preliminary information to such groups to outline the indicative benefits and risks for such an investment opportunity. Further assessment of the market, cotton supply potential, structuring options and funding considerations will be required to be completed collectively, and independently, by potential investors.

Figure 53 outlines a standardised roadmap to progress from a feasibility study to a final investment in a cotton gin, however, noting this process may vary dependant on investor appetites.

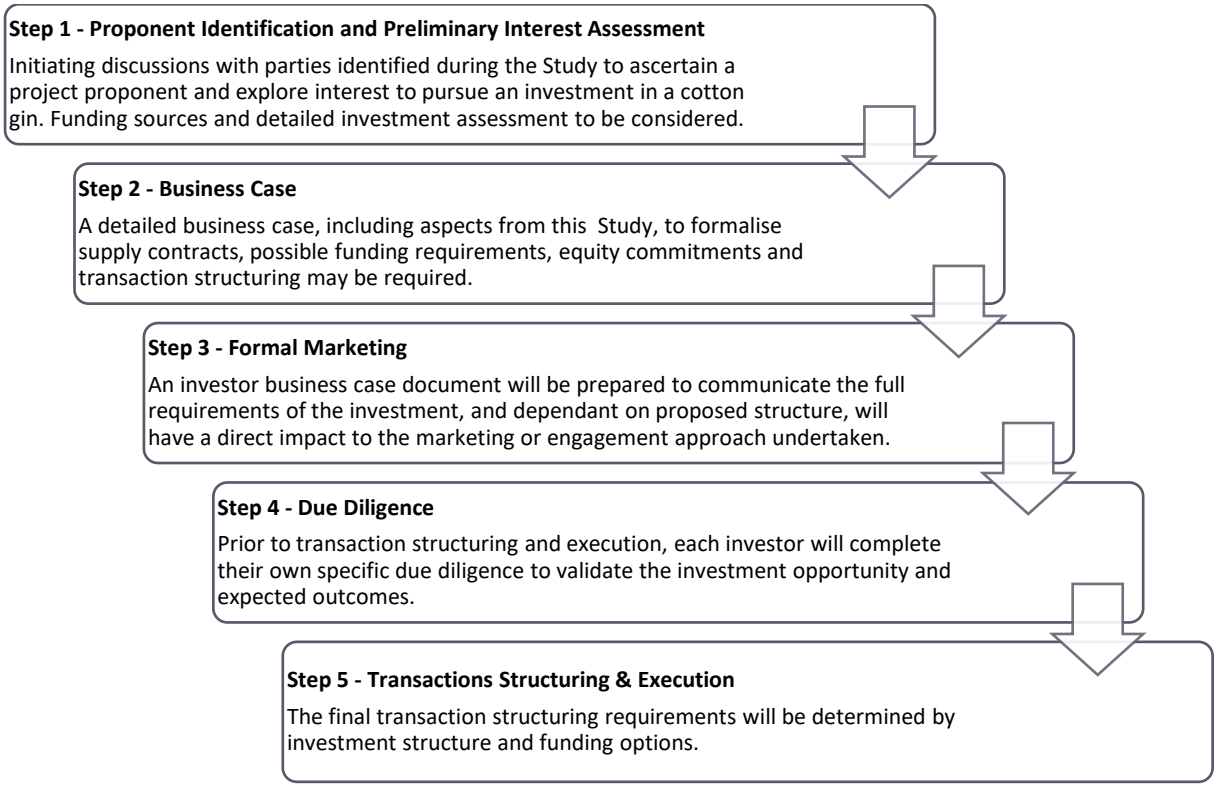


Figure 53 Investment Roadmap

10.2 Cotton Gin Ownership Structures

A future cotton gin investment will be largely determined by the profile and objectives of the investor and the funding available for the project. In Australia, the most common gin ownership structures are through corporate investment or grower ownership structures, or a combination of both. Outlined below are potential investment structures that may be adopted for a cotton gin in North Queensland.

10.2.1 Grower Cooperative Model

The Grower Cooperative Model is often established to support regional grower supply chains and to ensure cost effectiveness of transport and processing.

The main sources of funding for such structures includes a combination of Government grants, grower capital and/or external financier facilities.

