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Caroona Coal Project

Application for Gateway Certificate Agricultural Impact Assessment – Appendix A

1 PROJECT ASSESSMENT AREA LAND USE AND PRODUCTION

1.1 Agricultural land use, production systems and productivity

With regard to agricultural land use, production systems and productivity, two methods of description were performed. The first was *description by engagement and inspection,* where access to the land and interview of the land manager was possible. However, where engagement and inspection was not possible, for whatever reason, a significantly less detailed *description by reconnaissance* method was used.

Analyses were performed on a *per-farm management unit basis* and are generally presented following in no particular order of preference. The analysis reveals an old maxim: *'there is no one way to farm, there are many'*, and no two production systems described herein are the same.

1.1.1 Description by engagement and inspection

Description by engagement and inspection was completed over an eight-month period ending in February 2014. This generally involved telephone discussions with landholders, exchange of correspondence via email, on-farm interviews with land managers, property inspection and photography, and a collaborative review of notes and findings.

Whilst La Tierra has applied every effort in gathering, transcribing and collaboratively checking information with landholders so as to ensure the following descriptions are representative, this qualitative method of data gathering assumes some variation. The information is representative only at the time of engagement. In some instances, landholders chose not to check and verify the information gathered.

1.1.1.1 Land reference #70, 71, 75, (166 and 2001)

This mixed farming agricultural enterprise is a family owned and managed aggregate of properties in Caroona (Doona Ridge), Pine Ridge and Quirindi. The farming systems feature beef cattle breeding and fattening with associated forage crops, as well as oil seed and grain crops. The key agribusiness indicators for this enterprise have been determined (Table 1.01). The details for this Agribusiness have been verified by Mr. Scott Fuller.

Table 1.01 Land reference #70, 71, 75, 166 and 2001 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	70 – "Bonnie Doon"; 71 – "The Reserve"; 75 – "Doona Vale"; 166 – Doona State Forest; 2001 – Doona State Forest (refer to Figure 3.01)	
Manager	Mr. Jack Fuller, Landowner (#70, 71) Mr. Scott Fuller, Manager, Advantage Grain Services Pty Limited	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	262 ha (#70) 91 ha (#71) 389 ha (#75) 1,287 ha (#166, 2001) Total – 2,062 ha	94 – owned by Mr. Jack Fuller 0 – owned by Mr. Jack Fuller 100 – owned by the Applicant 100 – owned by Doona State Forest
Water	Mooki River domestic and stock supply with 60ML allocation (#71) 1 bore to a depth of 36m with a 150,000 L/hour capacity, (#70, 71)	

Key Agribusiness Indicators	Description	
	1 bore with 1,514 L/hour capacity, 8 dams (#75) 3 dams (#166, 2001)	
System	Beef cattle	Dryland cropping
Product (unit)	Vealer steers (<350 kg LW) Bullocks (400-500 kg LW) Grown Steers (400-500 kg LW)	Fodder (#70): Oats (hay), Barley (forage) Cropping (#71): Canola, Barley, Sorghum
Scale	Vealer steers, Bullocks and Grown Steers - 120 Cows	72 ha (#70) + 34 ha (#71) Total: 106 ha
Yield	40 Vealer units/year 60 Grown Steer units/year 20 Bullock unit/year	Canola – 2 t/ha Barley – 4 t/ha Sorghum – 6 t/ha
Market	Grown Steers – Caroona Feedlot Bullocks – Wingham (slaughter) Vealers – Scone Sale Yards Heifers – Tamworth Regional Livestock Exchange	All crops sold through AMPS Agribusiness, Waverly via Caroona

The Fuller family operates a beef cattle and a mixed cropping agribusiness across an aggregate of properties in the Caroona (Doona Ridge), Pine Ridge and Quirindi areas. In total, the Fuller family are managing an area of 2,062 ha. The family property, "Wee Willow", is located outside the Project area on Bundella Road and Caroona-Pine Ridge Road, Pine Ridge. This property is also the base for the Fuller grain transport enterprise, Advantage Grain Services Pty Limited (Advantage Grain), managed by Mr. Fuller's son, Mr. Scott Fuller.

A land use profile for the properties managed by the Fuller family follows.

- Land reference #70 – property name is "Bonnie Doon" (Figure 1.01). The property has been owned by Mr. Fuller for around 27 years. The property is accessed by Rossmar Park Road, which runs through the eastern side of the property. Walhallow Road forms the southern boundary of the property. The land also fronts the Mooki River and backs on to the Doona State Forest. The property neighbours the Walhallow Local Aboriginal Land Council (Land reference #156) and Priestley (Land reference #126). The Fuller's other property, Land reference #71 ("The Reserve") is directly across the Mooki River from "Bonnie Doon".

  "Bonnie Doon" is the base for the Fuller's cattle grazing and cropping agribusinesses on Doona Ridge. "Bonnie Doon" and "The Reserve" are managed as one unit. Combined, these properties are 352 ha in size. The majority of "Bonnie Doon" is cultivated (72 ha). The property has one bore and domestic and stock access to the Mooki River. "Bonnie Doon" has two cottages, one hay shed, a machinery shed, a woolshed, three grain storage silos and a set of cattle yards. Around one third of the property is covered in wooded vegetation, dominated by White Cypress Pine (*Callitris glaucophylla*).

- Land reference #71 – property name is "The Reserve". This property is almost completely cultivated (84 ha) and is bordered by the Mooki River and Quirindi Creek. The property has one large grain storage shed. There is scattered wooded vegetation across the cultivated area. The Fullers have owned "The Reserve" for around 10 years. It also has one bore to a depth of 36 m, drawing around 150,000 L/hour with a 60 ML allocation, reduced from 118 ML in 2003.

- Land reference #75 – property name is "Doonavale". The Fuller's have leased this property from the Applicant for around four years, since the time of acquisition. The property is 389 ha is size. The Fuller family run their beef cattle across this property, which is surrounded on three sides by the Doona State Forest (Land reference #166 and 2001). "Doonavale" has two residences and numerous associated storage sheds. The property has eight dams and one solar powered bore with a capacity of 1,514 L/hour. Around one quarter of the property is wooded vegetation that functions as an extension of the Doona State Forest, dominated by Narrow-leafed Ironbark (*Eucalyptus crebra*) – White Cypress Pine (*Callitris glaucophylla*) forests (Umwelt, 2011). Anecdotally koalas are widespread throughout "Doonavale" and the Doona State Forest. Doona State Forest (#166 and 2001) has three dams that the Fullers access for stock watering.

The Fullers farm summer and winter crops in rotations at both "Bonnie Doon" and "The Reserve". Forage crops sown at "Bonnie Doon" while "Doonavale" grows oats for hay production and forage barley. Winter crops of oats, barley and canola with summer sorghum form a season-dependent rotation.

The Fuller's beef production agribusiness is a low management-intensity Charolais over Angus beef cattle production system. The family grows out terminal progeny sourced from their additional property located at Quirindi. They fatten around 290 cows, and calves are fed through to the grazing land on Doona Ridge. The Fullers produce around 120 terminal progeny annual, as a mix of Vealers, Grown Steers and Bullocks. Terminal progeny is sold through the Scone Saleyards (Vealers), the JBS Caroona Feedlot (Grown Steers), Wingham Beef Exports a subsidiary of Nippon Meat Packers Australia (Bullocks), and the Tamworth Regional Livestock Exchange (heifers not needed as replacements).

Figure 1.01 "Bonnie Doon" – residence and cultivated plot (Land reference #70)

The Fullers have developed a vegetation management plan through Namoi Catchment Management Authority (CMA) and have hosted native grass studies onsite at "Bonnie Doon". They have also improved their properties by fencing, and establishing new cattleyards at "Bonnie Doon". The primary weed across the aggregation is African Boxthorn (*Lycium ferocissimum*) but the Fullers also consider the White Cypress Pine (*Callitris glaucophylla*) to be invasive to farming practice.

1.1.1.2 Land reference #4

This agricultural enterprise (Land reference #4) is the JBS Australia Caroona Feedlot, a beef cattle feedlot with National Feedlot Accreditation Scheme and European Union (EU) accreditation, managed by Mr. Richard Nicholls. The key agribusiness indicators for this enterprise have been determined (Table 1.02).

The Caroona Feedlot is a facility of JBS Australia, the largest meat processing company in Australia and a division of JBS, itself the largest animal protein processing company in the world. JBS work in the areas of food, leather, products for pets, biodiesel, collagen, cans and cleaning products. JBS Australia operates a network of ten strategically located processing facilities and five feedlots between Townsville in north Queensland and Devonport in Tasmania. JBS Australia has a daily processing capacity of more than 8,000 cattle and 21,000 small stock (JBS Australia, 2014a). The details of this agribusiness have been verified by the Manager, JBS Caroona, Mr. Richard Nicholls.

Table 1.02 Land reference #4 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	4 (refer to Figure 3.01)	
Manager	Mr. Richard Nicholls	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	1,382 (#4)	90
Water	4 bores to 28 m depth (2 operational) with an allocation licence of 402 ML.	
System	Beef cattle finishing	Irrigated and dryland fodder cropping and production
Product (unit)	Finished Grown Steers Bullocks Heifers (not favoured)	Wheat, barley, triticale, forage sorghum Kikuyu, Rhodes grass
Scale	23,500 head/day capacity over 400 ha of finishing pens	Variable areas of - Wheat Barley Triticale Forage Sorghum Kikuyu and Rhodes grass
Yield	75,000 cattle per year finished Transported out to processing four times per week	Variable
Market	JBS Australia processing plants in QLD and NSW. EU, Export and Domestic	Beef cattle rations

The Caroona Feedlot is one of five JBS Australia feedlots covering more than 10,000 ha combined, located in prime grain and cattle-producing regions in NSW and QLD. The feedlots operate a one-time feeding capacity of 150,000 head of cattle, with an annual cattle turnoff of more than 330,000 head (JBS Australia, 2014b). The Caroona feedlot was installed (by others) at the current site in 1972. The property is located 35 km west of Quirindi on Doona Ridge within the Project assessment area. It is located on Caroona Feedlot Road off Coonabarabran Road to the west of Caroona.

The Binnaway Werris Creek Railway line, Walhallow Road, the Walhallow Village, the Doona State Forest, "Doonavale" and other private landholders, border the feedlot. The feedlot is intentionally equidistant from the JBS Riverina Beef Plant in Yanco, NSW and the JBS Beef City in Toowoomba, QLD. Beef City itself is a large cattle feedlot, however cattle from Caroona Feedlot are washed at this location prior to slaughter at JBS Dinmore Abattoir in Ipswich.

The Caroona Feedlot operates a 23,500 head capacity beef cattle finishing facility over 1,382 ha. Ancillary agricultural systems include fodder cropping and production, livestock waste processing, and onsite wastewater treatment through plantings, including Kikuyu and Rhodes pastures. Fertiliser from livestock waste is processed onsite and sold directly from the property to local and regional markets.

The feedlot has four steam flaking mills. It sources locally grown wheat, barley and sorghum grains as well as corn and sorghum silage, cereal crop hay, cotton seed/hulls and molasses, from further afield, for use in manufacturing rations. Feeder cattle for the Caroona Feedlot are sourced from producers throughout central NSW in a 350km radius of the feedlot. The Caroona Feedlot has seven Feedlot Buyers based in Tenterfield, Aberdeen, Cowra, Dubbo, Grafton, Quirindi and Armidale (JBS, 2013b). Cattle are regularly backgrounded in the local Caroona area. The site has 400 ha of finishing pens, finishing up to 75,000 head of cattle per year. The cattle are mustered by horseback with employees bringing their own horses to the property. The site includes both irrigated and dryland farming, supplying feed commodities directly to onsite storage (JBS Australia, 2014c).

The Caroona Feedlot produces four finished products. The products are sensitive to market-demand, for example, one product may be a 350 kg beast with a marble score of 1 to 3 or a 350 kg beast with a marble score of 7 in accordance with Meat Standards Australia. Four feeding programs are applied in generating the finished product. These feeding programs include a European Union (EU) program (Figure 1.02), a 120-day, 140-day, and a 160-day feeding programs, applied according to breed and desired market outcome.

Figure 1.02 Caroona Feedlot EU marked Angus cattle (Land reference #4) (Source: Condon, 2011)

The business is export-focussed, with an estimated 85% of the product exported and 15% sent to the domestic market. Cattle are trucked in and out four times per week using the JBS Carriers.

There are three residences and associated buildings/sheds on the property. One of the residences is the home of Mr. Nicholls. There is also an office building, large grain storage sheds and a steam flaking mill

(Figure 1.03 and Figure 1.04). The property has an airstrip and a quarry. An estimated 15% of the site is covered by native forest, which is contiguous with the Doona State Forest. Koalas are widespread in the forest and across the property, and have been seen in cattle pens.

Figure 1.03 Caroona Feedlot feed ration storage shed and flaking mill (Land reference #4)

Figure 1.04 Caroona Feedlot Steam Flaking Mill (Land reference #4)

Regionally sourced grain is the dominant input to feed rations. Up to 80,000 t/y of grain is sourced from local and regional growers. Sorghum forage for silage is sourced from within a 30 km radius from the property, and made and stored onsite in five covered ground pits. Up to 105,000 t of rations are fed out per year. Five

different rations used as part of the feed program. The rations are a varied mix of wheat, barley, triticale, sorghum, sorghum silage, corn, cotton seeds/hulls, and molasses. Steam flaking is undertaken on site using the original 1972 infrastructure design. The steam flaking process is generated by water tube boiler natural gas.

The balance of the property is cultivated for both summer and winter crops dryland and irrigated crops. Wheat, barley, triticale are the winter crops (Figure 1.05) with forage and grain sorghum in summer. Pen effluent is managed and applied to 46 ha of Kikuyu and 7 ha of Rhodes grass in permanent pastures (Figure 1.06).

Figure 1.05 Caroona Feedlot germinating wheat crop, June 2013 (Land reference #4)

Figure 1.06 Effluent disposal onto permanent Kikuyu pasture (Land reference #4)

Solid livestock waste is screened, mainly to remove gravel from pen floors, then composted on site. Between 35,000 and 45,000 t of composted solid waste are produced annually. This product is sold to the local and regional market (Figure 1.07).

The property has four bores but only two are operational. The operational bores have a depth of 18 m and an access licence for 402 ML annually. This access licence was reduced by 25% in 2004, constraining the number of cattle that can be finished at the feedlot to its current operating capacity.

Figure 1.07 Livestock waste is composted and screened to make a saleable fertiliser product (Land reference #4)

1.1.1.3 Land reference #38

This agricultural enterprise is on a property known as "Walhallow Farm". The property is now owned by the Applicant and is leased to the former owner Lindenow Pastoral Company and managed as a mixed system farming enterprise. The key agribusiness indicators for this enterprise have been determined (Table 1.03). The details of this agribusiness have been verified by Mr. Jake Corner, owner of Lindenow Pastoral Company.

Table 1.03 Land reference #38 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	38 – "Walhallow Farm" (refer Figure 3.01)	
Manager	Mr. Michael Cudmore	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	356 (#38)	0
Water	3 bores, 422ML aquifer access licence, supplementary licence of 215ML (supplementary licence reduced by 10%p.a. until extinguished) Domestic and stock licence	
System	Beef cattle	Cropping and forage
Product (unit)	Weaner (<350kg LW) Grown Steers (400-500kg LW)	Cropping – Sorghum (irrigated) Forage – Oats (dryland)
Scale	400 units/year 50:50 Weaners to Grown Steers	Sorghum – 91ha Forage Oats – 36ha
Yield	200 Weaner units/year 200 Grown Steers units/year	Sorghum - 7.5 t/ha

Key Agribusiness Indicators	Description	
Market	Weaners - Gunnedah Regional Saleyards Grown Steers - Coles, Woolworths and Wingham Abattoir	Sorghum – "diverse market"

Lindenow Pastoral Company (Lindenow) currently leases "Walhallow Farm" (Land reference #38) from the Applicant. Mr. Jake Corner owns Lindenow Pastoral Company. Mr. Corner's son-in-law, Mr. Michael Cudmore, manages the 356 ha property for beef cattle production as well as opportunity cropping of sorghum under 91 ha under irrigation. "Walhallow Farm", as well as the adjacent property, "West Mooki" (Land reference #5), were previously run together as a partnership known as "West Mooki Enterprises". Both properties are now owned by the Applicant and leased to the previous owners. Mr. Andrew Thompson previously owned "West Mooki".

