St Arnaud – Agricultural Land Quality Assessment

North Grampians Shire Council

July 2023

SED

REGIONAL ADVISORY

Report statement

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Key Points

Commented [TI1]: Subject to final review with industrial land and flooding study

This study supports the development of the St Arnaud Structure Plan which seeks to improve the growth in the region's agricultural productivity.

The Wimmera Southern Mallee Growth Plan and MSS provide that agricultural land is to be protected from the encroachment of sensitive use. Both documents also recognise the strategic importance of region's agricultural land.

Future intensive use is likely to come from further broiler farms, piggeries and potentially from renewable energy built around the intensive agriculture cluster.

There are a range of strategic issues that are relevant to the ambition of increasing the region's agricultural productivity through improved planning and land use mechanisms including:

- Land fragmentation
- Flooding, bushfire and vegetation constraints
- Zoning inconsistencies
- Current conflicting land use
- Buffers extending into adjacent and incompatible zones
- Growing agricultural and intensive agricultural industries

Applying a range of agricultural production, landscape and planning considerations the quality of agricultural land has been assessed in seven investigation areas. Detailed mapping, soil analysis and visual observation was used to inform the assessment.

The reports concludes that although the St Arnaud region has highly productive and agriculturally significant land, it is not necessarily the case within the study areas. The current zoning is satisfactory except for the following recommended changes:

1. Rezone a part of Area B to FZ provide protection to an existing piggery operating in this area
2. An expansion of the FZ in Area E to protect some highly productive agricultural land
3. Expansion of the FZ into Area G to protect intensive agriculture outside the area with a buffer that extends into Area G
4. Conversion of part of Area G containing a reservoir and St Arnaud Park currently zoned RLZ to a suitable conversation or public use zone
5. Investigation of a parcel of land to the north of Area G for potential rezoning to FZ

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1. Background

It has been almost 20 years since preparation of the St Arnaud Strategic Framework Plan ·Since that time there has been numerous zoning, policy and strategy changes that have cumulatively resulted in adverse and conflicting land uses and which will potentially act to limit future growth opportunities.

There is a need for a long-term vision and plan to reset the strategic and planning framework for the town so future growth opportunities can be realised through improved land use and planning mechanisms. To this end the St Arnaud Structure Plan is currently being prepared.

It is proposed the Structure Plan will support a range of agricultural outcomes including the improvement of agricultural productivity across the region, protecting the land best suited for agricultural use as well as understanding the land quality and planning controls that may be restricting potential productivity improvements.

This project is being undertaken to support the development of the Structure Plan and assist in identifying where high-quality agricultural land is located and to be protected from encroachment of growth and possibly to inform zoning changes. The project includes a determination of the agricultural land capability and an assessment of the potential conflict between agricultural uses and future residential and industrial development for the township of St Arnaud.

1.1 Project scope of works

Four primary work tasks have been completed:

1. Collation of mapping / literature regarding various land and land attributes
2. Identification of and mapping of these attributes
3. Determining the suitability of land for agriculture, agricultural industry or other agricultural uses
4. Providing recommendations regarding the potential impacts on agricultural productivity or any proposed rezoning or rural land for urban development and policy or zoning changes to support agricultural productivity

1.2 Methodology

The approach used for the assessment consisted of the following step

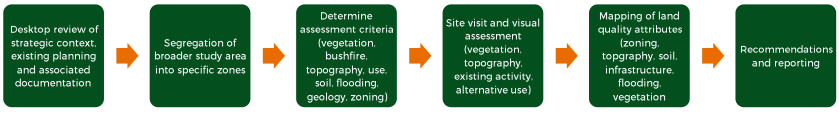

Figure 1 – Methodology

A specific methodology was employed to undertake visual assessment. This is further detailed in 3.2.1 below.

1.3 Areas for analysis

The areas for detailed analysis are shown in Figure 2.