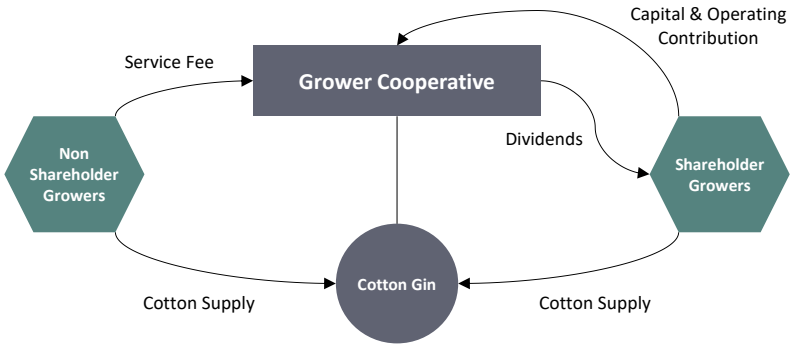


Figure 54 Grower Cooperative Model

The Grower Cooperative Model is often utilised in emerging cotton regions and is designed for joint responsibility and decision making of members, utilising a single vote per member system. These are effective models when the cooperative is of a small to medium scale, and these structures often mature into corporatised models as the scale of cotton supply increases.

WANT Cotton Pty Ltd is a recent example of this structure being developed in the Northern Territory's emerging cotton market [64]. Namoi Cotton cooperative is another example of this type of model being deployed. Created in 1962, the Namoi Cotton model has since progressed into a corporate business structure with a Board of Directors and executive management layers now in place. Namoi Cotton was restructured to become Namoi Cotton Limited and listed on the ASX in 2017 [65]. Namoi Cotton is one of the largest cotton businesses in Australia.

[64] https://www.northqueenslandregister.com.au/story/7050624/want-cotton-plans-north-australia-gin/
[65] https://www.namoicotton.com.au/about/

10.2.2 Corporate Investor Model

The Corporate Investor Model is a traditional model for stable or growth cotton markets. These structures are often managed with executive management and Board layers in the organisational design. The focus for this operating structure is on return on equity and expansion or growth opportunities.

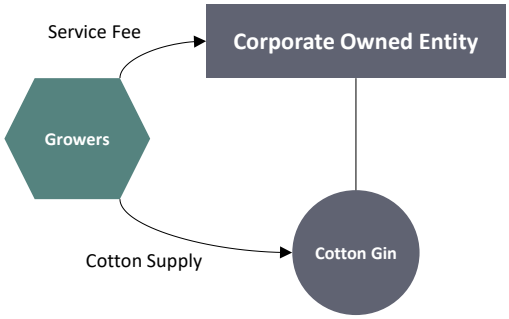


Figure 55 Corporate Investor Model

These models are most effective where the Board and executive management have a high degree of commitment to the industry and region and the longevity of the business. Initiatives focused on quick returns and short-term exit strategies are not suitable for these types of models. Queensland Cotton is a committed corporate investor demonstrating this operating model.

10.2.3 Corporate and Grower Investor Model

The Corporate and Grower Investor Model is often a structure developed when a cooperative structure has grown to scale or a corporate investor is seeking expansion opportunities. It is a common design in many agribusinesses to ensure the grower has commitment to the regional supply chain and strategic direction of the industry.

Namoi Cotton and Queensland Cotton businesses have similar structures or arrangements in place throughout Australia.

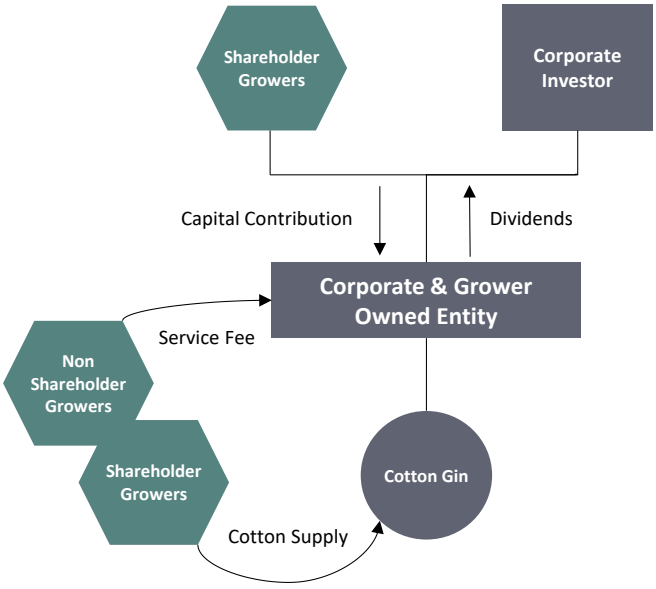


Figure 56 Corporate and Grower Investor Model

10.2.4 Corporate Gin Model

The Corporate Gin Model is a wholly owned value chain enterprise from growing cotton to export of refined goods. These are less common cotton business structures in Australia and more often utilised in North America or China and other larger scale, volume driven cotton producing nations.