The Mooki River forms the western boundary of the property, which is immediately outside the Project area. "Walhallow Farm" is accessed by Caroona-Pine Ridge Road and the Coonabarabran Road, and is within an estimated 1 km of the Caroona village. Lindenow purchased "Walhallow Farm" from the Estate of Murray Tyrrell approximately 12 years prior to its sale to the Applicant. At the time of purchase, the property was a dedicated cattle-grazing enterprise. Anecdotally, "Walhallow Farm" is an historical property in the Caroona area. Walhallow Station is understood to have once covered an area of 1,300 km^2 along the Mooki River, primarily for sheep grazing. The historical homestead and outbuildings (Figure 1.08) remain on land also previously owned by Lindenow, but subsequently subdivided and sold to the Todman family (Land reference #149). The homestead is accessed by Quirindi Premer Road.

Figure 1.08 Historic "Walhallow Station" outbuildings, located outside of Project assessment areas

Lindenow's beef production agribusiness is a low management-intensity Charolais x Santa x Angus beef cattle production system finishing Grown Steers and Weaners. Lindenow runs 200 Grown Steers and 200 Weaners, retaining a 50:50 ratio (Figure 1.09). Mr. Cudmore also runs breeders at Lindenow's other property, near Quirindi. The Weaners are sold through the Gunnedah Regional Saleyards and the Grown Steers are

sold directly to both Woolworths and Coles, and also to Wingham Abattoir. Most cattle are finished on 100 ha of forage oats.

Figure 1.09 Mixed breed Grown Steers grazing on forage oats (Land reference #38) , located outside of Project assessment areas

A total of 91 ha of sorghum is farmed as a summer crop under centre pivot irrigation. Around 32 ha of this can also be farmed under flood irrigation. A total of 100 ha is planted as dryland forage oats each winter. Historically, Lindenow has also farmed corn and sunflowers under centre pivot irrigation, as well as dryland oats.

The property has three bores, two of which are currently unused and a 422 ML (reduced from 900 ML in 2004) aquifer access licence. It also has a 215 ML supplementary licence that reduces automatically by 10 percent per annum until extinguished. No weed issues have been identified, as the majority of the property is under cropping.

1.1.1.4 Land reference #57

This agricultural enterprise is on a property known as "Burwood", which is now owned by the Applicant. At the time of interview, the property remained under the agricultural management of the former owner, Mr. Ben Evans, who has subsequently vacated the property. The key agribusiness indicators for the enterprise, at the time of interview, have been determined (Table 1.04). The details of this agribusiness have not been verified by Mr. Ben Evans as he has vacated the property.

Table 1.04 Land reference #57 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	57 (refer Figure 3.01)	
Manager	Mr. Ben Evans	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	797 (#57)	57
Water	2 bores (1 dried up, 1 irrigation)	

Key Agribusiness Indicators	Description	
System	Beef cattle trading and agistment	Cropping
Product (unit)	Agistment of: Dry Cows (<380kg LW) Grown Steers (400-500kg LW) Trade cattle: Grown Steers (400-500kg LW)	Cropping: Barley, wheat, sorghum Forage: Sorghum, oats, wheat, millet, cow peas, clover, medium digit grass, bambatsi
Scale	Agistment of: Between 300 to 600 Cow units/year Trade cattle: 250 cow units/year	Cropping: Barley, wheat, sorghum Forage: Sorghum, oats, wheat, millet, cow peas, clover, medium digit grass, bambatsi
Yield	Agistment of: 600 Grown Steers and Dry Cows Trade cattle: 250 cow units/year	Cropping: Barley, Wheat, Sorghum Forage: Sorghum, Oats, Wheat, millet, cow peas, Clover, medium digit grass, bambatsi
Market	Trade cattle: Dry Cows through Gunnedah Regional Saleyards Trade cattle: Grown Steers through Bindarra, Primo (Scone) meatworks and Killara Feedlot	Crops sold through AMPS, Waverly via Caroona

Mr. Ben Evans sold the 797 ha property "Burwood" (Land reference #57) to the Applicant in 2012. The property was leased back to Mr. Evans, where he resided with his wife and son, until he vacated in late 2013. He managed the agribusiness as a mixed cropping and beef cattle agricultural enterprise. The property is accessed by Rossmar Park Road and has a 6 km frontage to the Mooki River. The Mooki River, the Doona State Forest and other private landholders border "Burwood". The majority of the property is divided into 12-15 ha paddocks for cell or rotation grazing.

The Evans' beef cattle agribusiness was the trading and agistment of steers and dry cows. Mr. Evans also provided backgrounding for the nearby Killara Feedlot. There were no breeders on the farm. The cattle were mixed-breed but the majority Angus x Hereford (Figure 1.10). The grown steers were worked on a three-month grow-out grazing rotation through summer and spring. The cattle were supplementary fed in winter. Mr Evans sourced locally from Narrabri, Moree, Armidale, Gunnedah, Meriwa and Casino markets. Dry cows were sold through the Gunnedah Regional Saleyards, finished steers through Bindarra and Primo (Scone) meatworks and Killara Feedlot.

The cropping enterprise at "Burwood" was for grain and forage. The grain system was based on barley and wheat in winter and summer sorghum. Forage crops included oats, wheat, millet, cow peas and sorghum. Mr. Evans also planted pastures including clover, Premier Digit and Bambatsi grasses. Fertiliser was sourced from Caroona Feedlot and applied at a rate of 2.25 tonnes/ha for forage and 4.5 tonnes/ha for cropping. Mr. Evans did not use chemical pesticides, but the property's proximity to cotton cropping prohibited an Organic Certification.

Figure 1.10 Mixed breed cattle trading and agistment (Land reference #57)

The property has one residence with associated infrastructure including a hay shed, silos, steel cattle yards, a cattle crush and calf-cradle (Figure 1.11 and Figure 1.12) and two bores. One of the bores dried up around six years ago while the other is equipped with a solar pump and delivers about 2 L/s for stock watering.

Figure 1.11 Residence and associated sheds (Land reference #57) with Doona State Forest in background

Mr. Evans has been actively involved in sustainable farming practices. He has participated in a number of land management training projects through Namoi Catchment Management Authority and the Liverpool Plains Land Management – both in terms of education and re-vegetation. One of the projects involved tree planting along the Mooki River banks to stabilise the riparian zone and river flats (Figure 1.13).

Figure 1.12 Cattle crush and cattle yards (Land reference #57)

Figure 1.13 Mooki River flows on the margin of the property (Land reference #57) , located outside of Project assessment areas

1.1.1.5 Land reference #5

This agricultural enterprise is on a property known as "West Mooki". The property is now owned by the Applicant but remains under the agricultural management of former owner, Mr. Andrew Thompson. It is a mixed cropping and beef cattle production agribusiness. The key agribusiness indicators for this enterprise have been determined (Table 1.05).

"West Mooki"(Land reference #5) and "Walhallow" (Land reference #38) are separated by the Mooki River and were previously run together as a partnership known as "West Mooki Enterprises". Both properties are now owned by the Applicant and leased to the previous owners. The current managers and previous owners of "West Mooki" are Mr. Andrew Thompson and Mrs. Jillian Thompson. Mr. and Mrs. Thompson have verified the details of this agribusiness.

"West Mooki" is within the Project assessment area. "West Mooki" is a 564 ha mixed cropping and beef cattle agribusiness. A total of 270 ha is farmed without irrigation water entitlements. Typical crop varieties include Durum wheat, barley, sorghum and pulses of chickpeas and mungbeans, in a rotation that delivers three crops in two years. Rotations are either Wheat or Barley in winter, followed by a summer pulse, a winter ley fallow and a summer sorghum crop. A pulse always precedes the fallow, which is required for soil moisture accumulation in this dryland cropping system.

Table 1.05 Land reference #5 - key agribusiness indicators

Key Agribusiness Indicators	Description		
Land reference #	5 – "West Mooki" (refer to Figure 3.01)		
Manager	Mr Andrew Thompson		
Area of production (ha)	TOTAL	Within Project assessment area (%)	
	564 (#5)	86 %	
Water	Nil irrigation water supply entitlements		
System	Cropping		Opportunity trading - beef cattle
Product (unit)	Wheat (Durum) Sorghum Barley Pulses (chickpeas, mungbeans)		Cow and Calf units
Scale	270 ha dryland cultivation		Up to 120 units, seasonal
Yield	Wheat (Durum) – 4.5 t/ha Sorghum – 7 t/ha Barley - 4 t/ha Mung beans - 2 t/ha Chickpeas - 2 t/ha		120 Cows 100 Calves
Market	Wheat (Durum) - If feed quality to local feedlots or chicken growers in Newcastle, or if for human consumption to AWB; Sorghum - Local feedlots Barley - Local feedlots or AWB; Mungbeans / Chickpea - Through Blue Ribbon Seeds in Toowoomba or Peter Howard in Sydney		Cows - Gunnedah Municipal Saleyards - Feature Angus sale Calves - Woolworths in Tamworth

Minimum tillage is practiced for erosion control and soil moisture conservation. The soil is cultivated only periodically and every few years. This practice requires chemical weed control, typically pre-emergent herbicides. Prevalent weeds in cultivation include Annual Ryegrass, Milk Thistle, Flaxlead Fleabane and White Clover. As is common throughout the district, Annual Ryegrass is now Glyphosate resistant.

All cultivation on the property features contour banks, which are designed to be trafficked by trailing equipment (Figure 1.14). AMPS at Waverley via Caroona provide agronomic support services. Fertiliser inputs are typical at sowing, mainly nitrogen (N) via Urea or N, phosphorus (P) and zinc (Zn) via Mono-Amonium Phosphate (MAP) with added zinc. Foliar N may be applied to Wheat at flowering-stage to lift grain protein to achieve market specifications. Fertilisers are sourced from AMPS Commercial in Caroona. Occasionally composted feedlot manure may be applied to soils.

The operation is self-reliant for all ground preparation including weed control and sowing, but utilises contract-harvesting services. Seed is often retained on farm for subsequent crops.

Figure 1.14 Durum wheat crop with work-over contour bank system, August 2013 (Land reference #5)

The balance of the land is used for opportunistic cattle trading and presently holds about 60 mixed breed cows with calves (Figure 1.15). Cattle graze predominantly unimproved, native pastures although small areas of lucerne and clover in waterways and creek flats are utilised. Cattle numbers could reach up to 120 units, but would require supplementary feeding. The current stock will be sold in spring; cows under auction at the Gunnedah Feature Cow Sale and calves to 10 months directly to Woolworths' processing facility at Tamworth.

Figure 1.15 Mixed breed beef cattle (Land reference #5)

The Mooki River at the property features permanent water, even when flow ceases. This provides a reliable source of stock and domestic water supply. The property features a homestead and associated outbuildings and is fully fenced. There is 400 t of on-farm grain storage capacity. Access is provided via Williewarina Road that bisects the property.

1.1.1.6 Land reference #166 and 2001

This agricultural enterprise is the Doona State Forest. The compartment is owned and managed by Forestry Corporation of NSW as part of the Northern Forests District White Cypress Pine Area. The key agribusiness indicators for the forest have been determined (Table 1.06). The details for this agribusiness were provided to, but not verified by, this land manager.

Table 1.06 Land reference #166 and 2001 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	166 and 2001 (refer to Figure 3.01)	
Manager	Mr. Conan Rossler, Northern Cypress District Manager	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	1,321 (#166 and 2001)	100
Water	Nil bores, 3 dams for stock water	
System	Forestry with ancillary agricultural land use	
Product (unit)	White Cypress Pine (*Callitris glaucophylla*) (t)	
Scale	1,300 ha of native forest	
Yield	Small-scale. Forest harvesting is campaign-based	
Market	Majority export to Japan, some to USA. Limited domestic market.	

The Doona State Forest (the State Forest) is a minor component of the Northern Cypress District, which includes 270,000ha of State Forest within the Pilliga to the northwest. The State Forest is managed by Mr. Conan Rossler, of the Forestry Corporation of NSW. Mr. Rossler is the Northern Cypress District Manager, based in Baradene, via Coonabarabran. The State Forest is managed for forestry production of White Cypress Pine (*Callitris glaucophylla*) (Figure 1.16 and Figure 1.17).

The Forest Types previously identified in the State Forest include: White Cypress Pine forest (*Callitris glaucophylla*); Narrow-leafed Ironbark (*Eucalyptus crebra*) – White Cypress Pine (*Callitris glaucophylla*) forest; White Box (*Eucalyptus. albens*) - White Cypress Pine (*Callitris glaucophylla*); Bimble Box (*E. populnea*); and Yellow Box (*E. melliodora)* (Umwelt, 2011).

The State Forest is part of 350,000ha of woodlands in the Brigalow and Nandewar Bioregions, including the Piliga region, that was converted to Community Conservation Areas (CCAs) in 2005 under the *Brigalow and Nandewar Community Conservation Area Act 2005.* The NSW National Parks and Wildlife Service now manage these CCAs areas and logging is prohibited within the majority of these forests. These CCAs span the Brigalow Belt and Nandewar regions from Dubbo to the Queensland border. The Doona State Forest is managed as a CCA Zone 4 and now managed under the *Forestry Act 2012*. The zoning is designated as Forestry, Recreation and Mineral Extraction (NSW EPA, 2013).

Figure 1.16 – Site of previous harvesting, Doona State Forest

Figure 1.17 - White Cypress Pine (*Callitris glaucophylla*), Doona State Forest

The ancillary land uses in the State Forest include grazing, conservation hunting, apiary (honey) and general public access. Adjacent landholder, Mr. Jack Fuller (Land references #70 and #75), grazes his beef cattle in the State Forest by lease agreement with NSW Forestry Corporation. Timber harvesting at the State Forest is campaign-based, and only when weather conditions prohibit access to better stands in other locations. Contractors perform all harvesting operations. Logs are sold as standing trees. Harvested logs are transported by road to Gunnedah for milling at Gunnedah Timbers (Figure 1.18). This is the closer of two

dedicated White Cypress Pine sawmills that remain operating in the region. The other remaining sawmill is located at Baradine.

Figure 1.18 - Logs harvested from Doona State Forest are usually milled in Gunnedah

A large number of small local sawmills in the region once relied on White Cypress Pine forests for their timber supply. Many of these mills have now closed concurrently with the establishment of the CCAs. Nevertheless, *Callitrus* is still the second most important genus in the native forest-based timber industry after *Eucalyptus* and is the only significant softwood timber harvested commercially in native forests. In 2007, 58,000 m^3 of White Cypress Pine sawlogs were harvested in NSW. After the Second World War, native cypress dominated Australian flooring for 30 years, supplying 90% of the market (BRS, 2008). The Pilliga region remains an important producer of Cypress timber, although today the domestic market is limited and the majority of products are exported to Japan and the USA.

The White Cypress Pine timber has high durability, being particularly decay and termite resistant for between 25 and 50 years (Lacey, 1973). The timber has been widely used as flooring, house framing, external cladding and fencing. It was originally abundant throughout the pastoral zone of western NSW and southwest QLD, but widespread clearing of the timber to allow agricultural development has caused a substantial decrease in its distribution (Lacey, 1973).

In terms of management, perpetuation of White Cypress Pine forests is entirely dependent on natural regeneration. Together with good drainage, seed supply, seed viability and soil type, these natural generation factors include rainfall, soil moisture, degree of overstorey, grass, shrub and litter cover, grazing and fire. White Cypress Pine is highly sensitive of fire. In the absence of fire, the stands may become highly dense. Mature trees of White Cypress Pine on reasonable sites will attain 18 metres in height and 45 centimetres in diameter and could live for up to 200 years (Lacey, 1973).

Weeds and pests in the Doona State Forest include African Boxthorn (*Lycium ferocissimum*) (Figure 1.19) as well as feral pigs, foxes, goats and rabbits. The maintenance of fire breaks and the control of weeds and pests is the responsibility of the Forestry Corporation of NSW.