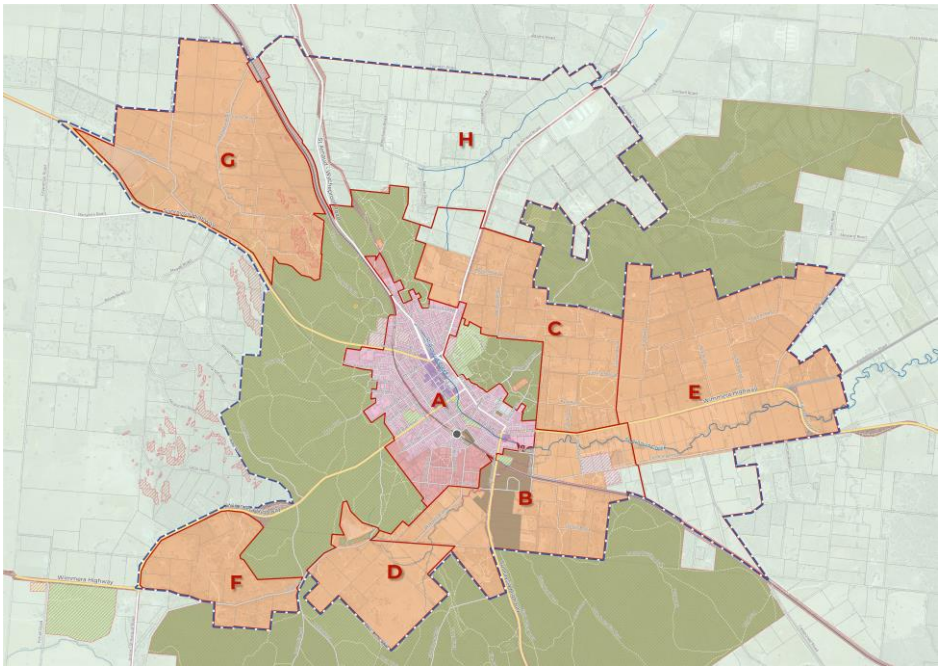

Figure 2 - Areas for analysis

Area A has not been considered in this report as it has no agricultural production qualities.

2. Criteria for assessment

There are several local factors that help explain the likelihood and location of agriculturally significant land within the study area. These criteria have been used to inform assessments of the quality of the agricultural land in each of the areas under investigation.

2.1 Landscape considerations

2.1.1 Geology

Generally, areas where there is a history of gold discovery are indicative of land with poor agricultural potential. This is largely due to the presence of shallow bearing reef structures being exposed close to or at the surface. This formation predisposes a lack of a quality topsoil and substrate structure required to sustain the nutrients required for plant growth within the soil profile.

The origin of St Arnaud's was the discovery of gold at a sandy knoll later called Bakery Hill, St Arnaud north, in January 1855. The resulting goldfield was known as New Bendigo, and mining spread into several hills and gullies (Victorian Places, 2015)

St Arnaud is variously described as displaying a geology of "Cambrian marine sediments (shale, quartz) (Imhof, Rampant, & De Plater, 1995) and a geomorphology corresponding to a G_s designation; described as a landform of "gentle hills' with a geology of "Palaezoic sediments" (Lorimer & Rowan, 1982) .

2.1.2 Topography

Soil and nutrients, particularly where there is weathered profiles or poor soil structure, will, over time, tend to wash from elevated areas until such time as the gradients and water velocity become less, allowing sediment to settle from flows, that are often initiated because of high rainfall events.

This process usually takes place low-lying areas along creeks and water courses that are subject to flooding events, where further sedimentary deposition occurs.

Given the geology of the area, this effect appears to explain the positioning of some of the identified productive land within the study area.

2.1.3 Soil profile

A soil profile analysis was undertaken by the Department of Agriculture (Imhof, Rampant, & De Plater, 1995) (Appendix A) roughly three kilometres south-west from the town centre, within the State Forest.

We have used this analysis, together with a detailed soil mapping analysis (3.3 below) to guide the assessment of soil conditions. While care needs to be taken when transposing the results of a single profile analysis across multiple locations, there are a number of similarities that indicative that the same profile is common in and around the study area, particularly pertaining to the slopes of the surrounding hills. These include:

- The description of the A1 layer; *'Brown, sandy clay loam; weakly structured; hard-setting surface condition; firm consistence dry; contains many (25%) siltstone fragments and a few (5%) quartz fragments'*, was consistent across many locations. This was evidenced by the resultant bare patches commonly observed, including quartz and the level of aggregate visible both on the surface and in places where the soil had been disturbed.
- There were similar large tracts of land with the same vegetation and appearance, including Ironbark (Eucalyptus sideroxylon), Grey Box (E. microcarpa) and Golden Wattle (Acacia pycnantha), similar to that where the pit site was located.
- The acidic nature, likely deficient nutrient levels and low inherent fertility within both the surface and subsurface horizons was also evident in the nature and distribution of the groundcover present in a number of cleared areas, where large bare tracts were evident along with poor grass cover and unimproved pastures.

2.2 Agricultural Production Considerations

2.2.1 Size and location

For agricultural production to be sustainable, it needs scale. Small and isolated land parcels are counterproductive to efficient farming practices.

2.2.2 Access

Much of the study area suffers from poor vehicular access, let alone the conditions required for the safe movement of livestock and machinery. Alternatively, given the study area is largely located in the town's environs, there were also several major arterial roads and State significant highways carrying high speed traffic that interface with relevant landholdings that also provide their own specific challenges to the safe movement of machinery and livestock.

2.2.3 'Freedom to farm' issues

Farmers need to be able to employ accepted agricultural production practices unincumbered from unsympathetic or conflicting neighbouring land use. This can often become a problem when co-located within urban environments where, factors such as unfamiliarity, dust, smell, spray drift and domestic dog attacks on livestock and other issues can become a source of potential conflict.

2.2.4 Type of production system

To be sustainable cropping and livestock production systems generally rely on productive soils and a sympathetic climate. This is not necessarily the case for intensive agricultural production systems such as piggeries and poultry sheds, for which St Arnaud is recognised.

The positioning of these production facilities is often determined by logistical considerations such as access to feed and water, relative distance to processing plants and end markets. As such, they become production platforms, where the fertility of the underlying land becomes less important.

2.3 Planning considerations

2.3.1 Fragmentation

Given the various zones have been in place for a number of years, a mixture of both 'lifestyle' and farming activities can be observed within the same study area. This increases complexity, should there be an attempt to separate these activities through planning overlays.