This model requires a higher degree of capital and results in a higher risk associated with industry volatility. Auscott Cotton originates from the United States and implemented this business design in the 1960's and has continued to be a leader in export and research in the Australia cotton industry.

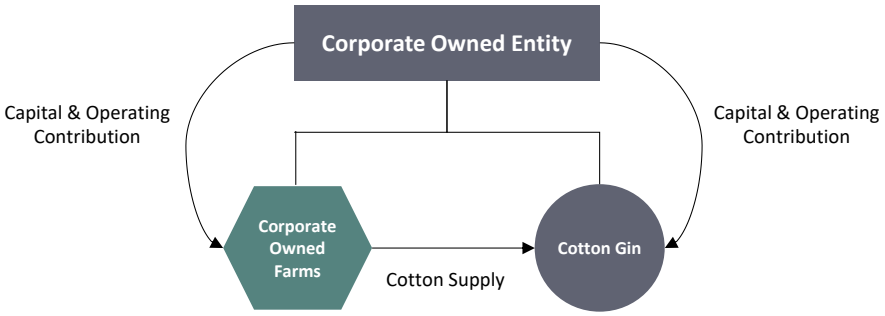


Figure 57 Corporate Gin Model

10.3 Investment Risk Considerations

All investment structures will be required to consider, and to effectively manage, three levels of risk:

- **Strategic Risk** – those risks specific to the investor in entering the investment and establishing the relevant investment vehicle. Alignment of project and operational structures and management to strategic objectives of the investor is a critical factor to ensuring long term sustainability.

- **Construction and Project Related Risk** – those risks specific to the design, management, and execution of the construction of the infrastructure, and commonly managed through the project governance structure

- **Operational Risk** – those risks specific to the operation phase of the project. These risks will be defined based on the operating model implemented for the facility and will be managed by the operational leadership team.

Table 36 demonstrates some of the key internal and external risks and considerations that may require evaluation by the investor, project delivery team and operational management of a future cotton gin.

Strategic Risk	Construction/ Project Risks	Operational Risks
Culture and human capital	Design and planning	Culture and human capital
Brand and reputation	Environmental acceptance	Health and safety
Strategic alignment	Community acceptance	Working capital and financial performance
Capital constraints	Project execution	Risk management controls and testing
Financial performance	Health and safety	Compliance
Risk management framework and legislative compliance	Change management	Environment and biosecurity
Technology and cyber	Financial controls	Technology and information management
Global market and trends	Labour requirements	Supply contracts
Environmental, biosecurity and climate	Damage and theft	Access to skilled labour
Project alignment	Contract execution and subcontracting	Community engagement
Community acceptance	COVID-19	

Table 36 Cotton Gin Risk Assessment Categories

11 RECOMMENDED APPROACH

This Report has assessed and demonstrated that in a 5-year Horizon, the North Queensland region, collectively, has the potential to generate cotton production levels necessary to support the establishment of a viable cotton gin. Further growth in cotton production levels beyond this point will largely be driven by major water infrastructure and agricultural projects proposed for the region, such as the Richmond Agriculture Project, Hughenden Irrigation Project and Gilbert River Irrigation Project.

At the 5-year Horizon, the primary cotton growing areas are expected to be in the Flinders River catchment, with over 99,800 bales estimated to be grown. Julia Creek and Richmond have been identified as the centres near to which the primary production will occur. A secondary growing region is expected to be located across the Gilbert River catchment (Georgetown), Mount Surprise and Mareeba – Dimbulah regions. Collectively this region is estimated to produce 79,010 bales at the 5-year Horizon.

Based on the assessment completed, **Richmond or Hughenden were identified as the preferences for the location of a cotton gin and secondarily was Mount Surprise.** The location assessment for a cotton gin primarily considered proximity of the gin to the cotton growing regions, access to transport infrastructure, proximity to port terminal in Townsville, availability of operational support services for the gin and financial performance of a gin. The establishment of a secondary or tertiary cotton gin in the region would be determined primarily by the likelihood of the gin to attract sufficient volumes of cotton for processing.