Figure 1.19 - African Boxthorn (*Lycium ferocissimum*) is a prevalent weed in the Doona State Forest

1.1.1.7 Land reference #48, 49, 50 and 135

This agricultural enterprise comprises Land references #48, 49, 50 and 135. It is a highly productive mixed-system agribusiness, referred to collectively as "the Rossmar Park aggregate", featuring largely dryland and irrigated cropping on alluvial Vertosol soil, as well beef cattle trading. The key agribusiness indicators for this enterprise have been determined (Table 1.07). The details for this agribusiness have been verified with Mr. Angus Duddy and Ms. Jaimie Burt.

Table 1.07 Land reference #48, 49, 50, and 135 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	48 – "Warrawong"; 49 and 50 – "Rossmar Park Homestead"; 135 – "Rossmar Park" (refer to Figure 3.01)	
Manager	Mr. Angus Duddy and Ms. Jaimie Burt	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	1,032 ha (#48) 1,128 ha (#135) 194 ha (#49, #50) Total – 2,354 ha	49 13 100 (#49, 50)
Water	10 dams (#48, #135, #50) 1 bore (#135); 1 bore (#48) Yarraman Creek catchment irrigation licence (48#, 135#)	
System	Beef cattle trading	Cropping
Product (unit)	Bullocks (600-700kg LW) Trade Grown Steers (500-600 LW) Trader Grown Heifers (400-500 LW) Cow and Calf Units	Cropping (#48, #135): wheat (durum), wheat (bread), barley, cotton, canola, corn, sorghum pulse/legume Fodder (#48, #135): lucerne sub-tropical grasses (Premier Digit, Rhodes Grass and Bambatsi), oats

Key Agribusiness Indicators	Description	
Scale	Up to 500 units	Majority of the Rossmar Park aggregate 2,354 ha - (dryland and irrigated cropping and cultivated pastures).
Yield	300 Bullocks 200 Cows	Wheat (durum) – 4.5 to 6 t/ha Wheat (bread) – 4.5 to 6 t/ha Barley – 4.5 to 6 t/ha Cotton – 4.2 to 7.5 b/ha Canola – 1.8 to 2.75 t/ha Corn – 5 to 8.5 t/ha Sorghum – 3.5 to 8.5t/ha Pulse/Legume – 2 t/ha
Market	Primo, Scone JBS Dinmore, QLD Kilkoy Pastoral Company, QLD	Wheat (Durum) - GrainCorp, Australian Durum Co. Newcastle Wheat (Bread) – Various markets Cotton - Namoi Cotton or QLD Cotton Canola – n/a Corn – Mountain Industries, Forbes Sorghum - Inghams, GrainCorp, Feedlots Pulse/Legume – n/a

Mr. Angus Duddy and his partner Ms. Jaimie Burt manage this high-production, mixed agribusiness on the Mooki River floodplain and Doona Ridge uplands. Cropping land is largely black soil alluvium (Figure 1.20) and Mr. Duddy also runs a beef cattle trading enterprise (Figure 1.21). Collectively, the agribusiness is known Rossmar Park Pastoral Company. The agribusiness covers an aggregate of Land references #48, 49, 50 and 135 with a total area of 2,354 ha ("the Rossmar Park aggregate"). The properties are located on Rossmar Park Road and back on to the Doona State Forest, Doona Ridge. The Mooki River forms the eastern boundary of the "Rossmar Park" property (Land reference #135). Land references #49 and 50 are wholly within the Project area. Land references #48 and 135 are partially within the Project assessment area.

The majority of the Rossmar Park aggregate is cultivated. The balance of the property comprises small residential blocks, working areas and heavily timbered woodlands that are grazed. The Rossmar Park aggregate neighbours include Mr. Andrew Pursehouse (Land reference #111), Mr. Rob Clift (Land reference #31), Mr. Michael Clift (Land reference #29), and Birrawa Pastoral Pty Ltd (Land reference #11).

Mr. Duddy has managed the agribusiness for 14 years. Mr. Duddy and Ms. Burt live on the property "Warrawong" (#48). Mr. Duddy's father and mother, Mr. Clive Duddy and Mrs. Patricia Duddy, as well as Mr. Duddy's brother, Mr. Tim Duddy, live on the property "Rossmar Park" (#49, 50, 135), which includes the Rossmar Park Homestead. The Rossmar Park aggregate has been owned and managed by the Duddy family for around 80 years. Prior to the 1960s, the aggregate ran an estimated 16,000 sheep. Following the establishment of irrigation on the property at around this time, the Duddy family focussed on wheat cropping. Up until recent times, the Duddy family operated a highly successful thoroughbred stud for around 30 years, breeding specifically for the Inglis Sales.

Figure 1.20 Wheat stubble on Rossmar Park in November 2013 with Mt Watermark in background

Figure 1.21 Cattle grazing forage on Rossmar Park in November 2013

The Rossmar Park aggregate is divided according to the following land and farming units.

- Land reference #48 – property name "Warrawong". Comprises 586 ha of black soil, and 226 ha of heavily timbered land, characterised by Narrow-leafed Ironbark (*Eucalyptus crebra*), White Box (*Eucalyptus albens*) and Yellow Box (*E. melliodora)* and 220 ha of red soil cultivated for oat crops and forage pasture.
- Land reference #135 – property name "Rossmar Park". Comprises 923 ha of dryland black soil for cropping, 61 ha of irrigated black soil and 144 ha of grazed pasture and timbered by White Box (*E. albens*).
- Land reference #49 and 50 ("Rossmar Park Homestead"). Comprises 194 ha of open grazing land on red soil. This land is pasture improved with native and tropical pastures as well as lucerne.

In addition to the two residences on the aggregate, there is a stable facility, a 1,000 head capacity feedlot – divided into four feed yards, and a set of cattle yards with a five-way hydraulic draught. There is a machinery shed and a grain shed near the Rossmar Park Homestead. All farming land is fully fenced. There are ten dams distributed across "Rossmar Park", varying in capacity from 2 to 30 ML. The Duddy's keep stock horses and retain some thoroughbreds.

There is a commercial herd of between 400 to 500 head of Angus and crossbred cattle on "Warrawong" (#48), turning off an estimated 300 head per year to Primo abattoir in Scone, JBS Dinmore abattoir in QLD and Kilcoy Pastoral Co., Kilcoy, also in QLD. Mr. Duddy generally buys in steers and grows them out to Jap Ox (600 – 700 kg LW). Steers and heifers are sometimes traded on an opportunity basis.

"Warrawong" held a Murray Grey Stud up until about three years ago when stud cattle were dispersed in favour of commercial Angus genetics. Grazing pasture is sown on Land reference #135 and #48 and typically includes 50 ha of Lucerne, 243 ha of sub-tropical grasses such as Premier Digit, Rhodes Grass and Bambatisi, and 162 ha of oats. Pastures are sown amongst standing timber.

A total of 1,578 ha black soil alluvium is farmed dryland. An estimated 61 ha is farmed under irrigation (#135) from underground aquifer entitlements. A further potential exists for 650 ha to be developed using existing Yarraman Creek catchment entitlements. Crop varieties include durum wheat, bread wheat, barley, sorghum and cotton with a pulse/legume, in rotation. This system delivers three crops in two years. Rotations are not set but generally are wheat to long-fallow dryland cotton to long-fallow sorghum, then a pulse and long-fallow wheat. Opportunity crops include canola and corn. A pulse/legume always precedes long-fallow wheat and this is required for soil moisture accumulation and N fixation in this largely black soil alluvium cropping system. Mr. Duddy has operated a no-till farm for 10 years. No-till fallow management increases soil water storage and reduces soil erosion potential. Mr. Duddy uses local contractors for harvesting.

The cropping system at "Rossmar Park" is high input. Fertiliser inputs are typical at sowing including 120 to 160 kg of N via Urea, or N, P and Zn via MAP with added zinc. Foliar N may be applied to wheat at flowering-stage to lift grain protein to achieve market specifications. Prevalent weeds in cultivation include Annual Ryegrass and Fleabane. As is common throughout the district, Annual Ryegrass is now Glyphosate resistant. The management of excess water is key issue.

The property has 10 dams, one of which feeds a 1 ML capacity tank driven by an electric pump. The remainder of the dams water the property through a gravity-fed system. There is one irrigation bore with a 118 ML, 33 L/sec capacity, powered by a 4 cylinder John Deere motor, on Land reference #135, and one with a 55 ML capacity on Land reference #48. Mr. Duddy holds an irrigation licence to Yarraman Creek catchment for 1,360 ML.

As the property shares a border with the Doona State Forest, a large number of feral pigs and foxes enter the land. White Cypress Pine (*Callitris glaucophylla*) is widespread across the upland country of the property.

1.1.1.8 Land reference #161, 162 and 172

This agricultural enterprise comprises Land reference #161, 162 and 172. It is a mixed-system agribusiness, managed by Mr. Struan Willis and his brother Mr. Richard Willis. The agribusiness features dryland cropping and beef cattle production. The key agribusiness indicators for this enterprise have been determined (Table 1.08). The details for this agribusiness have been verified by Mr. Struan Willis.

Mr. Struan Willis and his brother Mr. Richard Willis (the Willis family) own and manage this mixed cropping and beef cattle agribusiness. Both Willis brothers and their families live on the property, which comprises Land references #161 (Willis RNB and SNB), 162 (Willis SN and MJ) and 172 (Not disclosed). The property is 1,421 ha in size and is located at the end of 4D Road and is adjacent to Land reference #132 and #152. The

Willis brothers have managed the property for 35 years and are fifth generation farmers. The property is managed as one farming unit. There are five residences on the property, a set of cattle yards, two woolsheds and two grain sheds with an on farm storage capacity of 600 tonnes.

Table 1.08 Land reference #161, 162 and 172 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	161 – Willis RNB and SNB; 162 – Willis SN and MJ; 172 – Not disclosed (refer to Figure 3.01)	
Manager	Mr. Struan Willis Mr. Richard Willis	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	1,192 (#161) 47 (#162) 182 (#172) Total – 1,421	33 36 0
Water	1 dam 10 bores with windmills (some irrigation-equipped)	
System	Beef cattle	Cropping and forage
Product (unit)	Grown Steers (400-500kg LW) Heifers (400-500kg LW)	Wheat (bread), barley, sorghum, pulses (chickpeas/mungbeans) Forage – oats, Premier Digit, lucerne, Rhodes Grass, Bambatsi
Scale	280 Cows and Calves	Total: 567ha - including 81 ha under forage oats
Yield	220 units/year	Wheat (bread) – 3.5 to 4t/ha Barley – 3.5 to 4t/ha Sorghum – 6t/ha Pulse (Chickpeas/Mung beans) – 1 to 1.5t/ha
Market	Grown Steers - sold directly to Woolworths, Tamworth Heifers - Gunnedah Sale Yards	Wheat (bread), barley and pulses - stored on farm and sold at best price to various markets Sorghum – sold through local market at 14% moisture. Kept on farm until each winter.

The Willis' breed Limousin and Simmental x Hereford bulls over Poll Hereford heifers (Figure 1.22). Progeny is turned off at 18 months age. The steers and heifers are finished on a 40-day sorghum grain supplement. Approximately 220 terminal progeny are sold annually direct to Woolworths in Tamworth or via the Gunnedah Sale Yards. Each year about 40 heifers are retained as replacements for breeding. Grazing pasture typically includes 330 ha of lucerne, sub-tropical grasses such as Premier Digit, Rhodes Grass and Bambatsi, as well as forage oats.

Figure 1.22 Hereford cross cattle on the Willis property, November 2013

A total of 576 ha is dryland farmed (Figure 1.23) and since 1993 this has been a no-till system. No-till farming it thought by the Willis' to decrease soil moisture losses by about 200 mm/y, increasing the effectiveness of fallowing for soil moisture accumulation in this dryland cropping system.

Figure 1.23 Long fallow, dryland wheat crop on the Willis property, November 2013

Crop varieties include wheat (bread), barley and sorghum, with either a chickpea or mungbean legume, in rotation. Typically wheat is double-cropped to long-fallow sorghum, then barley, followed by a pulse.

Fertiliser input is typical at sowing and includes 150 kg/ha of N via Urea and P. Prevalent weeds in cultivation include Glyphosate resistant Annual Ryegrass.

The management of excess water is a key land management issue. The property has one dam and 10 bores with mills. Some of the bores are irrigation-equipped. An estimated 200 ha is wooded by White Cypress Pine (*Callitris glaucophylla*). Feral pigs and large mobs of kangaroos are key land management issues.

1.1.1.9 Land reference #163

This agricultural enterprise is Land reference #163. It is a beef cattle agribusiness, managed by Mr. Barry Wilson. The key agribusiness indicators for this enterprise have been determined (Table 1.09). The details for this agribusiness have been verified by Mr. Barry Wilson.

Table 1.09 Land reference #163 - key agribusiness indicators

Key Agribusiness Indicators	Description		
Land reference #	163 – "Mindi" (refer to Figure 3.01)		
Manager	Mr. Barry Wilson		
Area of production (ha)	TOTAL	Within Project assessment area (%)	
	494 (#163)	100	
Water	5 dams (2 major) 5 bores with for stock watering		
System	Beef cattle		Pasture for forage
Product (unit)	Grown Steer Yearling (400-500kg LW) Heifer Yearling (400-500kg LW)		Forage: Oats, Bambatsi, Tropicals, Lucerne
Scale	140 Cows and Calves		Oats - 60 to 80 ha Bambatsi – 8 ha Tropicals – 100 ha Lucerne – 30 ha Balance is "semi" native pasture
Yield	120 units/year		Pasture for forage
Market	Grown Steers - sold directly to JBS Caroona Feedlot Heifers - Gunnedah Sale Yards		Pasture for forage

Mr. Barry Wilson, together with his sister Ms. Eleanor Wilson, has lived on the property "Mindi" (Land reference #163) (Figure 1.24) for 13 years, moving from north west of Gunnedah. The property is 494 ha and is accessed via the Kamilaroi Highway. It is adjacent to Mr. Allan Grant (Land reference #113) and Mr. Charlie Pike (Land reference #124) and a property now owned by the Applicant (Land reference 170). Prior to the purchase by Mr. Wilson and Ms. Wilson, the property was used for cattle grazing, grain and seed production, running between 200 breeders and utilising summer and winter stubble with lucerne and clover leys between crops. "Mindi" is wholly within the Project area and is located on Nicholas Ridge.

The property had been previously contour banked throughout. Before Mr. Wilson purchased the property it has always been used for a mix stock, including sheep grazing until 1970 then cattle, as well as summer and winter cropping. Seed production commenced on the property in the 1990s. All but 10ha of the property has been previously cultivated for grain production.

Mr. Wilson breeds Hereford x Limousin cattle to produce yearling steers and heifers. He runs around 140 cows and calves. He turns off the terminal progeny at around 400-500 kg LW with steers going to the JBS Caroona Feedlot and heifers through the Gunnedah Sale Yards. Mr. Wilson farms around 210 ha of fodder, generally including oats for grazing and hay, Bambatsi Panic, a variety of tropical grasses and lucerne. The balance of the country is "semi" native pasture (Figure 1.25).

Figure 1.24 Pastures on the Wilson property, November 2013

Figure 1.25 Windmill for stock water on the Wilson property, November 2013

There is one residence on the property, two machinery sheds/workshops, a wool/storage shed, one set of cattle yards, a hay shed, a machinery shed and four grain silos. There are five bores on the property, largely for cattle watering and five dams, two of which are large. Feral goats from the adjacent property (Land reference #170) and large mobs of kangaroos are key land management issues.

1.1.1.10 Land reference #160

This agricultural enterprise comprises land reference #160. It is a productive mixed-system agribusiness, known as Williewarina Pty Ltd, featuring both irrigated and dryland cropping and beef cattle production. The property fronts the Mooki River. The key agribusiness indicators for this enterprise have been determined (Table 1.10). The details for this agribusiness have been verified by Mr. Ken Dugan.