2.3.2 Zoning

While not ideal, we note farming pursuits are able to be conducted within RLZ's and, as such, these activities aren't precluded from occurring, albeit perhaps in a moderated form.

In the case where intensive farming practices are undertaken in the form of for example, piggeries, poultry sheds and hay processing activities that require associated buffer zones, in our opinion, these should be conducted in FZ's away from dwellings, to reduce the possibility of conflict through unsympathetic land uses.

2.3.3 Bush fire and flood overlays

Our understanding is that agricultural production is permissible, possibly even desirable, within these designations.

3. Results

3.1 Strategic context

3.1.1 Strategic issues

The relevant and primary strategic issues identified in across the broad study area that provide context for this report include:

Issue	Issue	Relevance / implications for study
Underutilised residential land supply	• Significant vacant land, predominately RLZ • Lifestyle land supply of 12 years • Rural residential land supply of 43 years • RLZ for other purposes land supply of 41 years	• There is little evidence for existing agricultural land (RLZ or FZ) to be set aside for residential land
Land fragmentation	• Land is highly fragmented, with predominant RLZ land being 2-8ha • Some larger lots on the SW and E are used for mixed agricultural purposes	• Agriculture requires consolidated holdings • Many existing lot sizes are too small to accommodate large, perhaps any, rural industries
Growing industries	• 30% of RLZ land is vacant and other 30% is being used for medium to large scale agriculture • Broiler farms and piggeries around the periphery of the study areas, mostly sufficient distances from sensitive uses • INI1Z are being used for either rural residential or remain vacant because of flooding concerns	• MSS cl 02.03-6 requires industrial uses to be protected from the encroachment of sensitive use • Potential inconsistent use with current zoning • Buffer zones of existing uses • Future buffer zones • Nature of future industries
Industrial and agricultural land subject to flooding	• Industrial land and RZ land is subject to potential flooding from St Arnaud Creek	• Floodways and land subject to inundation tend to offer high value agricultural land • Supporting industry and potential future use such as intensive agriculture may require alternative zoning
Vegetation	• St Arnaud is densely populated which contributes to landscape characteristics but acts to constraint development and is a bushfire hazard • Situation is made more acute by the large areas of state forest and vegetation cover located within both the RLZ and town's environs	• Vegetation presents as an inherent fire risk within the RLZ • Current vegetation cover in these areas maybe appropriate given the underlying soil characteristics • Balancing biodiversity and agricultural development maybe a challenge • Agricultural production less impacted by bushfire risks
Zoning inconsistencies	• Mismatch between RLZ and potential locations for industries • Land in RLZ has significant environmental and infrastructure constraints	• Location of future industries • Existing use maybe inconsistent with zoning

Table 1 - Key strategic issues

3.1.2 Future use considerations

The Wimmera Southern Mallee Growth Plan (Victorian Government, 2014) includes:

- A principle that key agricultural resources should be protected, productivity maintained, and the development of industry supported
- A strategic direction that strengthen(s) the farming sector's capacity to prosper in a changing climate

The plan outlines the following key directions for rural land use:

- Support and protect agriculture as the key rural land use and driver of the regional economy
- Encourage diversification and value adding to agricultural production
- Develop clusters of economic activity based on locational advantages and infrastructure
- Provide opportunities for uses and infrastructure in rural areas which can take advantage of the region's sparse population and large buffer distances to minimise land use conflicts

The plan encourages diversification of rural land uses and the rural economy as a central strategic direction. However, this should not be at the expense of agriculture, which is a land use of statewide and national importance. Opportunities exist for further value adding to agricultural commodities.

There are two primary considerations for future use relevant for this report:

1. The area surrounding St Arnaud is identified as preferred for intensive agriculture, specifically for medium to large piggeries and broiler farms. Developments should have good access to feedmills, electricity, main roads and secure water supplies.
2. The plan identifies St Arnaud as being the potential location for renewable energy biomass built around the potential development of piggery and broiler farm clusters.

3.2 Visual assessment

A visual evaluation of current agricultural activity and the suitability of land for agricultural production was undertaken in the relevant study areas, as defined by study areas B, C, D, E, F, G and H, specific to the land designated as either RLZ or FZ within those areas.

3.2.1 Methodology

No requests for access to private property within the study area were made, nor were any permissions received. Visual assessments were made 'across the fence'. There are several limitations arising from relying solely on visual representation:

- Due to limited access assessments were often made from a distance. These observations, by their nature, can only be estimations of the relative agricultural productive capacity of the relevant landholdings
- No detailed soil testing, paddock inspection or agronomic assessment undertaken
- There was no understanding of relevant cropping, pasture renovation or fertiliser application histories of the land involved
- No information was received pertaining to previous cropping yields where applicable, or the level of any established improved pasture species and the resultant potential carrying capacity of the different parcels of land observed

Despite these limitations when taken in conjunction with the mapping information they provide corroborative evidence and assurance as to the land quality under assessment.

The process of visual observation can also reduce the risk associated with relying solely on dated mapping information. As the last major strategic review of land use planning and related information is over two decades old, this risk is real.