Prior to a cotton gin being established in North Queensland, cotton produced in the region will likely be directed to gins located in Emerald or Moura, with gin operators offering transport subsidies and incentives to attract cotton supply volumes. It has been identified, however, that the cost of transporting cotton to these locations does not present a long-term viable option for growers, with transport costs equating up to $100 per bale (approximately 20% of the current market price for processed cotton).

Furthermore, to ensure cotton is a mainstay agricultural industry for the region, risks associated with water supply, land use and clearing regulations and supporting infrastructure must be addressed to provide certainty to existing growers, and to enhance the attractiveness of the region and industry for new growers.

To advance this Study and to progress further towards a sustainable cotton industry in North Queensland, supported by one or more cotton gins, we recommend the following actions are undertaken by MITEZ or an appropriate industry advocate to maintain momentum of the project.

1. Cotton Production

- Continued consultation with growers and landowners to formalise interest and commitments to growing cotton, and to supply a locally established cotton gin;
- Education for existing growers regarding the opportunities for the integration of cotton as a rotational crop or into a livestock production enterprise;
- Lobbying of Federal and State Governments to review existing land use, environmental and vegetation management legislation and regulations to enable the establishment and expansion of broadacre cropping operations;
- Lobbying State Government to provide increased certainty to growers and landholders regarding water access and availability.

2. Cotton Gin Establishment

- Identify the primary proponent for the project and establish an appropriate governance structure to advance the project through further assessment and/or investment phases;
- Undertake an assessment of the investment appetite for a cotton gin based on the findings outlined in this Report;
- Engage professional services for the preparation of a detailed business case based on the preferred of the three identified location options. The business case should include preliminary design and planning, project management and structuring, economic and social impact assessment, funding assessment, operational planning, confirmation of supply volumes and establishment of preliminary supply chain requirements;
- Completion of a detailed risk assessment on the willingness of growers to pay for a cotton ginning service in the region and to establish a cotton supply commitment;
- Continue gin site land evaluations and zoning investigations, including engagement with Local Councils on environmental and community impacts;
- Review the status of the proposed major water and agricultural infrastructure projects and update production assessment information to reflect significant changes to operational timeframes for these projects.

3. Other Matters

- Assess the viability of utilising Port of Townsville as the primary export terminal for cotton grown in North Queensland. Engage existing cotton gin operators, port operators, shipping lines and merchant traders to investigate feasibility of the port terminal;
- Investigate the potential of integrating rail as a mode of transporting cotton from the growing region to gin, and from the gin to port terminal;
- Execute the Communication Strategy to distribute Report findings and messages to stakeholder groups.

APPENDIX A: COTTON PRODUCTION ASSESSMENT

The following figures illustrated the outcomes of the assessment completed across the three scenario timelines in relation to the cotton production potential for the five Study Areas.

Scenario 1 – Current Cotton Production Volumes

Region	Grower Appetite	Water Availability (Total Available and Annual Rainfall)	Climate (Temperature)	Soils (Predominant)	Precinct Land Potential	Forecast Cotton Production Volumes
Flinders River Catchment	3 Current Growers Rain Grown – 1,100ha Irrigated – 200ha Total – 1,300ha	Av. Water - 239,650ML Rainfall (North) – 789mm Rainfall (South) – 492mm	9 to 41 degrees Celsius	Black/ grey cracking clay soils	Limited vegetation management issues. Some land tenure considerations exist	6,200 bales
Gilbert River Catchment	4 Current Growers Rain Grown – 1,000ha Irrigated – 150ha Total – 1,150ha	Av. Water – 467,000ML Rainfall (East) – 791mm Rainfall (West) – 905mm	12 to 36 degrees Celsius	Sandy loams, sandy loam over clay and cracking clay soils	Significant vegetation management and land use issues exist	5,350 bales
Mount Surprise Region	3 Current Growers Rain Grown – 1,100ha Irrigated – 400ha Total – 1,500ha	Av. Water – 2,000ML Rainfall – 780mm	10 to 35 degrees Celsius	Friable non-cracking clay and clay loam soils	Significant vegetation management and land use issues exist	8,000 bales
Mareeba-Dimbulah Region	3 Current Growers Rain Grown – 0ha Irrigated – 800ha Total – 800ha	Av. Water – 191,957ML Rainfall – 832mm	13 to 32 degrees Celsius	Sandy loams and sandy clay loams soils	Existing agricultural precinct with significant cleared land. Grower crop adoption issues exist	7,200 bales
Lower Burdekin Region	0 Current Growers Rain Grown – 0ha Irrigated – 0ha Total – 0ha	Av. Water – 636,664ML and 255,000ML Rainfall (North) – 937mm Rainfall (South) – 1,144mm	12 to 32 degrees Celsius	Black/ grey cracking clay and sandy soils	Existing agricultural precinct with significant cleared land. Grower crop adoption issues exist	0 bales
Study Region Totals	**13 Current Growers & 4,750ha**					**26,750 bales**