Table 1.10 Land reference #160 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	160 – "Williewarina" (refer to Figure 3.01)	
Manager	Mr. Ken Dugan	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	1,301 (#160)	28
Water	8 dams and 4 bores. Groundwater allocation licence for 980 ML.	
System	Beef cattle	Cropping
Product (unit)	Grown Steers (450-500 kg LW) Weaners (200 kg LW)	Wheat (bread), barley, sunflowers, sorghum, cotton, lucerne, corn
Scale	300 Cow and Calves units	809 ha
Yield	300 Grown Steer units/year, and 200 Weaner units/year	Wheat (bread) – 4 t/ha Barley – 4 t/ha Sunflowers – 2 t/ha Sorghum – 6.5 t/ha Cotton – 5.1 bales/ha Lucerne – 500 square bales Corn – 10 to 11 t/ha
Market	Grown Steers – Gunnedah Sale Yards Weaners – grown out on family property in Walgett.	Wheat – Killara Feedot, Graincorp, and Agracom Barley, sunflowers, sorghum, corn – AMPS, AGS, Agracom and Elder (Toefel) Lucerne – hand feeding onsite and to family's sheep grazing property at Walgett Corn – corn stubble to Killara Feedlot, majority transported to the family property in Walgett

Mr. Ken Dugan and his wife Mrs. Rita Dugan have owned the 1,301 ha property "Williewarina" (Land reference #160) since the 1950s. The property is located on Williewarina Road, approximately 7 km south of the Caroona village, along the Mooki River. The Dugan family lives on the property on the eastern side of Williewarina Road. The majority of cropping and grazing land is on the western side of the road. The property is adjacent to "West Mooki" (Land reference #5), managed by Mr. Andrew Thompson.

Mr. Dugan states that, at that time of purchase in the 1950s, the Mooki River plains area surrounding the property was all floodplain and dominated by native pastures. Mr. Dugan moved to Caroona from Walgett in the 1960s during a four-year drought. His brother still operates a large sheep grazing property in Walgett, for which Mr. Dugan supplies corn feed for sheep. Mr. Dugan recalls that the high productivity of the black soils was identified in the 1970s. At the time, Mr. Dugan was an early mover for irrigated cropping in the area. Flooding has been a large land management issue on the property: "historically, floods have done more damage than droughts". Mr. Dugan has been an active participant in Landcare activities and extension programs in learning how to best farm floodplain areas.

Of the 1,301 ha, an estimated 809 ha is cultivated. Mr. Dugan's beef cattle agribusiness is run on the balance of the property. Of the 809 ha cultivated, 324 ha is irrigated under centre-pivot and furrow flood (Figure 1.26), and 485 ha is dryland cropping on upland soils (Figure 1.27).

Figure 1.26 Flood irrigated corn on the Dugan property in January 2014, located outside of Project assessment areas

The property has eight dams and four bores. The dams on the floodplain areas are all licensed through the Blackville Floodplain Management Plan (FMP) (DIPNR, 2003). This FMP has also regulated the development of contouring, channels and diversion banks along the Mooki River floodplain. The property also has a Groundwater Licence allocation of 980 ML. The aquifer is thought to have a capacity of between 50-60 kL/hr.

Figure 1.27 Dryland cultivation on the Dugan property, January 2014

Dryland cropping is a simple rotation of sunflower or sorghum then long-fallow wheat or barley. Under centre-pivot and flood irrigation, cropping is a rotation of cotton or corn and wheat or barley. There is lucerne under one pivot that is cut four times per year, yielding 500 bales annually. Urea and liquid N are used at sowing.

Corn produced is sent to the family's property near Walgett where it is fed to sheep. This other property has 12,000 breeding ewes and produces 6-8,000 fat lambs annually. Primary markets for grains are AGS, Killara Feedlot and Elders Grain. Corn stubble is baled and sold to the Killara Feedlot. Some lucerne is retained on-farm for supplementary cattle feed and the balance goes to the Walgett property. Local contractors with specialist equipment are retained for weed spraying and harvesting.

There is a 300 head cattle herd based on Hereford and Angus genetics, producing either Hereford or Black Baldy terminal progeny (Figure 1.28). Yearling cattle are either sold through the Gunnedah Sale Yards or, if too light, may be sent to grow out on the Walget property.

The property has two residences, seven large storage sheds and an estimated 2,100 t of on farm storage in multiple silos. The residences are proximate to the Mooki River.

Figure 1.28 Hereford-based cattle grazing dryland wheat stubble on the Dugan property, January 2014

1.1.1.11 Land reference #19 and 20

This agricultural enterprise comprises Land reference #19 and 20. It is a highly productive mixed-system agribusiness, featuring largely irrigated cropping and some opportunity beef cattle trading. The key agribusiness indicators for this enterprise have been determined (Table 1.11). The details for this agribusiness have been verified by Mr. Craig Charters.

Mr. Craig Charters and his wife Mrs. Sharon Charters, manage the property "Gabo" (Land reference #19) and the property "Spring Creek" (Land reference #20) as a highly productive cropping agribusiness, with his son, Mr. Clint Charters and his wife Mrs. Amy Charters (the Charters family). Their agribusiness is known as Gabo Pastoral Co. Mr. Charters also grows out around 10 steers, seasonally, on "Spring Creek". "Gabo" is located on the plains along Coonabarabran Road between the Kamilaroi Highway and the Caroona village. "Spring Creek" is accessed via Waverley Road and has Quirindi Creek frontage at the foot of Nicholas Ridge. "Spring Creek" is within the Project area. Both properties are subject to flooding events.

Table 1.11 Land reference #19 and 20 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	19- "Gabo"; 20 – "Spring Creek" (refer to Figure 3.01)	
Manager	Mr. Craig and Mrs. Sharon Charters Mr. Clint and Mrs. Amy Charters	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	339 (#19) 58 (#20) Total - 397	0 9%
Water	6 bores (#19). 6 licenses for 700 ML in total - carry over from 2012 provides 1,400 ML available currently; 1 bore (#20) with license to irrigate but not equipped.	
System	Cropping	Opportunity trading - beef cattle
Product (unit)	Sorghum, cotton, corn, legume (Soya Bean, Pigeon Pea)	Grown Steers (400-500 kg LW)
Scale	334 ha irrigated cultivation (#19) 64 ha dryland cultivation (#19, 20)	10 Grown Steers
Yield	Sorghum: 10 t/ha Cotton: 10 bales/ha Corn: 10-11 t/ha Legumes (Soya Bean) – 3 to 3.5 t/ha	10 units/year
Market	Sorghum – Bayliss Grain Trading Cotton – Carroll Cotton Corn – Killara and JBS Caroona Feedlots Legume (Soya Bean) – traded through local agents for either human consumption or stockfeed	Gunnedah Sale Yards

Mr. Charters has lived on "Gabo" all his life and farmed it for 39 years. His father purchased the block in 1948. Mr. Charters and Clint Charters are fourth and fifth generation farmers, respectively. "Spring Creek" was purchased around 12 years ago.

"Gabo" has been fully developed since purchase and now includes 344 ha of laser-levelled flood irrigation on alluvial Vertosol soils (Figures 1.29 to 1.30). Crop rotation features cotton every second year, with corn, sorghum and soya beans. This land is never fallowed for soil moisture accumulation. Precision farming includes GPS controlled traffic, auto-steer machinery. Cotton has been farmed for 25 years and is now exclusively Monsanto Bollgard II. In accordance with Monsanto requirements, a sacrificial crop of Pigeon Pea is sown alongside the genetically modified cotton. The 2011/12 corn crop (variety PAC 607IT) grown on part of "Gabo" yielded a notable 11 t/ha.

Mr. Charters states that he has responded to relative uncertainty regarding the potential impacts from the proposed Project on his land, by postponing his planned development of the "Spring Creek" land (#20) (Figure 1.31). The property is currently dryland to a wheat-sorghum rotation but if developed the rotation would include irrigated cotton with a demonstrated higher commercial return.

Soil is cultivated only periodically and only every few years. The property has virtually no weeds. The cropping system at "Gabo" is high input. Fertiliser inputs are typical at sowing including 120 to 160kg of N via Urea or N, P and Zn via MAP with added zinc.

Figure 1.29 Furrow irrigated juvenile cotton on Gabo in November 2013, located outside of Project assessment areas

Figure 1.30 Furrow irrigated corn on Gabo in November 2013, located outside of Project assessment areas

There are two residences with adjacent machinery sheds on Land reference #19. There is one residence at "Spring Creek". "Gabo" has an on farm storage capacity of around 1,100 t. There are six bores at "Gabo", totalling 700 ML in licences (e.g. Figure 1.32). Despite the property being fully irrigated and intensively farmed, Mr. Charters has an allocation and carry-over of around 1,400 ML from last year. "Spring Creek" has one capped bore to a depth of 24.4 m with a drawing capacity of 350,000 L/hr. The bore is licenced for irrigation but not equipped.

Figure 1.31 Harvesting dryland wheat on Spring Creek in November 2013

Figure 1.32 Irrigation infrastructure on Gabo in November 2013, located outside of Project assessment areas

1.1.1.12 Land reference #59, 113, 158a (Doona Ridge) and 158b (Nicholas Ridge)

This agricultural enterprise is an aggregate of Land references #59 ("Berega"), 113 ("Walla Park"), 158a ("Lanark") and 158b ("Talinga"), owned and managed by the Grant family. Property #59 "Berega" was recently purchased by the Grant family. The Grant family aggregation is a high-precision, mixed farming agribusiness that primarily focuses on irrigated and dryland cropping on alluvial Vertosol soils. The Grants also breed beef cattle for a local market. The key agribusiness indicators for this enterprise have been determined (Table 1.12). The details for this agribusiness have been verified by Mr. Rodney Grant.

Table 1.12 Land reference #59, 113, 158a and 158b

Key Agribusiness Indicators	Description	
Land reference #	59 – "Berega"; 113 – "Walla Park"; 158a – "Lanark"; 158b – "Talinga" (refer to Figure 3.01)	
Manager	Mr. Rodney Grant	
Area of production (ha)	TOTAL	Within Targeted area (%)
	215 ha (#59) 569 ha (#113) 730 (#158a + #158b) Total – 1,514 ha	0 23 58 (158a - "Lanark")
Water	"Berega" - 750ML irrigation licence. 180ML irrigation licence to Quirindi Creek. "Walla Park" – 2 stock watering dams, an irrigation license of 927ML (I windmill bore, 1 irrigation bore) "Lanark" – 1 bore, 1 sandstone aquifer "Talinga" – 2 stock watering dams, 2 bores (1 solar pump)	
System	Cropping	Beef cattle
Product (unit)	Irrigated Cropping: Properties - Walla Park (#113), Berega (#59) Cotton, pulse - Pigeon Pea Dryland Cropping: Properties - All wheat (durum), barley, sorghum, chickpeas, dryland cotton (opportunity) Fodder: Properties: "Walla Park" (#113), "Talinga" (158b) Native and sub-tropical grasses (Rhodes grass, Premier digit and Bambatsi panic)	Grown Steers (400-500kg LW)
Scale	~1,200 ha under cultivation. Majority of all properties farmed.	70 Cow and Calf units
Yield	Wheat (Durum) – 4.5 to 6 t/ha Cotton (irrigated) – 8 to 10 b/ha Cotton (dryland) – 4 to 9b/ha Sorghum – 4 to 5 t/ha Chickpeas – n/a t/ha	60 units/year
Market	Wheat (Durum) – Exported, Italy Cotton – traded through local agents Sorghum - Local stock feed and export to China Chickpeas – Exported, India	Gunnedah Sale Yards

The Grant family, Mr. Allan and Mrs. Marie Grant with their son Mr. Rodney Grant and his wife Mrs. Kelly Grant, own a mixed farming agribusiness that focuses on irrigated and dryland cropping on alluvial Vertosol soils. The agribusiness is managed by Mr. Rodney Grant. The land area of 1,514 ha is an aggregate of four properties on the plains adjacent to both Nicholas Ridge and Doona Ridge. The majority of this area, about 1,200 ha, is cultivated. The balance of land is pasture improved for grazing. Dominant crops are cotton, sorghum and wheat, in a controlled-traffic and zero-tillage farming system. Beef cattle are also bred to supply the local market. A farming profile for each property is as follows.

- Land reference #158a – property name "Lanark". This property is wholly within the Doona Ridge assessment area and is over 423 ha in size. "Lanark" is accessed via 4D Road and neighbours Hanuta Pty Ltd (Land reference #83) and Mr. Derek Blomfield (Land reference #131 and 150). The property has one homestead dating to 1928, another residence, one cottage, associated sheds, a workshop, and a woolshed. Around 80 percent of the "Lanark" is arable land and there is no livestock on this property. There are two areas of densely wooded vegetation, dominated by White Cypress Pine (*Callitris glaucophylla*).

  Cropping is generally a sorghum-pulse-wheat rotation. The five-year rotation is sorghum-sorghum-sorghum to double crop pulse (chickpeas), to short-fallow wheat, then long-fallow back to sorghum. A long fallow into Wheat is seldom or rarely used. The current farming system is focussed on high-opportunity, low-risk from multiple crops in close rotations. The pulse precedes a short fallow into wheat for accumulation of soil moisture and organic N.

  "Lanark" is farmed by high-precision, controlled traffic tramlining on 3 m tracks. The Grants have been control-traffic farming since 1997. There is one groundwater bore, operated by windmill. There is a sandstone aquifer at "Lanark" which provides the Grant family with potential to irrigate the property in future.

- Land reference #113 – property name is "Walla Park". An estimated 23% of the property is located within the Nicholas Ridge assessment area. Accessed via the Kamilaroi Highway, the property size is 569 ha. This property has two residences – one homestead and a cottage. Mr. Allan Grant and his wife, Mrs. Marie Grant, live on this property. The property also has large storage sheds, a workshop, a set of cattle yards, and on farm grain storage of 2,000 t. "Walla Park" and "Berega" (Land reference #59), a recent acquisition by the Grant family, are managed as one farming unit on the plains at the base of Nicholas Ridge.

  The property neighbours include Mr. Les Alcorn (Land reference #2), Mr. Charlie Pike (Land reference #124), the Applicant (Land reference #170), Mr. George Cohen (Land reference #74), RG and HD Thompson Pty Ltd (Land reference #134) and Mr. Barry Wilson (Land reference #163). "Walla Park" has two stock watering dams, 2 bores, and one irrigation licence of 972 ML - with large on farm dam water storage capacity of 200 ML (Figure 1.33). "Walla Park" has some timbered areas of White Box (*Eucalyptus albens*) and Yellow Box (*E. melliodora*).

- Land reference #59 – property name is "Berega". This property is managed as one farming unit with "Walla Park", but "Berega" is located outside of the Nicholas Ridge assessment area. The property is accessed via the Kamilaroi Highway and is 215 ha in size. The majority of the property is cultivated. There is one residence and associated sheds and one large irrigation dam. The property neighbours RG & HD Thompson Pty Ltd (Land reference #134) and Eykamp (Land reference #60). The Quirindi Creek forms the southern boundary of the property. "Berega" has a 750 ML irrigation licence as well as a 180 ML irrigation licence to Quirindi Creek.

Figure 1.33 Water storage at Walla Park in November 2013

The primary crop farmed at "Walla Park" and "Berega" is genetically modified cotton on laser-levelled, flood irrigated alluvial Vertosol soils (Figure 1.34). The Grants farm a total area of around 750 ha of cotton across the aggregation.

The Grants are into the fourth year of an intensive five-year back-to-back cotton trial of Monsanto Bollgard II, assessing yields and return (Figure 1.35). It is thought that the trial is proving successful. The Grants generally include a sacrificial pulse (Pigeon Pea) crop for accumulation of organic N into the black soil. The Grants have been following a schedule of late harvest and pupae bust, then furrow form and fertilise. Yield from the irrigated cotton is between 8 to 10 b/ha on one watering. The Grants gin their cotton through Carroll Cotton and it is traded through local agents.

The dryland farming rotation at the "Walla Park" and "Berega" properties is the same as "Lanark". The Grants will occasionally replace the sorghum in the sorghum-pulse-wheat rotation with a dryland cotton crop. Dryland cotton yield is generally between 4 to 9 b/ha.