3.2.2 General observations

The assessments were based on factors which point to the underlying quality of the land under observation:

Consideration	Which means	Key observations
Ground cover	Whether there was open space available for agricultural activity and the visual condition of these areas.	In some areas there is evidence of cropping activity indicating that the land is arable, while others exhibit an even grass cover, suggesting that the land may be suitable for grazing. There are also areas that exhibit large bare areas, soil characteristics and unimproved pasture species that indicate that they are less productive
The level of any agricultural activity evidenced	The presence or otherwise and relative numbers and type of livestock and/or cropping activity was used as an indicator of land currently used for agricultural production purposes.	Much of the agriculture activity was not sufficiently intensive to be commercially viable. Many smaller herds indicating hobby or small-scale activities.
Condition of related infrastructure such as fencing, yards and buildings	Poor and unmaintained infrastructure suggests cessation of farming activities or low marginal activities	There was evidence in some areas of abandoned farm buildings and structures, suggesting that primary production in certain areas has become untenable
Evidence of alternate land use	A concentration of related lifestyle infrastructure, including houses, sheds, caravans, containers etc., within certain areas was used as an indicator that commercial production agriculture was no longer taking place.	Based on past industry experience, once land is converted from farming to residential use, it doesn't return to tradition agriculture production. It is considered appropriate that these blocks are excluded for inclusion as agricultural land
Tree cover	The species type, height and diameter of trees in a specific location may be used as an indicator or proxy as to relative productivity of the land where they grow.	Much of the study area has tree cover like that of the surrounding State Forests, making these areas unsuitable for agriculture. In other areas there was substantial regrowth evident, suggesting that previously cleared land was no longer being used for agricultural production

Table 2 - Land Quality Assessment Criteria

Figure 3 - Example of arable relatively high value cropping land

Figure 4 - Example of poor unimproved ground cover, tree regrowth and abandoned infrastructure

3.3 Soils analysis

Maps of the soil types in each of the study areas is included in Appendix B.

Soils are not the sole determinant of underpinning agricultural land productivity. Other factors such as water access, as well as the specific combination of factors (infrastructure, weather, water) in a location can influence land productivity other than soil. Soils however tend to indicate underlying land quality. Taken with other forms of analysis, soil analysis based on existing scientific data provides a useful guide into the likely quality of land for agricultural purposes.

Given the generalised descriptions of the soil types used in the Victorian Government Database (Department of Jobs, Precincts and Regions, 2015), it is difficult to be definitive about the suitability of specific areas with regard to agricultural production without further identification relating to their suborder, great group and subgroup.

This said we are of the view that the distribution of the various soil types throughout the study areas does validate visual observations indicative of different land uses. This result is line with expectations as

historically higher quality soils will have been the location of more intensive agricultural production activities ie: land use naturally occurs that matches the underlying soil type.

Generally, dermosols and vertosols are likely to be more productive soils than those identified as kurosols, sodosols, and rudosols. With perhaps the exception of dermosols there also appears to be proclivity towards soils within the study area tending towards being highly acidic which would be indicative of poor fertility.

This pattern matches our visual observations. For example, Area H has predominant soil type dermosols and is currently the most agriculturally intense Area. It would also appear apparent that some grazing activity (identified as moderately sustainable) is possible on these lesser soil types, which also matches our observations (although there is no recommendation for rezoning these areas from their current RLZ.).

The soil type in each Area and the suitability for agricultural production is summarised in Table 3.

Area	Predominate soil type	Suitability for agricultural production (Poor, Moderate, High)
B	Kurosols, Sodosols	Poor
C	Kurosols, Dermosols	Moderate
D	Kurosols	Poor
E	Kurosols, Dermosols, Sodosols	Poor with some high
F	Kurosols, Rudosols	Poor
G	Sodosols, Vertosols, Rudosols	Poor / moderate
H	Sodosols, Vertosols, Rudosols, Kurosols, Dermosols	Predominately moderate to high

Table 3 - Soils analysis

There is further information pertaining to soil quality and suitability for agricultural production in Appendix B – Soil Analysis.

4. Area Analysis

The designations applied to relevant activity within the study area have been determined through the application of the criteria detailed above.

4.1 Area B

4.1.1 Existing conditions

	Existing Conditions
Current Zoning	RLZ2, INZ2, PUZ1
Flooding	Yes
Vegetation	Minimal
Lot Sizes	2ha- 8ha
Fragmentation	High
Heritage	Nil
Potentially Contaminated Uses	Yes, buffers with intensive agricultural use as well as wastewater plant buffer
Proximity to Towns Core	Within 2 kms
Utilities	Power, water, sewerage
Access	Wimmera Highway
Soil type	Kurosols, Sodosols
Constraints	Township to northeast, wastewater treatment plant to the west, rail dissects area
Bushfire risk	Landscape risk type 3 & 4
Current agricultural activities	Intensive agriculture, cropping and grazing
Intensive agricultural uses	Broiler and piggeries
Topography	Runs towards St Arnaud Creek
High value agricultural land	Yes, west of the area, surrounding wastewater plant