Scenario 2 – Indicative 5 Year Horizon Cotton Production Volumes

Region	Grower Appetite	Water Availability (Total Available and Annual Rainfall)	Climate (Temperature)	Soils (Predominant)	Precinct Land Potential	Forecast Cotton Production Volumes
Flinders River Catchment	7 Forecast Growers Rain Grown – 6,500ha Irrigated – 8,200ha Total – 14,700ha	Av. Water - 239,650ML Rainfall (North) – 789mm Rainfall (South) – 492mm	9 to 41 degrees Celsius	Black/ grey cracking clay soils	Limited vegetation management issues. Some land tenure considerations exist	99,800 bales
Gilbert River Catchment	4 Forecast Growers Rain Grown – 4,000ha Irrigated – 3,200ha Total – 7,200ha	Av. Water – 467,000ML Rainfall (East) – 791mm Rainfall (West) – 905mm	12 to 36 degrees Celsius	Sandy loams, sandy loam over clay and cracking clay soils	Significant vegetation management and land use issues exist	44,800 bales
Mount Surprise Region	4 Forecast Growers Rain Grown – 1,600ha Irrigated – 2,250ha Total – 3,850ha	Av. Water – 2,000ML Rainfall – 780mm	10 to 35 degrees Celsius	Friable non-cracking clay and clay loam soils	Significant vegetation management and land use issues exist	26,650 bales
Mareeba-Dimbulah Region	3 Forecast Growers Rain Grown – 0ha Irrigated – 840ha Total – 840ha	Av. Water – 191,957ML Rainfall – 832mm	13 to 32 degrees Celsius	Sandy loams and sandy clay loams soils	Existing agricultural precinct with significant cleared land. Grower crop adoption issues exist	7,560 bales
Lower Burdekin Region	20 Current Growers Rain Grown – 0ha Irrigated – 2,667ha Total – 2,667ha	Av. Water – 636,664ML and 255,000ML Rainfall (North) – 937mm Rainfall (South) – 1,144mm	12 to 32 degrees Celsius	Black/ grey cracking clay and sandy soils	Existing agricultural precinct with significant cleared land. Grower crop adoption issues exist	24,000 bales
Study Region Totals	**38 Growers & 29,257 ha**					**202,810 bales**

Scenario 3 – Indicative 10 Year Horizon Cotton Production Volumes

Region	Grower Appetite	Water Availability (Total Available and Annual Rainfall)	Climate (Temperature)	Soils (Predominant)	Precinct Land Potential	Forecast Cotton Production Volumes
Flinders River Catchment	10 Forecast Growers Rain Grown – 6,500ha Irrigated – 18,500ha Total – 25,000ha	Av. Water - 239,650ML Rainfall (North) – 789mm Rainfall (South) – 492mm 3 potential major water infrastructure projects	9 to 41 degrees Celsius	Black/ grey cracking clay soils	Limited vegetation management issues. Some land tenure considerations exist	192,500 bales
Gilbert River Catchment	5 to 10 Forecast Growers Rain Grown – 6,000ha Irrigated – 9,675ha Total – 15,675ha	Av. Water – 467,000ML Rainfall (East) – 791mm Rainfall (West) – 905mm 1 potential major water infrastructure project	12 to 36 degrees Celsius	Sandy loams, sandy loam over clay and cracking clay soils	Significant vegetation management and land use issues exist	111,075 bales
Mount Surprise Region	4 Forecast Growers Rain Grown – 1,600ha Irrigated – 3,350ha Total – 4,950ha	Av. Water – 2,000ML Rainfall – 780mm	10 to 35 degrees Celsius	Friable non-cracking clay and clay loam soils	Significant vegetation management and land use issues exist	36,550 bales
Mareeba-Dimbulah Region	8 Forecast Growers Rain Grown – 0ha Irrigated – 2,200ha Total – 2,200ha	Av. Water – 191,957ML Rainfall – 832mm	13 to 32 degrees Celsius	Sandy loams and sandy clay loams soils	Existing agricultural precinct with significant cleared land. Grower crop adoption issues exist	19,800 bales
Lower Burdekin Region	40 Current Growers Rain Grown – 0ha Irrigated – 5,333ha Total – 5,333 ha	Av. Water – 636,664ML and 255,000ML Rainfall (North) – 937mm Rainfall (South) – 1,144mm	12 to 32 degrees Celsius	Black/ grey cracking clay and sandy soils	Existing agricultural precinct with significant cleared land. Grower crop adoption issues exist	48,000 bales
Study Region Totals	**67 to 72 Growers & 53,158 ha**					**407,925 bales**