- Land reference #158b – property name "Talinga". The property is outside of the Nicholas Ridge assessment area. "Talinga" is also accessed via the Kamilaroi Highway and is directly opposite "Walla Park". Mr. Rodney Grant and his family live on this property. In addition to the residence, "Talinga" has associated farming sheds and two stock watering dams and about 70% of the land is cultivated. The balance of the country is pasture improved with native and sub-tropical grasses with scattered wooded vegetation.

Figure 1.34 Laser-leveled flood irrigated field on Walla Park in November 2013, with Nicholas Ridge in the background

Figure 1.35 Juvenile cotton on self-mulching Vertosol soil on Walla Park in November 2013

Additionally, the Grants breed between 60 and 70 Poll Hereford cattle at "Walla Park" (#113) and "Talinga" (#158b) each year, producing steers at between 12 to 18 months age. Cattle graze native and improved pastures, including the sub-tropical grasses Premier Digit, Rhodes Grass and Bambatsi Panic. Terminal progeny is sold through the Gunnedah Sale Yards.

1.1.1.13 Land reference #23, 93, 111, 127, 128, 129 and 130

This agricultural enterprise comprises Land reference #23, 93, 111, 127, 128, 129 and 130. It is a highly productive mixed-system cropping and beef cattle agribusiness, referred to collectively as "Pursehouse Farms" and centred on "Breeza Station". These lands are outside of the Project assessment areas. The key agribusiness indicators for this enterprise have been determined (Table 1.13). The details for this agribusiness have been verified by Mr. Andrew Pursehouse.

Table 1.13 Land reference #23, 93, 111, 127, 128, 129 and 130 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	23, 93, 111, 127, 128, 129, 130 (refer to Figure 3.01)	
Manager	Mr. Andrew Pursehouse Mrs. Cynthia Pursehouse	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	143 (#23) 25 (#93) 701 (#111) 185 (#127) 440 (#128) 900 (#129) 487 (#130) Total – 2,881	0 0 0 0 0 0 0
Water	Mooki River irrigation licence allocation - 548ML Groundwater license allocation - 1,866ML 6 bores – aquifer with up to 14ML/day capacity to a depth of up to 70m Stock water from windmill to a depth of 20-25m Tail and stormwater collected and stored on site for reuse	
System	Beef cattle	Cropping
Product (unit)	Yearling (12 – 18 months)	Dryland cropping: wheat (durum and bread); sorghum; legumes (fababeans, chickpeas); cotton Irrigated Cropping: cotton; corn; legumes (fababeans, chickpeas)
Scale	120 units/year	1,040 ha - furrow irrigated 1,569 ha – dryland farmed 272 ha – grazed
Yield	100 yearling steers and heifers per year	Summer (2014 year - budget): Cotton - 5,500 b Corn – 2,000 t Sorghum – 1,600 t Winter crop (2013 year- actual): Canola – 240 t Wheat (Durum) – 1,000 t Wheat (Bread) – 1,050 t Fababean – 160 t Chickpea) – 80 t
Market	Direct to Woolworths or	Wheat (durum) – exported to Italy and to semolina factories in Australia; Wheat (bread) – Last crop all delivered to Namoi Flour Mill, Gunnedah. Often exported or to local bread manufacturer;

Key Agribusiness Indicators	Description	
	Gunnedah Saleyards	Sorghum – Export to China; local poultry mill and cattle feedlots; Legumes: Fababean – Egypt out of Narrabri and Newcastle. Chickpeas to India; Cotton – gins at Carroll or Boggabri. Lint is exported to China, predominantly, and the seed component is used for stock feed and export; Canola – Cargills, Newcastle Processing corn – Corn flake, corn chip manufacturing plants (Defiance and Allied Mills, Picton); Feed Corn - Dairy industry, pet food, cattle feedlots, horse industry, sheep and cattle graziers Waxy corn – Processing factories, e.g. National Starch.

Pursehouse Farms Pty Ltd (Pursehouse Farms) is an extensive family owned and operated farming and grazing agribusiness, located at Breeza, just outside and to the north of the Project assessment areas. The principals of Pursehouse Farms are Mr. Andrew Pursehouse and Mrs. Cynthia Pursehouse. The agribusiness employs six full-time staff. The property aggregation is centred on "Breeza Station" and includes Land reference #23, 93, 111, 127, 128, 129 and 130. The Pursehouse family are the second owners of the "Breeza Station", having been originally settled by the Clift family in the 1830s. The Pursehouse family purchased the property in 1984. The property neighbours Mr. Angus Duddy (Land reference #135), the Applicant (Land reference #57), previously managed by Mr. Ben Evans, Mr. M. Burt (Land reference #18) and Mr. W Ryan (Land reference #139).

The total property area is 2,881 ha, comprising 1,040 ha of furrow irrigated land (Figure 1.36 and 1.37), 1,569 ha of dryland farming and 272 ha of grazing pasture. The property is predominantly black soil with wood areas of White Box (*Eucalyptus. albens*); Bimble Box (*E. populnea*); and Yellow Box (*E. melliodora).* Koalas are widespread across the vegetated areas. The majority of the property is laser-levelled, using Pursehouse family-owned laser-levelling machinery.

Figure 1.36 Furrow irrigated corn on "Breeza Station" in November 2013, located outside of Project assessment areas

The furrow irrigated crop system at "Breeza Station" is based on a cotton-corn-legume rotation that yields three crops in three years (Figure 1.38). Cotton is planted in October, and picked in May. Corn follows planted the next October and harvested in March. Fababeans or chickpeas follows planted in May/June and harvested

in November. Land is then fallowed and back to cotton planted in the following October. To prepare for the corn, the Pursehouse family mulch and root cut the previous cotton, pupae busting as they go, then furrow form and fertilise (Norris, 2012).

Figure 1.37 There is greater than 1,000 ha of laser leveled, furrow irrigated cropping at "Breeza Station" , located outside of Project assessment areas

Figure 1.38 Juvenile cotton at "Breeza Station" in November 2013, located outside of Project assessment areas

The Pursehouse family's use of pulses and legumes is always for opportunity cropping in both the furrow irrigated and dryland systems. These legume opportunity crops deliver organic N to the soil. Zero tillage farming is practised at Breeza Station for erosion control and soil moisture conservation. The zero tillage practice has been implemented since 1992. Permanent beds and controlled traffic lanes have been in place since 1996. The Pursehouse family has owned and operated a round bale cotton picker since 2011 and utilise GPS technology extensively across the property.

The dryland crop system generally follows two separate rotations. First is a wheat to sorghum rotation with opportunity pulse cropping of either chickpeas or faba beans in May/June of the year. This rotation delivers three crops in three years. The second dryland rotation is wheat to cotton followed by a long fallow back to wheat. This second rotation delivers two crops in three years. The long fallow preceding wheat is necessary for soil moisture accumulation. The Pursehouse family introduced 4 m spaced tracks utilising John Deere tracked tractors and 12m-wide machinery in 2012.

Fertiliser inputs are, mainly N via Urea (up to 300 kg/ha). At planting, starter fertilisers are used to provide a source of N, P, K and trace element Zn. Foliar N may be applied to wheat at flowering-stage to lift grain protein to achieve market specifications. Fertilisers are sourced from Pursehouse Rural in Quirindi.

Irrigated water is sourced from one to four alluvial aquifers, with six turbine pumps set 30-70 m below ground level (Figure 1.39). The pumps extract between 5 and 14 ML/day. The water quality is stated to be excellent. All tail water and stormwater runoff is collected by three dams in water storage onsite (800 ML) and recycled. An existing Mooki River irrigation river licence is to be utilised for the first time this year, with the installation of a pump. The on farm grain storage capacity is 4,750 t.

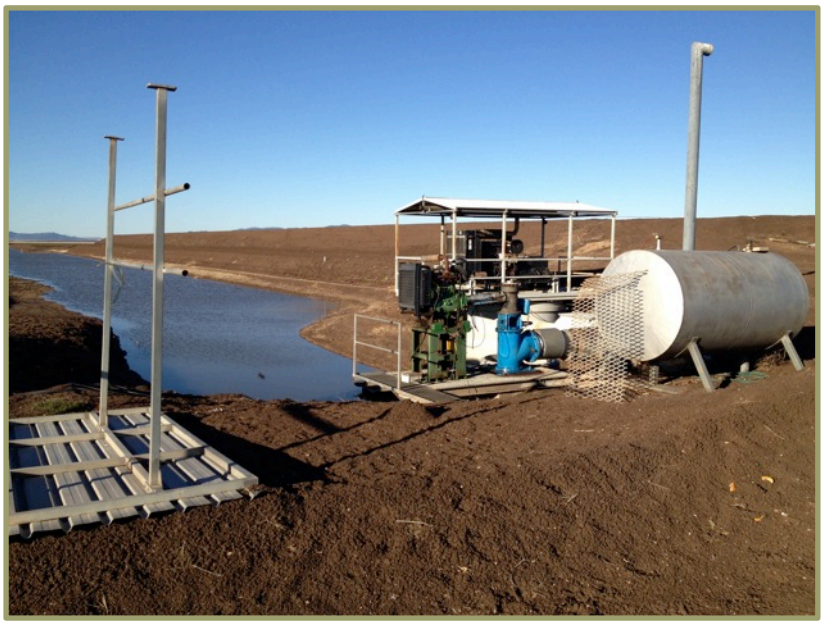

Figure 1.39 Irrigation infrastructure on "Breeza Station" , located outside of Project assessment areas

1.1.1.14 Land reference #131 and 150

This agricultural enterprise comprises Land reference #131 and 150. The properties are managed as one unit and referred to collectively as "Colorado". The agribusiness focussed on production of grassfed yearlings for direct sale to consumers. The key agribusiness indicators for this enterprise have been determined (Table 1.14). The details for this agribusiness have been verified by Mr. Derek and Mrs. Kirrily Blomfield.

Table 1.14 Land reference #131 and 150 - key agribusiness indicators

Key Agribusiness Indicators	Description
Land reference #	131 – Rado Ranch Pty Ltd 150 – Thyrek Pty Limited (refer to Figure 3.01)
Manager	Mr. Derek Blomfield

Key Agribusiness Indicators	Description	
	Mrs. Kirrily Blomfield	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	875 (#131) 109 (#150) Total – 984	59 100
Water	6 dams 3 bore – 1 in use by electric submersible pump equipped bore (depth of 26m) – 8,100L/hr capacity, 2 with windmills Yarraman Creek catchment irrigation and domestic and stock supply (48#, 135#)	
System	Beef cattle trading	Perennial Pasture
Product (unit)	Grown Steers (400-500kg LW)	Perennial pasture for fodder Sub-tropicals including: Rhodes grass, Premier Digit, Bambatsi, Gatton Panic, Consul Lovegrass Temperate pastures including: Fescue, Chicory, Lucerne and sub-clovers Native pastures and vetch including: Queensland bluegrass (*Dicanthium sericeum*)
Scale	Up to 800 units of non-lactating cattle over summer AND 400-500 units over winter OR Between 350-400 lactating cows and progeny year round	578 ha
Yield	350 steer and heifer units/year	Fodder
Market	Self-slaughter, self-distributed: local, regional and their own online market	Fodder

Mr. Derek Blomfield and his wife Mrs. Kirrily Blomfield (the Blomfields) manage the beef cattle agribusiness, "Colorado", that combines Land reference #131 (Rado Ranch Pty Limited) and 150 (Thyrek Pty Limited). The property is 984 ha and is located on 4D Road south of Doona Ridge. The Blomfields neighbour the property owned by Mr. Allan Grant (Land reference #158), Mr. Struan Willis (Land reference #161), and Mr. Dugan (Land reference #160). The property was purchased by Mr. Blomfield's grandfather in 1946. The majority of the property is black soil and red soil. The ridge country on Land reference #131 is dominated by White Box (*Eucalyptus. albens*) and Yellow Box (*E. melliodora)* and native grasslands. The total area of wooded vegetation is estimated at 563 ha (Figure 1.40).

The Blomfields operate a beef cattle grazing agribusiness based on sustainable land management principles within a perennial grazing system. The Blomfields apply the sustainable farming principles of Holistic Management International (HMI). Dr. Christine Jones of the University of New England encourages these

principles (Jones, 2010). The Blomfields also follow a model for sustainable production and marketing of farm produce developed by Mr. Joel Salatin of the USA. HMI principles include:

- Use grazing to stimulate grasses to grow vigorously and develop healthy root systems;
- Using the grazing process to feed livestock and soil biota;
- Maintaining 100 percent soil cover 100 percent of the time;
- Rekindling natural soil forming processes; and,
- Providing adequate rest from grazing without over-resting.

Figure 1.40 Improved grazing pasture species, tree planting (mid-ground) and remnant vegetation (background) on "Colorado" in November 2013

The Blomfield's current management of their beef cattle enterprise focuses on improving groundcover and biodiversity through grazing management (Figure 1.41). The practice is aimed at improving the agricultural productivity and sustainability of the agro-ecosystem on their property and harnessing the ecosystem services of the landscape. The property is majority pastured, comprising sown perennial grass and legume pastures including sub-tropicals such as Rhodes grass, Premier Digit, Bambatsi, Gatton Panic, Consul Lovegrass, as well as temperate pastures, including such as Fescue, Chicory, Lucerne and sub-clovers and native pastures including Queensland Bluegrass (*Dicanthium sericeum)*. It is thought that around 288 ha of the property is contoured (contour banks) and 290 ha is black soil. The Blomfields withdrew around 350 ha that was previously cultivated for grain and fodder and subsequently converting the land to grazing pasture. The Blomfields practice non-tillage farming across the property. They may commence pasture cropping into the future, including the maintenance of the current pasture base and sowing forage crops directly into pasture during dormancy.

Livestock are managed using planned rotational grazing, focussing on pasture recovery as well as animal performance (Landcare, 2013). The Blomfields have gained recognition for their sustainable land management and farming practices through the following awards:

- Nominated for the 2013 Landcare Awards for Innovation in Sustainable Farm Practices (Landcare, 2013); and,
- Received an Award for Innovation in Sustainable Farm Practices (Namoi CMA, 2013).

Figure 1.41 Former cropping land is now permanent pastured and carefully grazed at "Colorado"

The current beef cattle trade and agistment system has been in place since around 2010. Prior to this, the Blomfields ran around 300 Red Angus breeders with around 230 ha under fodder cropping. The Blomfields have modified the ratio of trade and agistment cattle since 2010 and current run 100 head of trade cattle and 200 head of agistment cattle. The Blomfields have created a brand (The Conscious Farmer) and have begun slaughtering, marketing and distributing the grass fed beef through this mechanism. The Blomfields plan to move back to a breeding herd in the next phase of their agribusiness, possibly focussing on Red Angus x Shorthorn. The aim is to run up to 400 breeders and their progeny.

The Blomfields have an olive grove stand of 1,500 trees of which 500 are producing oil. They produce olive oil for their own consumption and sale in the local market.

There are two residences on the property, one woolshed, a set of sheep yards, a set of cattle yards, and two grain silos with 150 t capacity and a 100 t bulk grain shed. The property has an irrigation licence allocation of 18 ML, six dams and three bores. One electric submersible pump equipped bore is used regularly and has a draw capacity of 8,100 L/hour. The bore is 26 m. The property has both irrigation allocation and Domestic and stock licences to the Yarraman Creek catchment. The remaining two bores are windmill driven. The property is reticulated by 12.1 km of 63-75 mm piping with water access points established throughout.

1.1.1.15 Land reference #104

This agricultural enterprise is Land reference #104. The property is known as "Iowa" and is a highly productive mixed farming agribusiness, featuring irrigated and dryland cropping on alluvial Vertosol soils, as well as beef cattle breeding. The key agribusiness indicators for this enterprise have been determined (Table 1.15). The details for this agribusiness have been verified by Mr. Michael and Mrs. Natel Bradfield

Mr. Michael Bradfield and Mrs. Natel Bradfield (the Bradfield family) own and manage the 555 ha property "Iowa" (Land reference #104) as a family agribusiness. The primary focus of this agribusiness is high-value seed forage sorghum production under contract to NuSeed. This contract has been in place for the last 10 years. The Bradfield family also produces wheat (durum and bread), grain sorghum and grain sunflowers. Additionally, the Bradfields operate a mixed breed beef cattle breeding enterprise supplying the regional market. The majority of the property is cultivated and intensively fertilised with JBS Feedlot-sourced cattle manure and other inputs.