Table 4 - Existing Conditions Area B

4.1.2 Area Assessment

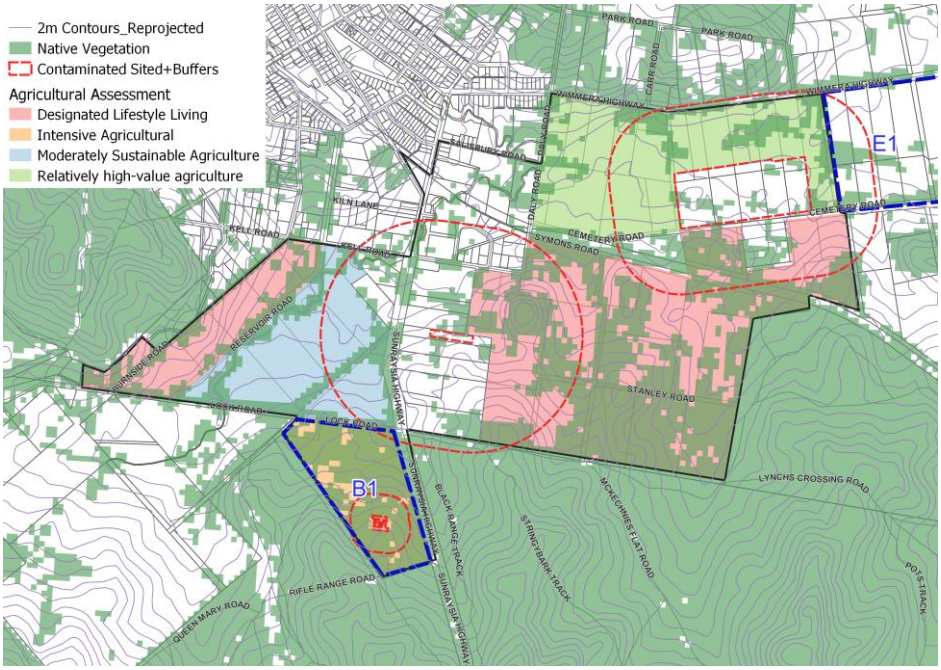

Figure 5 -Area B Land Assessment

4.1.3 Conclusion

There are a range of activities being undertaken in the area which are potentially in conflict, including some residential encroachment.

Rezone land ref B1 to protect buffer for piggery. The broiler farm in the area is problematic with a buffer that extends to adjacent RLZ2. The operation of this business appears to be contrary to INZ1 or INZ3. Subject to bushfire and flooding constraints area could support industrial use.

Green indicates arable cropping activity, designated as 'relatively high-value agriculture' however this land is not considered suitable for commercial agriculture as it has restricted access with the Wimmera Highway to the north, industrial zoning and residential encroachment to the west, railway line to the south and water treatment plant to the east. Area B also has potential bushfire related constraints, likely to have flood issues.

4.2 Areas C

4.2.1 Existing conditions

	Existing Conditions
Current Zoning	RLZ2, RLZ4
Flooding	Nil
Vegetation	Dense vegetation, becoming sparse to the north
Lot Sizes	Mostly around 8ha, with some consolidation to 20ha
Fragmentation	Moderate to high
Heritage	Nil
Potentially Contaminated Uses	Limited buffers from broiler production to the north
Proximity to Towns Core	Within 2 kms
Utilities	Limited power and water
Access	Wimmera Highway, Charlton – St Arnaud Road
Soil type	Kurosols, Dermosols,
Constraints	Township borders area to the south-west
Bushfire risk	Nil
Current agricultural activities	Minimal, small scale
Intensive agricultural uses	None noted
Topography	Undulating ridge runs roughly north-west to south-east
High value agricultural land	Nil