APPENDIX B: COTTON GIN LOCATION ASSESSMENT

The following figures illustrate the outcomes of the assessment completed in relation to the long list of cotton gin locations. The assessment was completed considering four criteria:

- Criteria 1 – Proximity to Growing Area
- Criteria 2 – Road Transport Infrastructure
- Criteria 3 – Proximity to Port of Townsville Terminal
- Criteria 4 - Services

Each location was rated and assessed against a benchmark.

Criteria Name	Criteria Description, Approach and Benchmark	Weighting	Scoring	
Proximity to Growing Region	Assessment of proximity of the gin location to the primary cotton growing regions. The assessment considers the total volume of cotton able to be produced and supplied within a 350km radius of the gin location. The cotton supply volumes are based on those volumes identified by Growing Region – Table 16. A primary benchmark of 70,000 bales was utilised for gin viability. A lower rating was allocated for volumes below this level on the basis that cotton may be transported beyond 350km to a cotton gin, however, the probability of this is low.	50%	Rating 1.00 0.75 0.50 0.25 0.00	Outcome >70,000 bales 52,500 - 70,000 bales 35,000 - 52,500 bales 17,500 - 35,000 bales <17,500 bales

Criteria Name	Criteria Description, Approach and Benchmark	Weighting	Scoring
Road Transport Infrastructure	Assessment of the accessibility, quality and reliability of road transport infrastructure servicing the gin location. A qualitative assessment of the following key considerations was completed: • Major road transport routes connecting growing region/s to gin location • Major road transport routes connecting gin location to port terminal (Townsville) • Infrastructure of suitable standard for road trains and B-Double access between growing areas, gin location and port terminal • Reliability of access to gin location throughout the year • Quality and design of infrastructure The benchmark standard is defined as: • Minimum of B-Double and Road Train access from primary growing areas to gin location and to port terminal • Multiple major arterials (Highway or Developmental Road) directly connecting growing areas and gin location • Multiple major arterials (Highway or Developmental Road) directly connecting gin location to port terminal • High reliability of access to gin location with limited impact from annual flooding or other outages • Sealed road pavements with minimum double lane bitumen	20%	Rating / Outcome 1.00 Meets 100% of benchmark 0.75 Meets 75% of benchmark 0.50 Meets 50% of benchmark 0.25 Meets 25% of benchmark 0.00 Does not meet 25% of benchmark
Proximity to Port of Townsville	Assessment of the proximity of the gin location to the Port of Townsville. A benchmark of 500km was used as the maximum distance by road from the gin location to the Port of Townsville.	20%	Rating / Outcome 1.00 <500km 0.75 500km to 750km 0.50 750km to 1,000km 0.25 1,000km to 1,250km 0.00 >1,250km

Criteria Name	Criteria Description, Approach and Benchmark	Weighting	Scoring	
Services	Assessment of the industry and essential services and potential skilled labour within the gin location to support the operation of a cotton gin. A qualitative assessment of the following keys considerations was completed: • Access to skilled workers within the location or access via FIFO through airport (regular commercial and chartered services) • Proximity to major population centres of Cairns and Townsville for significant services, materials and parts • Essential services (accommodation, medical, emergency services, schools) and industry support services located at the location. The benchmark standard is defined as: • Population of >5,000 people with appropriate level of employable persons • <300km to major population centre of Cairns or Townsville for access to materials, parts and services • Ready access to skilled labour via FIFO through commercial airport with regular or chartered services from Brisbane, Townsville or Cairns, or <300km driving distance from major population centre • Sufficient essential services and industry support services to support the operation of a cotton gin.	10%	Rating 1.00 0.75 0.50 0.25 0.00	Outcome Meets 100% of benchmark Meets 75% of benchmark Meets 50% of benchmark Meets 25% of benchmark Does not meet 25% of benchmark