Table 1.15 Land reference #104 - key agribusiness indicators

Key Agribusiness Indicators	Description		
Land reference #	104 – "Iowa" (refer to Figure 3.01)		
Owner/Manager	Mr. Michael Bradfield Mrs. Natel Bradfield		
Area of production (ha)	TOTAL	Within Project assessment area (%)	
	533 (#104)	3	
Water	2 bores with two irrigation licences to a total of 92ML Domestic and stock access		
System	Cropping, Seed Production	Beef cattle trading	
Product (unit)	Cropping: Wheat (durum and bread); sorghum; sunflowers; pulses (chickpeas, mung beans) Seed production: Seed forage sorghum Pasture (Fodder): Tropical, sub-tropical grasses, lucerne (fodder and hay production)	Grown steers and heifers (400-500 LW)	
Scale	533 ha	Up to 30 Cow and Calf units	
Yield	Seeds under contract Wheat (Durum and Bread) – 3 to 8t/ha Sorghum – 4 to 10t/ha Sunflowers – 1.5 to 3t/ha Pulses (Chickpeas, Mung beans) – 1 to 3t/ha	Up to 30 units	
Market	Seed - NuSeed Wheat (Durum and Bread) and Sorghum, Sunflowers, Chickpeas, Mung beans – through various grain buyers and agents	Tamworth Regional Livestock Exchange	

The Bradfield family has owned and operated the property, located on Waverley Road on the plains to the north of Nicholas Ridge, for 20 years. The Binnaway Werris Creek railway line runs along the southern boundary. The neighbours to "Iowa" include Piper (Land reference #124), and Priestley (Land reference #126). The Bradfield family home is one of two residences on the property. The property also has two machinery sheds, a workshop, a set of cattle yards, and three drying silos with on farm storage of 1,000 t. Key infrastructure on the property is a centre-pivot irrigator watering 2 x 40 ha blocks. The Bradfields have also recently installed an in-ground swimming pool at their home.

The Bradfields state that the plains area of the property is regularly flooded by local water from Nicholas Ridge and surrounding land. They observe that the depth of the flood waters range from 50 to 1,500 mm. There have been an estimated three major flood events in the past 20 years, largely also from the Nicholas Ridge and surrounding land as well as back-up waters from the Quirindi Creek.

Farming practices include zero- and minimum-tillage with high-precision controlled traffic on cultivation. Portions of the cultivation have been laser levelled for irrigation efficiency.

The irrigation and dryland farming rotations are described as follows.

- Centre-pivot irrigation – rotational cycle of seed forage sorghum (Figure 1.42), then a double crop of wheat followed by a long fallow back to seed forage sorghum. This rotation is practiced in two separate 40 ha areas using a single centre-pivot irrigator. As an opportunity crop in this rotation, canola for seed may replace wheat.

Figure 1.42 Germinating seed forage sorghum under centre-pivot irrigation on "Iowa" in November 2013

Seed production requires greater management intensity than does typical grain production. The seed crop must be 'isolated' with adequate buffers of distance or time from any adjacent crops of similar varieties, including those on neighbouring properties that might otherwise cross-fertilise the seed crop. For seed sorghum the buffer is a seven-week sowing interval or 600 m.

The seed crop is planted as separate rows and a particular ratio of male and female plants that often do not resemble the commercial seed progeny. Sorghum is wind pollinated, so thought is required to the orientation of male and female rows to prevailing wind directions. Alternatively, as done by the Bradfields, pollination is achieved artificially with the aid of a helicopter at flowering. On this property, using a helicopter to blow pollen has been demonstrated to increase the pollination rate and hence, the amount of seed grain produced.

- Dryland – rotation is a long fallow into sorghum then a long fallow back to wheat (durum and bread) with an opportunity to double crop legumes (chickpeas) after the sorghum crop or, alternatively, mung beans after wheat, without affecting the rotation (Figure 1.43). The inclusion of an opportunity pulse in the rotation fixes organic N into the soil and, as it is only sown if soil moisture conditions allow, will not usually affect the fallow.

Figure 1.43 Dryland wheat on "Iowa" in November 2013

Over the past 20 years, the Bradfield family has also grown a variety of crops including corn, barley, black eyed cow peas, navy beans, commercials sunflowers and also seed sunflowers. The combination of high-clay content alluvial soils and reliability of both winter and summer rainfall, has delivered a summer and winter crop in each of these years.

Composted solid-waste from the Caroona Feedlot is a favoured fertiliser input as, apart from macro-nutrients, it adds micro-nutrients and organic matter to the soil. More than 5,000 t of composted manure has been applied at "Iowa". Inorganic fertilisers are also applied, typically N as urea, or N, P, K and Zn via MAP with zinc. Ammonium sulphate is also applied, and this may indicate inherent alkaline soil conditions typical of Vertosols. Fertilisers and farm chemicals are sourced from AMPS Commercial at Waverley via Caroona, which is near by.

The property has two bores with two irrigation licences of 70 ML and 22 ML per year each. Only one bore is operational at any one time. The bores are to a depth of 45m and deliver 50 L/s directly to the centre pivot irrigator. The property also has other bores for domestic and stock water.

The Bradfields run a commercial herd of up to 30 Hereford and Santa Gertrudis cows put to an Angus bull. Cattle graze an area of 40 ha sown to native and sub-tropical grasses including Premier Digit, Rhodes Grass and Bambatsi. Lucerne is also sown for both grazing and hay production.

1.1.1.16 Land reference #11 and 27

This agricultural enterprise comprises Land reference #11 and 27. It is an irrigated and dryland cropping agribusiness known as Birrawa Pastoral Company Pty Ltd. The key agribusiness indicators for this enterprise have been determined (Table 1.16). The details for this agribusiness have been verified by Mr. Andrew Clift.

The Birrawa Pastoral Company ("Birrawa") agribusiness comprises Land references #11 and 27 and is 2,023 ha in total size. The agribusiness is managed by Mr. George Clift, together with his wife Margaret and sons Mr. Andrew Clift and Mr. Sam Clift (the Clift family). An estimated 20% of Land reference #11 is within the Project assessment area, while the balance of the property is within EL7223 held by the Shenhua Watermark Coal Project (Shenhua) (Hansen Bailey, 2011). Birrawa is located on Clift Road and shares a boundary with Mr. Angus Duddy, Rossmar Park (Land reference #48).

Table 1.16 Land reference #11 and 27 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	11 – Birrawa Pastoral Company Pty Limited; 27 – Clift G (refer to Figure 3.01)	
Manager	Mr. George and Mrs. Margaret Clift Mr. Andrew Clift Mr. Sam Clift	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	1,340 (#11) 809 (#227) Total – 2,149 ha	10 0
Water	6 bores in total. 1 bore has a 90 L/sec capacity (324 kL/hour). The remaining 5 bores have a capacity of 80 L/sec (288 kL/hour).	
System	Cropping	
Product (unit)	Cotton, wheat, barley, sorghum, pulse – chickpea, faba beans	
Scale	Cotton – 240 ha irrigated and 300 ha dryland Wheat, barley – 400 ha Sorghum – 400 ha Pulse – chickpea, faba (opportunity cropping in rotation)	
Yield	Cotton - 5 to 6 bales/ha Wheat/Barley – 2 t/ha Sorghum – 2 t/ha Pulse (Chickpea and Faba bean) – 1.2 t/ha	
Market	Cotton – Carroll Cotton Wheat, barley, sorghum – Nea, Spring Ridge, Killara Feedlot Pulses – Quirindi Grain and Produce	

The extended Clift family are neighbours, Mr. Michael Clift (Land reference #29) and Mr. Rob Clift (Land reference #30). To the north of Land reference #11 is land now owned by Shenhua Watermark (Land reference #154). The Clift family are thought to be some of the original settlers in the Caroona area. Through interview, Mr. George Clift has stated that the Clift family has farmed Birrawa for seven generations. He also states that another 19 relatives own and manage an estimated 20,000 ha on the Liverpool Plains. The Clift family resides on "Birrawa". The total property size is 2,149 ha. The property has two houses and two cottages. The agribusiness also engages three full-time employees to work the farm.

The primary crop on "Birrawa" is cotton. An estimated 240 ha of the crop is grown annual under lateral irrigation. The Clift family has only recently moved from a furrow to lateral move irrigation. The cotton rotation is generally cotton to barley and then back to cotton. The property is irrigated from six bores, one with a capacity of 320 KL/h and the remaining five bores with 288 kL/h each. The bores are between 30 to 42 m deep and pump to a surface storage from which water is supplied to irrigators.

The Clifts also operate two 400 ha two-year dryland rotations of cotton, wheat (bread), sorghum and opportunity pulses (chickpeas and faba beans), depending on the weather. The rotations are either cotton to short fallow wheat then a long fallow back to cotton, or wheat to sorghum with a long fallow back to wheat. In both rotations the long fallow is about 12 months. Yields are marginally lower than for irrigated cropping.

Zero tillage has been practiced on the property for 15 years - for erosion control and soil moisture conservation. The farm is naturally very flat. Fertiliser inputs are typical at sowing include N via Urea, or N, P and Zn via MAP with added zinc.

In addition to the four residences on "Birrawa", the Clifts have two 1,200 t silos and a 600 t silo. They also have a 5,000 t bunker for grain storage. The property also has three 2 ML rainwater tanks. The Clifts sell their cotton through Carroll Cotton. Their primary grain and pulse market is to local feedlots and through grain traders at Spring Ridge, Nea and Ridleys. The pulses are sold through Quirindi Grain and Produce.

1.1.1.17 Land reference #52, 132 and 152

This agricultural enterprise comprises Land reference #52, 132 and 152. It is a highly productive, mixed farming system, featuring largely dryland and irrigated cropping as well as a beef cattle breeding and fattening agribusiness on the alluvial plains of the Yarraman Creek catchment. The key agribusiness indicators for this enterprise have been determined (Table 1.17). The details of this agribusiness have been verified with one of the landholders.

Table 1.17 Land reference #52, 132 and 152 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	52, 132 and 152 (refer to Figure 3.01)	
Manager	Not disclosed	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	209 (#52) 218 (#132) 1,752 (#152) Total – 2,179 (+ 243*) = 2,422 *243 ha leased from #83) Total – 2,422 ha managed	0 0 <1 (not including #83)
Water	Domestic and stock licence, 4 irrigation bores, 15 windmills. Irrigation licence of 450ML No Yarraman Creek catchment access	
System	Cropping	Beef cattle
Product (unit)	Wheat (durum), barley, sorghum, canola, corn, sunflowers, chickpeas	Grown Steers (420-550kg LW) Grown Heifers (470-520kg LW)
Scale	2,023 ha + 243 ha (black soil alluvium) 1,012 ha (red soil, ridge) Total – 3,278 ha cultivation	800 Cow and Calf units
Yield	Wheat (Durum) – 6 to 6.25 t/ha Barley – 6 to 6.25 t/ha Sorghum – 7.5t to 8.5 t/ha Canola – 2.8 to 3 t/ha Corn – 7 to 8 t/ha Chickpeas – 2.5 to 3 t/ha Sunflowers – 2.5 to 3 t/ha	350 Grown Steers 350 Grown Heifers
Market	Wheat (Durum) – Newcastle/Italy Barley – Caroona Feedlot Sorghum – Caroona Feedlot, Steggles, Newcastle	Woolworths

Key Agribusiness Indicators	Description	
	Canola – Cargill, Newcastle Corn – Bathurst for dog food Chickpeas – Narrabri/India Sunflowers – Cargill, Newcastle	

This family-owned and managed property aggregation comprises Land reference #52, 132 and 152. The aggregation is as a highly productive mixed farming system, focussed on intensive dryland and irrigated cropping (Figure 1.44), as well as a beef cattle breeding and fattening. The majority of the farmland is on the alluvial plains of the Yarraman Creek catchment. Yarraman Creek runs through the property.

The aggregation is accessed via 4D Road as well as well as Coonabarabran Road. A 243 ha block of alluvial Vertosol is also leased from their neighbour (Land reference #83) as an extension of their mixed cropping enterprise. The family describes the black soil alluvium of the Yarraman Creek catchment as being subject to regular flooding events. The majority of the aggregation is immediately outside the Project area. The family are third generation farmers on the property and have managed the farm since the 1980s. Their Grandfather purchased the land in 1935. Two permanent staff and seasonal local contractors are employed.

The family practices no-till, high-rotation intensive farming, focussing largely on the black soil alluvium of the Yarraman Creek catchment. The farming practices are heavily reliant on soil moisture retention of the black soil. Land is split equally to winter and summer rotations also incorporating opportunity cropping. Typical crops in rotation include wheat (durum), barley, sorghum, canola, corn and chickpeas. The inclusion of a pulse in the rotation ensures stubble retention and fixes organic nitrogen (N) in the black soil.

The farming system relies on high-inputs of fertiliser. Typical inputs at sowing including 120 kg/ha of N for wheat and between 80 to 100 kg/ha for barley, via Urea, or N, P and Zn via MAP with added zinc. Foliar N may be applied to wheat (Granuloc Starter) at flowering-stage to lift grain protein to achieve market specifications. Fertilisers are sourced from Pursehouse Rural in Quirindi. Prevalent weeds in cultivation include summer and winter grasses as well as broadleaf species. The management of available water in the soil profile is a key issue.

Figure 1.44 Dryland sorghum on the Yarraman Creek floodplain in January 2014, located outside of Project assessment areas

The primary trade market for the wheat (durum) is Italy, through Newcastle. Sorghum and barley are sold directly to Caroona Feedlot. Sorghum is also sold to Steggles in Newcastle for chicken feed. Chickpeas are exported to India via Narrabri, while canola and sunflowers are sold to Cargill in Newcastle. Some corn is sold for the production of dog food in Bathurst.

The family also breeds and fattens Simmental, Hereford and Angus beef cattle, primarily for a Woolworths market (Figure 1.45). Their focus is to breed and fatten a 14 to 16 month carcass. The family join Hereford cows to Simmental bulls, Simmental cows to Angus bulls, and Angus cows to Simmental bulls.

Figure 1.45 Cross-bred cattle specifically for sale to Woolworths

The herd comprises 800 breeders, producing around 700 calves off crop and supplementary feed, all sourced on farm or locally. Generally, 150 heifers are retained as replacements. The terminal progeny are sold as Grown Steers (550-600 kg LW) and Grown Heifer (500-550 kg LW). About 550 head are supplied to Woolworths annually.

Cattle graze 405 ha of forage oats, plus around 1,012 ha of arable land improved by native and sub-tropical pastures and 243 ha of Land reference #83. The production and finishing schedule generally follows a calving in June-July, weaning in the following January-February, and fattening in March-November. A supplementary ration of cotton seed, barley straws, barley grain, sorghum grain, wheat, chickpeas and other feed additives is used.

The property is watered by 15 water points, including windmills for domestic and stock purposes, each with a capacity of 3.8 kL/hour. The property also has four bores with one an allocation licence of 450 ML. There is no access to Yarraman Creek catchment. The creek is ephemeral and the black soil alluvium is prone to regular flooding events.

In addition to the two family residences on the aggregation, there are associated large farm and work sheds, four cottages, and two sets of new cattle yards. The family own most of their own machinery, including harvesters, and have around 7,000 tonnes of on farm storage in silos.

1.1.1.18 Land reference #2 and 3

This agricultural enterprise comprises Land reference #2 and 3. It is a mixed-system agribusiness, owned and operated by Mr. Les Alcorn and his wife Mrs. Margaret Alcorn. The agribusiness features a Limousin

Stud together with dryland and irrigated forage and grain production. Land reference #3 is a subdivision of Land reference #2. The key agribusiness indicators for this enterprise have been determined (Table 1.18). The details for this agribusiness have been verified by Mr. Les and Mrs. Margaret Alcorn.