Table 5 - Existing Conditions Area C

4.2.2 Area assessment

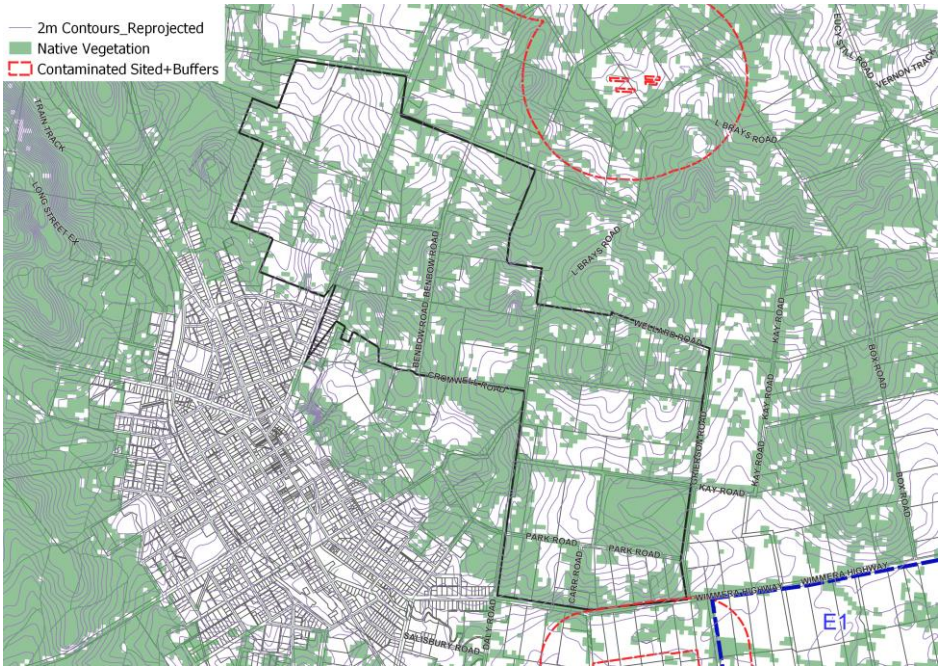

Figure 6 -Area C Land Assessment

4.2.3 Conclusion

Area C exhibits a high level of tree cover with intervening cleared areas, not generally suited for agriculture, that is more appropriately designated as lifestyle living. Elevated areas, vegetation cover and kurosols soil types make the area less conducive to agricultural production.

4.3 Area D

4.3.1 Existing conditions

	Existing Conditions
Current Zoning	RLZ2
Flooding	Flood inundation likely in some areas used for agriculture
Vegetation	Sparse
Lot Sizes	Most around 8ha, with vacant land apparent
Fragmentation	Some, consolidation of major parcel to the south
Heritage	None
Potentially Contaminated Uses	Buffer zones to northeast within 5 kms
Proximity to Towns Core	Within 2 kms
Utilities	Limited power and water
Access	Lock Road, Queen Mary Track
Soil type	Kurosols
Constraints	Reservoir within area, but does not appear in conflict with agricultural activities
Bushfire risk	Landscape risk type e
Current agricultural activities	Grazing
Intensive agricultural uses	Nil noted
Topography	Generally slopping from north to south
High value agricultural land	Nil noted

Table 6 - Existing Conditions Area D

4.3.2 Area Assessment

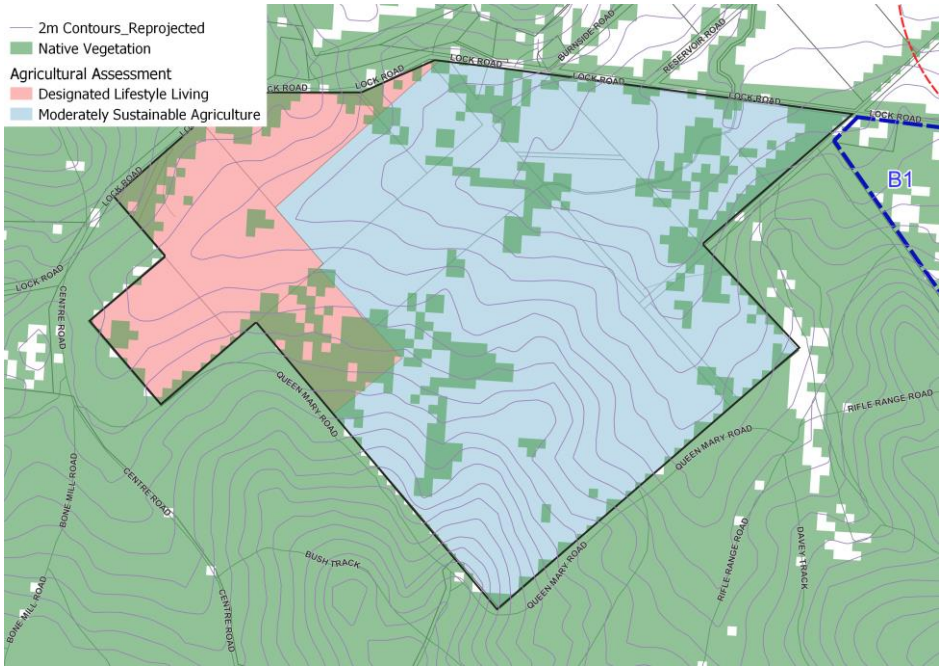

Figure 7 -Area D Land Assessment

4.3.3 Conclusion

Largely sparse land of moderate quality. Agricultural activity (grazing) is noted, however kurosols is the dominant soil type and are less conducive to agricultural production. Current zoning appears suitable.

4.4 Area E

4.4.1 Existing conditions

	Existing Conditions
Current Zoning	RL22, RLZ4, FZ
Flooding	Floodway affecting properties along the creek currently used for agriculture
Vegetation	Dense vegetation particularly north of the Wimmera Highway Regrowth noted in a number of vacant properties in the north of the precinct
Lot Sizes	Large, consolidated land south of Wimmera currently used for agriculture purposes
Fragmentation	Some, areas of consolidation throughout
Heritage	None
Potentially Contaminated Uses	Within 5km
Proximity to Towns Core	Within 4 kms
Utilities	Very limited connection to water and power No connection to sewerage
Access	Wimmera Hwy, Wedderburn Road, Cemetery Road & Carapooee Road
Soil type	Kurosols, Dermosols, Sodosols
Constraints	Water treatment plant to the west of the area, with buffer
Bushfire risk	None identified
Current agricultural activities	Mixed use including grazing, and cropping
Industrial uses	None identified
Topography	Undulating to the north, generally running towards St Arnaud Creek
High value agricultural land	Identified