Criteria 1 Assessment – Proximity to Growing Area (Total Bales within 350km)

Growing Region	Cloncurry	Julia Creek	Richmond	Hughenden	Mount Surprise	Georgetown	Charters Towers
Cloncurry	-	-	-	-	-	-	-
Julia Creek	52,800	52,800	52,800	52,800	-	-	-
Richmond	38,000	38,000	38,000	38,000	-	-	-
Hughenden	-	-	-	-	-	-	-
Mount Surprise	-	-	-	-	26,650	26,650	-
Georgetown	-	-	-	-	44,800	44,800	-
Normanton	-	-	-	-	-	9,000	-
Mareeba	-	-	-	-	7,560	7,560	-
Ayr	-	-	-	-	-	-	24,000
Total by Gin Location	**90,800**	**90,800**	**90,800**	**90,800**	**79,010**	**88,010**	**24,000**
Target	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Rating	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**0.25**

Criteria 2 Assessment – Road Transport Infrastructure

Gin Location	Growing Area to Gin	Gin to Port	Road Train and B Double Access	Reliability of Infrastructure Access (Flooding)	Quality & Design	Comments	Rating
Cloncurry	• Burke Development Road, • Wills Development Road, • Barkly Highway, • Landsborough Highway and • Flinders Highway	Direct access via Flinders Highway direct to Port of Townsville	Yes	Medium potential for road flooding or impacts during wet season for Flinders Highway	Growing region to gin and gin to port roads of high quality and suitability for heavy vehicle use	Medium number of transport routes but susceptibility to Flinders Highway flooding that may cut off port access or growing regions	**0.75**
Julia Creek	• Burke Development Road, • Wills Development Road, • Richmond Rd, • Richmond Woolgar Rd and • Flinders Highway	Direct access via Flinders Highway direct to Port of Townsville	Yes	Medium potential for road flooding or impacts during wet season for Flinders Highway	Growing region to gin and gin to port roads of high quality and suitability for heavy vehicle use	Medium number of transport routes but susceptibility to Flinders Highway flooding that may cut off port access or growing regions	**0.75**
Richmond	• Burke Development Road, • Wills Development Road, • Richmond Rd, • Richmond Woolgar Rd and • Flinders Highway	Direct access via Flinders Highway direct to Port of Townsville	Yes	Low potential for road flooding or impacts during wet season for Flinders Highway	Growing region to gin and gin to port roads of high quality and suitability for heavy vehicle use	Limited transport routes. Flooding impacts to growing regions but not port. Indirect access of growing regions through surrounding towns	**0.75**
Hughenden	• Burke Development Road, • Wills Development Road and • Flinders Highway • Kennedy Highway	Direct access via Flinders Highway direct to Port of Townsville	Yes	Low potential for road flooding or impacts during wet season	Flinders growing region to gin and gin to port roads of high quality and suitability for heavy vehicle use. Mount Surprise to Hughenden roads not fully sealed and some quality issues	High number of transport routes but on fringe of optimal proximity to Flinders and Mount Surprise growing areas. Road to Mount Surprise not sealed and quality issues	**0.75**

Gin Location	Growing Area to Gin	Gin to Port	Road Train and B Double Access	Reliability of Infrastructure Access (Flooding)	Quality & Design	Comments	Rating
Mount Surprise	• Gulf Development Road • Kennedy Highway	Direct access to port via Lynd Highway and Flinders Highway or alternatively via Hann Highway via Hughenden	Yes	Medium potential for road flooding or impacts during wet season for Gulf Development Road	Mareeba to Mount Surprise roads of high quality Mount Surprise to Hughenden roads not fully sealed and some quality issues Gulf Development Road has quality issues	Medium number of transport routes but susceptibility Gulf Development Road suffers from flooding susceptibility and quality issues	**0.75**
Georgetown	• Gulf Development Road	Access to port via Mount Surprise (via Gulf Development Road)	Yes	High potential for road flooding or impacts during wet season for Gulf Development Road	Gulf Development Road has quality issues	Limited transport routes. Flooding impacts to growing regions and to port access.	**0.50**
Charters Towers	• Hann Highway, • Lynd Highway, • Flinders Highway, • Kennedy Highway	Direct access via Flinders Highway direct to Port of Townsville	Yes	Low potential for road flooding or impacts during wet season	High quality of all major transport routes	High number of transport routes but outside all growing areas. Reliant upon routes all accessible to supply cotton	**1.00**