Table 1.18 Land reference #2 and 3

Key Agribusiness Indicators	Description	
Land reference #	2 – Alcorn LJ and MA, 3 – Alcorn ML (refer to Figure 3.01)	
Manager	Mr. Les Alcorn Mrs. Margaret Alcorn	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	592 (#2) 4 (#3) Total - 596	34 0
Water	3 irrigation bores, 2 equipped – both with capacity 5ML/day, 1 not equipped - potential 2ML/day available. Bore is at depth of 50m. Access licence to Quirindi Creek	
System	Beef cattle (Stud)	Cropping
Product (unit)	Bulls (Herd/Sire) (680 kg LW) Bulls (Sale) (680 kg LW) Grown Steers (~680 kg LW) Stud Cows and Calves (Cows 600 kg LW) Cull Cows (600 kg LW)	Forage and Silage production: Forage Sorghum Cropping: Wheat (durum), wheat (feed), barley, sorghum, soybeans
Scale	Bulls (Herd/Sire) - 3 Bulls (Sale) - 30 Grown Steers - 20 Stud Cows and Calves - 130 Replacement Heifers - 50	Dryland (160 ha) Irrigated (166 ha)
Yield	160-170 units, comprising: 30 Herd Bulls 110-120 surplus breeding females to commercial breeders 20 Grown Steers and Cull Cows to slaughter	Forage Sorghum – grazing Irrigated Wheat (Durum) – 6t/ha Dryland Wheat (Feed) – 3t/ha
Market	Livestock private sales on farm and Stud Sale at Curlewis. Sales through agents Davidson Cameron & Co, Gunnedah Livestock Sales.	Wheat (Durum) – NSW Grains Board Wheat (Feed) – Agracom Barley, Sorghum, Soy Bean – through local grain traders.

Mr. Les Alcorn, with his wife Mrs. Margaret Alcorn (the Alcorns), have owned and managed the 596 ha property "Greenacres" (Land reference #2 and 3) for over 40 years. In recent times, they subdivided Land reference #3 for their son Malcolm's residence (Land reference #2). The agribusiness is based on Land reference #2). The property is located on Nicholas Ridge (Figure 1.46) and accessed via the Coonabaraban Road, between the Kamiliaroi Highway and Caroona. "Greenacres" is directly opposite "Gabo" (Land reference #19). The property is within the Nicholas Ridge assessment area.

Figure 1.46 Wheat stubble on "Greenacres" in January 2014 and Nicholas Ridge (background)

The Alcorns state that both Quirindi Creek and "Dry Creek" (local reference for the section of the Quirindi Creek that flows above and through "Greenacres") run through the property. They state that this makes the land at the base of Nicholas Ridge subject to annual, and sometimes severe, flooding events. The Alcorns describe that the floodwaters regularly cover the plains area between Nicholas Ridge and the two family residences (Land reference #2 and #3). The property is subject to the Caroona-Breeza FMP (DNR, 2006).

The Alcorns have operated the Greenacres Limousin Stud (Figure 1.47) since 1973, making it one of the oldest in Australia. The herd size is currently around 230 head, including three sire and 30 sale bulls. An estimated 70 ha of the property is grazed.

Figure 1.47 Stud Limousin cattle on "Greenacres" in January 2014

An estimated 166 ha is irrigated and 160 ha is under dryland farming (of which 70 ha is grazed). The Alcorns produce livestock and grain crops including sorghum and soybeans in a double cropping system as well as

wheat (durum), wheat (feed) and barley. They produce forage sorghum for grazing and silage making. The grain crops are irrigated by flood irrigation. Some fertiliser inputs, usually N and Zn, are typical at sowing.

The Alcorns sell around 160 to 170 head from the stud herd each year, comprising 30 herd bulls, 110 to 120 surplus breeding females to commercial breeders, and 20 steers and cows to slaughter. They run their own private stud sale at Curlewis, managed by Davidson Cameron & Co, Gunnedah Livestock Sales. Any progeny that are not suitable for stud sale are disposed through the Gunnedah Sale Yards.

In addition to the two residences and their associated machinery sheds, "Greenacres" has two sets of cattle yards and a cattle crush. Some contour banking exists in upland areas on Nicholas Ridge. Lowland areas for irrigated cropping have been laser-levelled for irrigation efficiency. There are two on farm grain storage silos, each with a capacity of 110 tonnes, and a grain dryer.

Weeds in cultivation include Noogoora Burr (Xanthium pungens), Bathurst Burr (*Xanthium spinosum*), Wireweed (*Polygonum aviculare*), Johnson Grass (*Sorghum halapense*) and African Boxthorn (*Lycium ferocissimum*). These are controlled with chemicals and cultivation.

1.1.1.19 Land reference #33, 34, 35, 36, 39 and 170

This agricultural enterprise is an aggregation of properties managed by Mr. Gary Cohen. The aggregation includes Land references #33, 34, 35 and 36 are held by Mr. Cohen and family, and 39 and 170, formerly held by a relative, and now owned by the Applicant. In total, the aggregation is 914 ha and is managed as a mixed cropping and beef cattle enterprise. The key agribusiness indicators for this enterprise have been determined (refer to Table 1.19). The details of this agribusiness have been provided to, but not verified by, the landholder.

Table 1.19 – Land reference #33, 34, 35, 36 and 170 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	33, 34, 35, 36, 39 and 170 (refer to Figure 3.01)	
Manager	Mr. Gary Cohen	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	33 (#33) 103 (#34) 301 (#35) 81 (#36) 97 (#39) 299 (#170) Total - 914	7 100 0 65 73 – owned by the Applicant 100 – owned by the Applicant
Water	Nil irrigation supply entitlements (#33) Nil irrigation supply entitlements, 4 dams (one leaky) (#34) 62ML/y licensed groundwater entitlement (#35) No information was provided on water entitlements for (#36) and (#39) Nil irrigation supply entitlements, 1 windmill and 2 dams (#170)	
System	Cropping	Mixed breed beef cattle
Product (unit)	Wheat (t) Sorghum (t) Oats – forage Barley – forage Lucerne – Forage	Yearlings (320-340kg LW)

Key Agribusiness Indicators	Description	
Scale	515 ha (aggregate)	154 Cows with Calves
Yield	Sorghum - 2.4t/ha Wheat - 2.4 to 4.8t/ha Barely/Oats - Fodder Lucerne - Fodder	50 units/year
Market	Grain is typically sold in paddock to Mr. Jack Fuller (Land reference #70) Advantage Grain Services (cousin to Mr. Cohen)	Gunnedah Municipal Sale Yards

Mr. Gary Cohen manages an aggregation of eight properties with a total land area of 914 ha. The Cohen family has held all land, including that now owned by the Applicant, for a considerable period of time. For example, Land reference 170 "Woodlands" was an original family selection and has been under family management for more than 100 years. Up until the 1980s and 1990s, the land was used primarily for the grazing of sheep for wool production. After this time, production has shifted to opportunity cropping and beef cattle grazing. One farm labourer assists Mr. Cohen.

An estimated 515 ha is cropped without irrigation (Figure 1.48). Although a modest irrigation supply allocation and delivery infrastructure exists on Land reference 35, it is not considered adequate for intensive irrigated agriculture and is not typically used. Typical crop varieties include wheat, sorghum and barley for grain, plus oats, forage sorghum and lucerne for in-paddock cattle feed. Rotations are limited and typically provide for a single grain crop each year, either wheat or barley in winter or sorghum in summer. There are no pulses in the rotation.

Conventional farming practices include regular soil cultivation. Fallows are required for the accumulation of soil moisture. Weeds in cultivation include Wild Turnip (*Brassica tournefortti*), White Clover (*Trifolium repens L.*) and Noogoora Burr (*Xanthium pungens*). Chemicals and cultivation control weeds.

Some fertiliser inputs, usually N as urea, are typical at sowing. AMPS at Waverley via Caroona provide agronomic advice. The operation is self-sufficient in terms of farming equipment including harvesting and on-farm grain storage. Grain yields are typically around 2.4 t/ha for wheat and sorghum. Grain products are sold to Mr. Jack Fuller, of Advantage Grain Services (Land reference #70) and a cousin. These are typically feed quality grains.

The balance of land is used for the grazing of mixed breed beef cattle, predominantly Hereford and Murray Grey cross (Figure 1.49) and presently holds about 100 cows with calves. Cattle graze predominantly unimproved, native pastures. Terminal progeny is finished on oats or forage sorghum, and about 50 head to 18-months are produced annually. A 28 ha paddock of lucerne is also used to supplement feed cattle (Figure 1.50). The lucerne paddock is thought to be nearing the end of its productive lifespan and will shortly be cultivated. Young cattle are sold through Gunnedah Sale Saleyards.

Figure 1.48 Germinating wheat on land reference #35 in August 2013

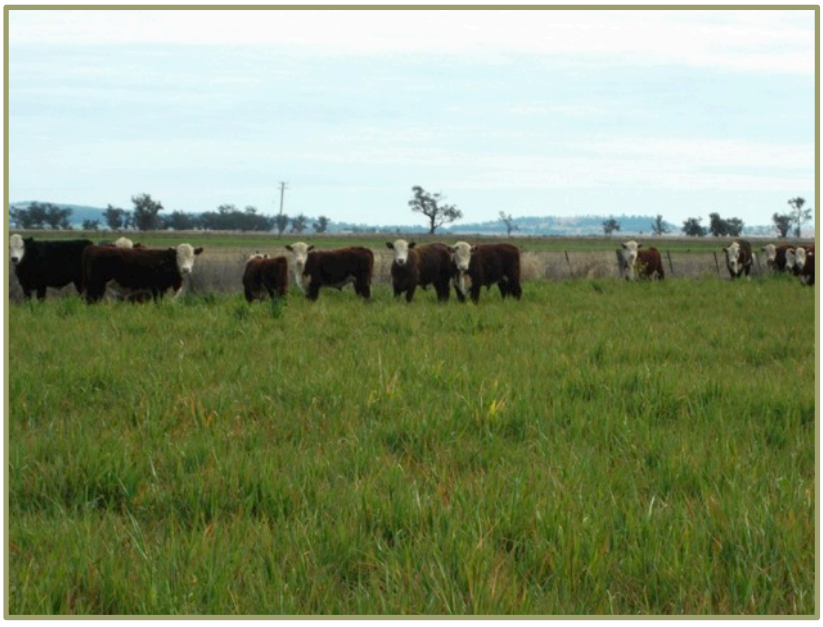

Figure 1.49 Hereford-based catted on land reference #50

Some parts of the land, for example on Land reference #170, contain Plains Grass (*Austrostipa aristiglumis*) (Figure 1.51). Plains Grass is a dominant species in the *Native Vegetation on Cracking Clay Soils of the Liverpool Plains* ecological community. This community is listed as Critically Endangered under the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and is subsequently afforded high-level protection from agricultural activities such as cultivation.

Figure 1.50 Lucerne for grazing and hay on land reference #50

Figure 1.51 Plains Grass (*Austrostipa aristiglumis*)

1.1.1.20 Land reference #32 and 74

This agricultural enterprise is on Land references #32 and 74, and managed by Mr. George Cohen. The key agribusiness indicators for this agribusiness have been determined (Table 1.20). The details for this agribusiness have been provided to, but not verified by, the landholder.

Table 1.20 – Land reference #32 and 74 - key agribusiness indicators

Key Agribusiness Indicators	Description		
Land reference #	32, 74 (refer to Figure 3.01)		
Manager	Mr. George Cohen		
Area of production (ha)	TOTAL	Within Project assessment area (%)	
	210 (#32) 101 (#74) Total – 311	90 100	
Water	Nil irrigation supply entitlements		
System	Cropping		Beef cattle
Product (unit)	Wheat (t) Oats forage Sorghum forage		Yearling (320-340 kg LW)
Scale	155ha cultivation (Wheat, 34ha)		50 cows with calves, 2 bulls
Yield	Wheat - 2.5-3 t/ha Oats and sorghum forage		47 units/year
Market	Mr. Jack Fuller – Advantage Grain Services, Caroona		Gunnedah Municipal Saleyards

This is a mixed cropping and beef cattle agribusiness. A total of 155 ha are farmed without irrigation supply entitlements. Typical crop varieties include wheat for grain and forages of sorghum and oats, which are grazed in paddock. The cultivation is divided into three sections, and crops are rotated and sown opportunistically in a basic wheat-forage-fallow system. Farm management practices have not changed in 25 years (Figure 1.52).

Figure 1.52 - Cultivation on Land reference #32, germinating Wheat (left) and fallow (right) in August 2013

Conventional farming practices are used including regular cultivation for seedbed preparation. Inputs are low due to the economics of farming this relatively small area. Wheat grain protein is low and sold as feed wheat. Forage crops support beef cattle.

The enterprise is currently running about 50 cows with calves, but Mr. Cohen would like to grow this herd to about 70 or 80 cows. Terminal progeny are crossbred yearlings from Santa Gertrudis cows and a Limousin bull (Figure 1.53 and Figure 1.54). These are sold to the local trade market at about 320 to 340 kg LW. The Glencohen property, Land reference #74, is heavily timbered and only grazed periodically (Figure 1.55). Land reference #32, contains a stand of protected Plains Grass, which Mr. Cohen says he is not allowed to cultivate (Figure 1.56).

Figure 1.53 - Santa Gertrudis cows on Land reference #32

Figure 1.54 - Limousin bull on Land reference #32

Figure 1.55 - View from Nicholas Ridge on Glencohen, Land reference #74

Figure 1.56 - Stand of Plains Grass on Land reference #32

1.1.1.21 Land reference #83

This agricultural enterprise is a property known as "Lynden" which is owned by Hanuta Pty Limited and managed by Mr. Jason Kim for the past nine years. The key agribusiness indicators for this enterprise have been determined (Table 1.21). The agribusiness exists for the purpose of raising, processing and exporting Angus-based beef to South Korea. The enterprise runs about 1,000 head of Angus-based cattle (Figure 1.57).

Table 1.21 – Land reference #83 - key agribusiness indicators

Key Agribusiness Indicators	Description		
Land reference #	83 (refer to Figure 3.01)		
Manager	Mr. Jason Kim		
Area of production (ha)	TOTAL	Within Project assessment area (%)	
	1,476 (#83)	73	
Water	Nil irrigation water supply entitlements		
System	Cropping		Beef cattle
Product (unit)	Wheat Barley Oats		Yearling
Scale	1,000 ha dryland cultivation		1,000 Cow and Calf units
Yield	Forage		About 400 units
Market	Feed grain to local feedlots, Forage on farm		Export to Korea. Some direct local trade to JBS Caroona Feedlot

According to Meat and Livestock Australia (MLA, 2013):

> *Korea is Australia's third largest beef market by volume. The Korean market liberalised on 1 January 2001. With liberalisation, the quota system was changed to a tariff-based import regime. Current tariffs for Australia are 40% for fresh and frozen beef and 72% for value added beef products.*
>
> *Australian beef and veal exports to Korea in 2012 totaled 125,956 tonnes – down 14% on 2011, but up 1% on 2010 volumes. The solid export volumes to Korea last year were assisted by strong demand in the last three months of 2012, making up 35% of total annual exports.*

Figure 1.57 - Angus bull on Land reference #83

There is thought to be fierce competition in the Korean beef import market, particularly from the USA who has established a Free Trade agreement with Korea. When unable to export, for whatever reason, Mr. Kim will sell into direct domestic Australian markets, for example JBS Caroona Feedlot, but will always avoid local saleyards.

Terminal progeny may be pure Angus or a composite including Hereford genetics (Figure 1.58). While the marketing arrangements for Mr. Kim's export beef products were not clear at the time of interview, the cattle are known to be processed at Warwick in southern Qld. The Warwick-based Carey Bros Abattoir is known to be one of only a few 'service kill' abattoirs that remain in operation in regional QLD or NSW. 'Service kill' means that ownership of the beef product is not transferred at the abattoir, which is typical of the larger export abattoirs, for example JBS Dinmore Abattoir in Ipswich. This would allow Mr. Kim to value-add to his product and directly export boxed beef products.

Figure 1.58 - Cross-bred (likely Angus x Hereford) terminal progeny destined for processing in QLD and export to South Korea

There are also about 1,000 ha of cultivation on the property (Figure 1.59). Typical crop varieties include wheat, barley, sorghum and oats, in a rotation that includes forage legumes, for example Lab Lab. Rotations are thought to be a long-fallow wheat or barley to long-fallow sorghum with Lab Lab sown opportunistically. Fallow is required for the accumulation of soil moisture. If harvested and not grazed-off, grains are sold locally as feed into cattle feedlots, e.g. JBS Caroona Feedlot.