Table 7 - Existing Conditions Area E

4.4.2 Area Assessment

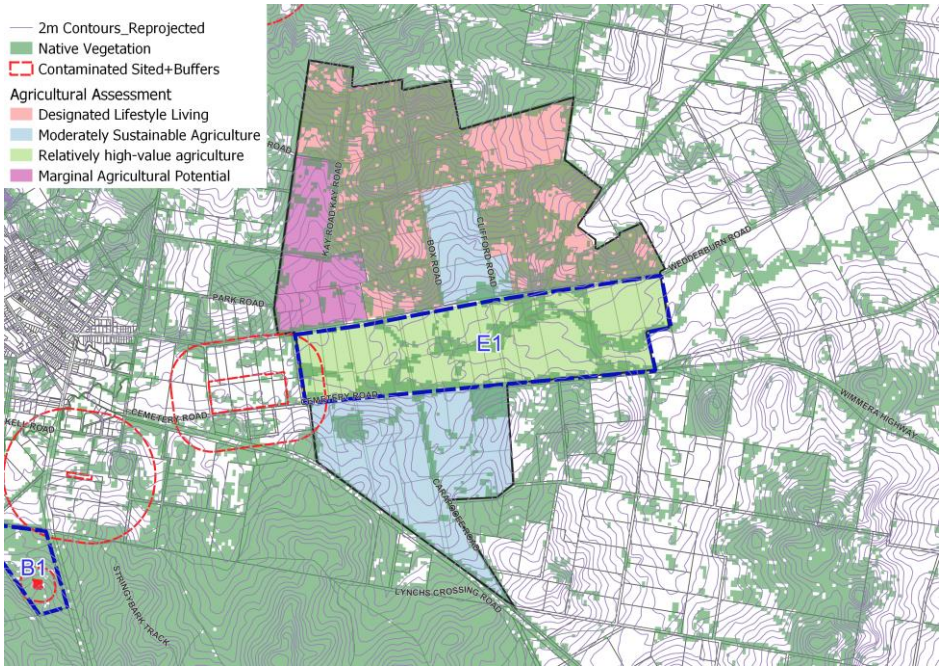

Figure 8 -Area E Land Assessment

4.4.3 Conclusion

The area north of the Wimmera Highway exhibits fragmented land use, has significant tree cover and with the identified soil types is assessed as having limited agricultural potential. As such the current RLZ is appropriate to the current land use.

The land to the south of Cemetery Road is zoned as FZ and is considered appropriate given its current land use.

E1 is currently zoned RLZ. Parts of E1 to the west and south are subject to a bushfire overlay This parcel has been identified as having relatively high potential farming potential and is such is assessed as warranting protection for agricultural production.

4.5 Area F

4.5.1 Existing conditions

	Existing Conditions
Current Zoning	RLZ2
Flooding	None
Vegetation	Dense vegetation throughout the precinct
Lot Sizes	Large 8ha + mostly vacant lots.
Fragmentation	Minimal Large, consolidated land currently used for agriculture purposes
Heritage	None
Potentially Contaminated Uses	No Known contaminated uses
Proximity to Towns Core	Withing 4 kms
Utilities	Very limited connection to water and power. No connection to sewerage
Access	Wimmera Hwy & Lock Rd leading to the town
Soil type	Kurosols, Rudosols
Constraints	None
Bushfire risk	None identified
Current agricultural activities	Minimal
Intensive agricultural uses	None identified
Topography	Undulating
High value agricultural land	None identified

Table 8 - Existing Conditions Area F

4.5.2 Area Assessment

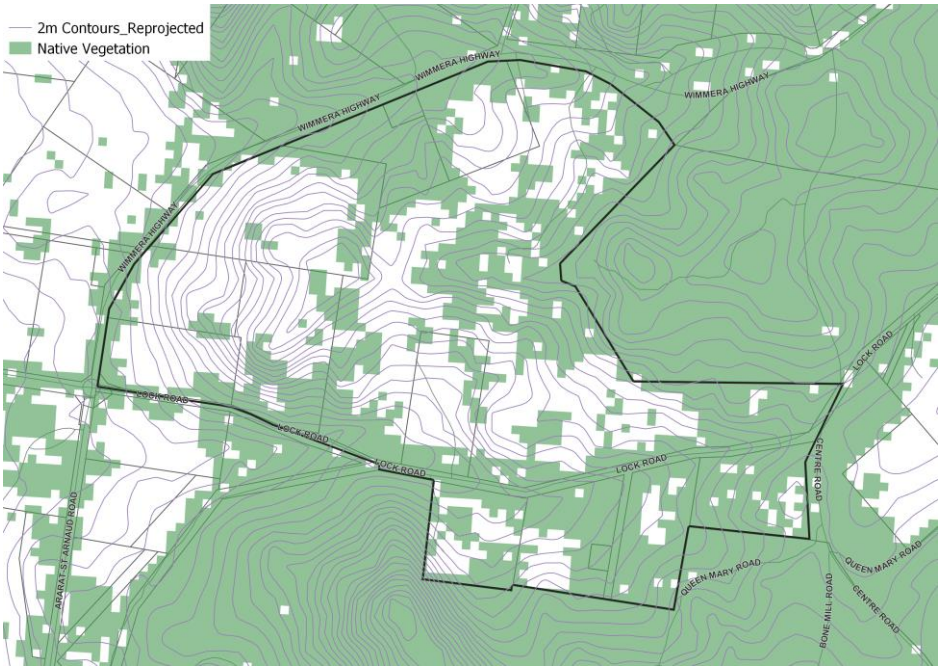

Figure 9 -Area F Land Assessment

4.5.3 Conclusion

Area F exhibits a high level of tree cover with intervening cleared areas, not generally suited for agriculture, that are more appropriately designated as lifestyle living.