Criteria 3 Assessment – Proximity to Port of Townsville

Gin Location	Distance to Port of Townsville (km)	Rating
Cloncurry	780	**0.50**
Julia Creek	645	**0.75**
Richmond	495	**1.00**
Hughenden	385	**1.00**
Mount Surprise	400	**1.00**
Georgetown	555	**0.75**
Charters Towers	140	**1.00**

Criteria 4 Assessment – Services

Gin Location	Skilled Labour & Seasonal Labour	Proximity to Major Centres	Essential and Industry Support Services	Rating
Cloncurry	• Population of 3,047 (70% working age) • 5.3% unemployment rate • 25% employed persons in mining and 11% in agriculture • 18.4% operators and 15.1% technicians and trades • Airport with > 12 services per week BNE, TSV and MTISA and FIFO charters	783km to Townsville and 985km to Cairns	• 3 schools, 2 police stations, 2 ambulance stations, 1 fire station and 2 hospitals • 922 total private dwellings (228 owned, 156 being purchased, 485 rented and 15 other) • 34% of businesses in agriculture industry and 12% in construction	**0.75**
Julia Creek	• Population of 818 (65% working age) • 3.3% unemployment rate • 38% in Agriculture and 12% in public administration • 32% Managers and 17% labourers by occupation • Airport with 3 commercial services per week	646km to Townsville and 852km to Cairns	• 3 police stations, 1 school, 1 ambulance station, 1 fire station and 2 hospitals • 270 total private dwellings (114 owned, 43 being purchased, 99 rented and 3 other) • 64% of business in agriculture and 12% in construction	**0.50**
Richmond	• Population of 810 (62% working age) • 3.3% unemployment rate • 33% employed persons in Agriculture and 17% in public administration • 26% Managers and 20% labourers by occupation • Airport with 3 services per week	497km to Townsville and 703km to Cairns	• 1 police station, 1 ambulance station, 1 fire station, 1 school and 1 hospital • 295 total private dwellings (99 owned, 67 being purchased, 110 rented, 9 other) • 59% of business in agriculture and 11% in construction	**0.50**
Hughenden	• Population of 1,505 (60% working age) • 3.3% unemployment rate • 35% employed persons in Agriculture and 13% in public administration • 32% Managers and 18% labourers by occupation • Airport with 3 commercial services per week	382km to Townsville and 589km to Cairns	• 2 police station, 1 ambulance station, 1 fire station, 4 school and 1 hospital • 586 total private dwellings (243 owned, 121 being purchased, 181 rented, 7 other) • 58% of business in agriculture and 9% in construction	**0.50**

Gin Location	Skilled Labour & Seasonal Labour	Proximity to Major Centres	Essential and Industry Support Services	Rating
Mount Surprise	• Population of 169 (65% working age) • 0% unemployment rate • 49% in Agriculture and 24% in Accommodation • 22% Managers and 31% Labourers by occupation • Airport with no commercial services	400km to Townsville and 378km to Cairns	• 1 police station, 0 ambulance stations, 0 fire stations, 1 school and 0 hospital • 87 total private dwellings (43 owned, 11 being purchased, 4 rented, 29 other)	**0.25**
Georgetown	• Population of 793 (55% working age) • 4.5% unemployment rate • 45% employed persons in Agriculture and 14% in public administration • 32% Managers and 24% labourers by occupation • Airport with no commercial services	553km to Townsville and 383km to Cairns	• 3 police stations, 2 ambulance stations, 0 fire stations, 3 school and 2 hospital • 319 total private dwellings (152 owned, 52 being purchased, 67 rented, 8 other) • 60% of business in agriculture and 9% in construction	**0.50**
Charters Towers	• Population of 11,739 (60% working age) • 7.5% unemployment rate • 13% employed in Education and Training and 12% in agriculture • 15% Managers and 15% labourers by occupation • Airport with no commercial services, close proximity to TSV	135km to Townsville and 480km to Cairns	• 12 schools, 4 police stations, 2 ambulance stations, 1 fire station and 1 hospital • 4,157 total private dwellings (1,522 owned, 1,181 being purchased, 1,238 rented and 52 other) • 39% of businesses in agriculture industry and 13% in construction	**1.00**