Mr. Kim uses the agronomic services of Pursehouse Rural, Quirindi. N as Urea is typically supplied to soils prior to wheat. Weeds include Barley Grass and thistles and these are controlled with herbicides. There is no irrigation to the property.

Figure 1.59 Juvenile wheat crop on land reference #83 in August 2013

1.1.1.22 Land reference #126

This agricultural enterprise is an aggregate of two properties on Doona Ridge and Nicholas Ridge (Land reference #126a and 126b, respectively). The property at Doona Ridge is "Prairie Downs". The property at Nicholas Ridge is "Merindie", and both owned by Mr. John Priestley and Mrs. Cheryll Priestley. The agribusiness features largely beef cattle trading with some opportunity cropping under irrigation. The key agribusiness indicators for the enterprise, at the time of interview, have been determined (Table 1.22). The details for this agribusiness have been verified by Mr. John and Mrs. Cheryll Priestley.

Table 1.22 Land reference #126 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	126a – "Prairie Downs" (Doona Ridge); 126b – "Merindie" (Nicholas Ridge) (refer to Figure 3.01)	
Manager	Mr. John Priestley Mrs. Cheryll Priestley	
Area of production (ha)	TOTAL	Within Project assessment area (%)
	651 (aggregate)	126a (17), 126b (90)
Water	2 bores (1 dried up, 1 irrigated), Mooki River allocation 250 ML/y	
System	Beef cattle trading and agistment	Cropping for forage/forage
Product (unit)	Agistment and trade cattle: Cow and Calf units Vealers (300-400kg LW) Grown Steers (400-500kg LW)	Forage: Forage Oats, Lucerne and mixed Pasture, including Clovers, and Fescue
Scale	Agistment and trade of ~350 head, comprising: - Cow and Calf units - Vealer - Grown Steers	Forage oats and lucerne (irrigated) – 45 ha Pasture (dryland) – 65ha

Key Agribusiness Indicators	Description	
Yield	Agistment and trade of ~550 estimated 550 head, comprising: - Vealer - Grown Steers	Forage
Market	Bindaree Beef (Inverell) - for export market. Primo (Scone) and Throsby (Singleton) – domestic.	Forage

Mr. John Priestley and Mrs. Cheryll Priestley (the Priestley family) operate two properties within Land reference 126. "Prairie Downs (Land reference 126a) and "Merindie" (Land reference 126b) are located on Doona Ridge and Nicholas Ridge respectively. This is a mixed system agribusiness, featuring an opportunity beef cattle agistment and trading enterprise, and dryland and irrigated cropping. "Prairie Downs" is 295 ha in size and "Merindie" is 356 ha, for 651 ha in aggregation. The majority of the Priestley's land is within the respective Project assessment areas. Both properties are subject to the flood management requirements of the Caroona-Breeza Floodplain Management Plan (DNR, 2006). The Priestleys note that the last major flood event was 2000. A land use profile for the respective properties is provided.

- Land reference #126a – property name is "Prairie Downs". Property size is 295 ha and is located partially within the Project assessment area. "Prairie Downs" is accessed by Rossmar Park Road, and the Mooki River flows through the property (Figure 1.60). The property neighbours Mr. Jack Fuller (Land reference #70), the Doona State Forest (Land reference #166 and 2001) and the Applicant (Land reference #57).

Figure 1.60 The Mooki River on Land reference #126a, located outside of Project assessment areas

The ridge land of the property is used for opportunity cattle trading and agistment (Figure 1.61). The plains land of the property is used for dryland and irrigated cropping (Figure 1.62). The Priestley's operate one centre pivot irrigator on Land reference #126a. The plains land of "Prairie Downs" is

bordered on one side by the Mooki River and Quirindi Creek also runs through the land. The two surface water systems meet at near the property border.

Figure 1.61 Hereford-based cattle on Land reference #126a

Figure 1.62 Juvenile wheat on Land reference #126a in August 2013

The plains land of "Prairie Downs" has one centre pivot over 23 ha, sown to forage oats and lucerne (Figure 1.63). The Priestleys converted from flood irrigation to centre pivot when their irrigation licence of 487 ML was reduced to the current 112 ML per year. There is one residence and two associate machinery sheds on the plains land of "Prairie Downs". The residence is by Quirindi Creek. The Priestleys use one bore on their farming. The bore has a capacity of 120,000 L/hour and is at a depth of 30 m. The ridge land of "Prairie Downs" features three storage/machinery sheds, one set of cattle yards, a cattle crush and one large dam for stock watering.

- Land reference #126b – property name is "Merindie". Property size is 356 ha and is located largely within the Project assessment area on Nicholas Ridge. "Merindie" is accessed by Waverley Road and

neighbours Mr. Barry Wilson (Land reference #163), Mr. Gary Cohen (Land reference #34) and Mr. George Cohen (Land reference #74). Mr. Michael Bradfield (Land reference #104) lives adjacent to the property on Waverley Road. The property has one homestead residence and three associated machinery/work sheds and a set of cattle yards. The property is watered by eight dams. Around 20% of the property is densely wooded vegetation, 30% is cultivated and the balance is sown to pasture.

Figure 1.63 Irrigated lucerne on Land reference 126a in August 2013

The Priestley's run around 350 cows and calf units and other mixed trade cattle between "Prairie Downs" and "Merindie". The Priestleys trade cattle, attending between four to five sales per week commission buying.

Fertiliser inputs on the irrigated forage include N via Urea. The Priestleys fertilise the ridge land of "Prairie Downs" with Sulphate of Ammonia and they intend to use Superphosphate at "Merindie". A prominent weed on the properties is African Boxthorn (*Lycium ferocissimum*). Chemicals and cultivation are used for weed control.

1.1.1.23 Land reference #101 and 143

This agricultural enterprise comprises Land reference #101 ("Maylan") and 143 ("Single Tree"). It is mixed-system agribusiness, referred to collectively as "Springfield" and is located outside of the Project assessment areas. "Springfield" features dryland and irrigated cropping on alluvial Vertosol soils across both properties, as well beef cattle breeding. The key agribusiness indicators for this enterprise have been determined (Table 1.23). The details of this agribusiness have been verified by Mr. James and Mrs. Rebecca Hockey.

Table 1.23 Land reference #101, 143 - key agribusiness indicators

Key Agribusiness Indicators	Description	
Land reference #	101 – "Maylan" 143 – "Single Tree" (refer to Figure 3.01)	
Manager	Mr. Michael Hockey Mr. James Hockey	
Area of production (ha)	TOTAL	Within Project assessment area (%)

Key Agribusiness Indicators	Description	
	1,426 (#101) 1,481 (#143) Total – 2,907	0 0
Water	5 Domestic and stock bores, 2 irrigation bores. Zone 7 irrigation licence of 211 ML (down from 500 ML)	
System	Beef cattle trading	Cropping
Product (unit)	Cow and Calf units Grown Steers (500-600 LW) Grown Heifers (400-500 LW)	Wheat (Durum) Wheat (Bread) Barley Sorghum Sunflowers
Scale	400 breeders, and ~500 fattened/year	2960 ha – dryland (two blocks) 40 ha – irrigated
Yield	500 Grown Steers and Grown Heifers	Wheat (Durum) – 5t/ha Wheat (Bread) – 5t/ha Barley – 5t/ha Sunflowers – 2.5 to 3t/ha Sorghum – 7 to 10t/ha
Market	Grown Steers and Grown Heifers to Caroona Feedlot and to various regional markets.	Wheat (Durum) - GrainCorp, Australian Durum Co. Newcastle Wheat (Bread) – Various markets Barley – Feedlot, including JBS Caroona Feedlot Sunflowers – Cargill, Newcastle Corn – Mountain Industries, Forbes Sorghum – Feedlots, Chicken Farms in Branxton

Mrs. Dianne Hockey and her two sons Mr. Michael Hockey and Mr. James and Mrs. Rebecca Hockey own and manage the agribusiness "Springfield" (the Hockey family). The agribusiness comprises Land reference #101 ("Maylan") and 143 ("Single Tree"), with a total area of 2,907 ha. The properties are managed as one unit. They are located off Coonabarabran Road, to the west of the Doona Ridge Project assessment area. Land reference #101 is partially within the Project assessment area. The two properties are divided by Clift Road. The Hockey family lives on the Georges Island ridge. "Springfield" neighbours include JBS Caroona Feedlot (Land reference #4) and Michael Clift (Land reference #29), and Mr. Grant and Mrs. Lisa Norman, "Rowena" (Land reference #118). The properties were purchased by Mrs. Dianne Hockey's late husband in 1946. Previously, the Hockeys operated a 200 to 300-sow operation in piggery on Land reference #101. They have also irrigated around 300 ha for food crop production, including tomatoes and rockmelons under a share-farming arrangement.

The Hockey family manage a highly-productive, largely dryland cropping system on the plains of the Yarraman Creek Catchment. Around 90% (3,000 ha) of the property is cultivated black soil alluvium. The balance of the property, comprising 300 ha, is largely ridge country, used for grazing and residential purposes.

"Springfield" is flooded from the Yarraman Creek annually. The Hockeys estimate that 50% of the property is flooded during each flooding event. The production system generally relies on bore water for Domestic and stock purposes. There are seven bores on the agribusiness. Additionally, the Hockeys have a 211 ML

irrigation allocation, across flood irrigation infrastructure. The Hockeys irrigate only when the irrigation country is very dry. The property has been zero till since around the mid-1990s. No-till fallow management increases soil water storage and reduces soil erosion potential. The Hockeys engage local contractors for on farm assistance and using their own header, but previously employed around 15 people.

About of 2,870 ha of the Hockey's black soil alluvium is farmed dryland. An estimated 40 ha is farmed under irrigation from underground Yarraman Creek catchment entitlements. The dryland cultivation is divided into ~1,400 ha blocks for winter/summer rotations. Crop varieties include wheat (bread and durum), barley, sorghum with sunflowers in rotation. Rotations generally follow a long fallow wheat (durum), wheat (bread) or barley, followed by long fallow sorghum, followed by sunflowers. The Hockeys sow at least two sorghum crops prior to the sunflowers. The Hockeys have previously incorporated a pulse into the rotation. They are considering the inclusion of dryland cotton in the rotation.

The cropping system at "Springfield" is high input. The Hockeys have observed a large increase in inputs in recent time. Fertiliser inputs are typical at sowing including 150 kg of N, via Urea or N, P and Zn via MAP with added zinc. Foliar N may be applied to Wheat at flowering-stage to lift grain protein to achieve market specifications. They may also apply manure. Prevalent weeds in cultivation include Annual Ryegrass, Fleabane and Milk Thistle. As is common throughout the district, some of the Annual Ryegrass on "Springfield" is Glyphosate resistant - they manage this through a number of processes. The management of excess water from overland flows is a key issue.

The Hockeys run an Angus x Hereford herd on the ridge country off George's Island, Trays Island and Sheepyard Hill. They hold one other cattle breeding property in the area at Pine Ridge. An estimated 500 head are brought to "Springfield" for finishing. Their current herd is run in two mobs across Land reference #101 and #143, also comprising around 400 breeders. The cattle are sold directly to the JBS Caroona Feedlot and to the regional market.

"Springfield" has six residences and over ten storage and machinery sheds. The piggery infrastructure remains onsite. The Hockeys have two 1,300 t storage silos as well as a further 2,000 t of storage in sheds/silos.

1.1.2 Description by reconnaissance

The following is a general description of properties where engagement was declined by landholders. The analysis was typically restricted to observations from public roads and information in the public domain, i.e. the Internet, including remote imagery. Key agribusiness indicators are not presented because of the nature of available information. Again, the analysis was performed on a *per-farm management unit basis* and is generally presented in no particular order of preference. The details presented for these agribusinesses have therefore not been offered to, nor verified by, the respective landholders.

1.1.2.1 Land reference #21 and 22

Land reference #21 (114 ha) and 22 (158 ha) ("Abbotslea") is an aggregation held by HF Charters and managed by Mr. Ken Charters. All of Land reference #22 but only 26% #21 is within the Doona Ridge assessment area. The property is accessed from 4D Road via Caroona. Roadside observation indicates wheat stubble from a late-2013 harvested crop produced in dryland conditions on #22 (Figure 1.64). Examination of aerial imagery reveals:

- A very high percentage of the total land area is currently cultivated; and,
- Upland areas are cultivated on the contour and contour banks are in place to control overland flow and limit erosion.

As there is no irrigation access licence associated with the land, and the NSW Office of Water (NOW) registered bores on the land are not screened in highly productive groundwater, it is likely that no irrigation is applied. A long-fallow wheat to sorghum rotation is the likely cropping regime.

Figure 1.64 Dryland wheat stubble and homestead on Land reference #22 in January 2014

1.1.2.2 Land reference #29 and 31

Land reference #29 (793 ha) is held by M and KA Clift and #31 (1,354 ha) by RS and A Clift. An estimated 46% of Land reference #29 and 11% of Land reference #31 is in the Doona Ridge project assessment area.

The land is thought to be accessed via Clift Road, off Coonabarabran Road to the west of Caroona. Roadside observation is of extensive wheat stubble from a late-2013 harvested crop grown on alluvial Vertosol soils (Figures 1.65 and 1.66). Review of aerial imagery indicates almost all of the aggregate land area is under cropping, save parts that grade to Doona Ridge and Georges Island. There are numerous NOW registered bores on the properties, with a spatial distribution suggesting irrigation supply to at least some portion of the property.

Figure 1.65 Land reference #29/31 (right), Clift Road (left) and Mt Watermark (back)

Figure 1.66 Land reference #29/31 wheat stubble, looking east from Clift Road to Doona Ridge (right, back)

1.1.2.3 Land reference #124

Land reference #124 is held by MG and CT Pike, and lies partially within the eastern portion of the Nicholas Ridge assessment area. The Pike family also own Land reference #122 and #123. It is assumed that these properties are managed with #124 as an aggregate. Land reference #124 is 251 ha, #122 is 270 ha and #123 is 126 ha. The total area owned by the Pike family is 647ha. Some 74% of Land reference #124 is located within the Nicholas Ridge project assessment area. The property (#124) is accessed via the Kamilaroi Highway and, most likely, operated as a management unit with the other nearby land parcels held by family members. Observation is that some parts of the land are cropped. Land reference #124 neighbours the Grant family (Land reference #113) and Mr. Barry Wilson (Land reference #163).

1.1.2.4 Land reference #125

Land reference #125 is "Ridge Station", an extensive mixed farming operation held by Mr. Sam and Mrs. Meg Piper. A relatively small portion (7%) of the total land area of 1,601 ha is contained within the northern limit of the Nicholas Ridge assessment area. The property is bounded by Pursehouse Farms (#129) to the north, Waverley Road and Iowa (#104) to the south, the Kamilaroi Highway to the east and Mystery Road to the west. Observation suggests extensive cropping production across the land (Figure 1.67), with interspersed patches of remnant vegetation associated with areas of greater relief. The property has numerous NOW registered bores.

The property was recently offered for sale (Farmbuy, 2014) and this advertisement reveals the land consists of 1,100 ha of cultivation on black and red self-mulching soils, and 540 ha of improved pastures. Crops of canola and sorghum are grown along with 400 breeder cattle and progeny.

Property infrastructure includes a large three-bedroom, three-bathroom homestead, a large four-car garage and guest quarters, plus sheds, grain storage and cattle yards. The property is watered by bores, windmills and dams (Farmbuy, 2014).

Mr. and Mrs. Piper operated an Angus cattle stud known as Trio Angus at Ridge Station from 2003 to 2010 (Trio Angus, 2014). The stud has since been relocated to another family-held property and last year offered 30 bulls for sale. It is thought that Ridge Station continues to be operated by the Pipers as a mixed agribusiness, with an emphasis now on supplying quality commercial cattle based on leading Angus genetics, plus dryland cropping.

Figure 1.67 Dryland sorghum on Ridge Station (from Farmbuy, 2014)