Kurosols and rudosols are the predominant soil types which do not favour agricultural production. There is some sodosols in the west of the region maybe acidic and unsuitable for agricultural production.

The current zoning RLZ suitable.

4.6 Area G

4.6.1 Existing conditions

	Existing Conditions
Current Zoning	RLZ2
Flooding	None
Vegetation	Dense vegetation to the east of the precinct
Lot Sizes	Lots of around 8ha mostly vacant,
Fragmentation	Some, consolidation in west of areas where land used for farming purposes
Heritage	None
Potentially Contaminated Uses	Western area within buffer to an existing broiler farm
Proximity to Towns Core	6 km
Utilities	Very limited connection to water and power. No connection to sewerage
Access	Sunraysia Hwy leading to the town
Soil type	Sodosols, Vertosols, Rudosols
Constraints	Reservoir and parkland to the West Buffer from broiler farm outside areas extends into the northeast corner Bushfire overlay in northwest corner over St Arnaud Park Properties along the east are constrained by dense vegetation
Bushfire risk	Nil
Current agricultural activities	Mixed farming including small scale olive and viticulture production Some cropping and grazing
Intensive agricultural uses	Broiler farm outside the area, adjacent to the western boundary
Topography	Hilly to the east, generally sloping away to the west with flatter land towards the west
High value agricultural land	None identified

Table 9 - Existing Conditions Area G

4.6.2 Area assessment

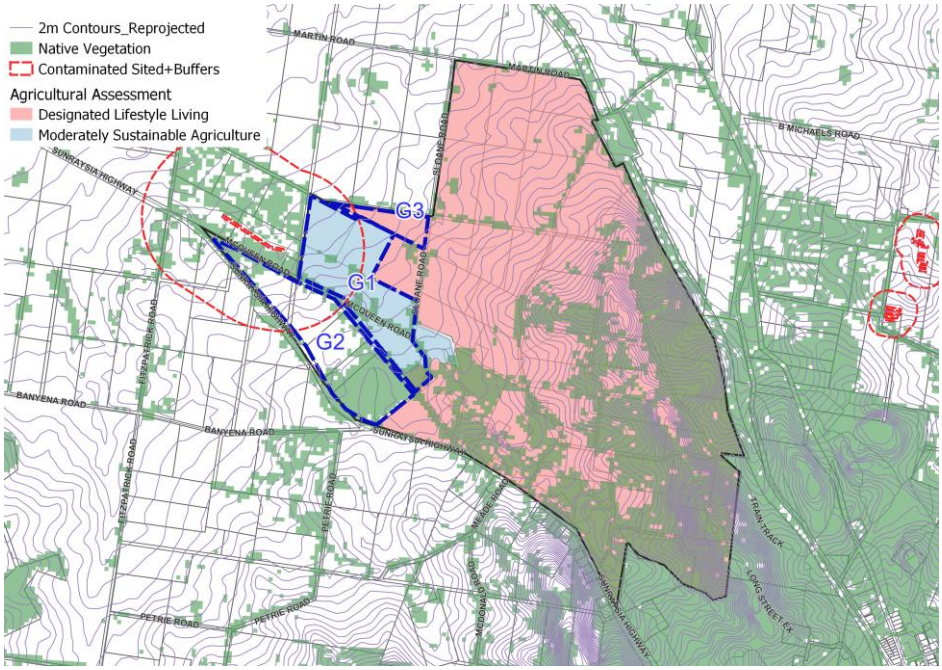

Figure 10 -Area G Land Assessment

The steeper slopes and hilly area to the east, while significantly tree covered exhibit significant bare areas with level of gravel apparent at the surface profile, generally indicative as rudosol soils with little agricultural potential.

There appears to be high occurrence of lifestyle living throughout the area, with an exception towards the west where pasture establishment would indicate grazing activity.

Zoning changes could clarify existing use and provide protection for broiler farm located outside the northeast corner of the Area. G2 contains a reservoir and parkland, which is subject to a bushfire overlay, and currently zoned RLZ.

The block one the east side of Sloane Road has a residence, preventing G1 from being extended further west. We are unsure of the ownership of G3. There appears to be some agricultural activity being undertaken on the site but it may be associated with the adjacent residential land.

4.6.3 Conclusion

Map reference – G1. Extend the FZ to the west to include land to the east of this area. This will protect existing farming operations in this area and remove existing RLZ from the buffer from the nearby broiler farm. G1 area has Sodosol soil type which may indicate soil suitable for agricultural production purposes

Map reference G2 – covers the reservoir and nearby St Arnaud Regional Park, all of which is under RLZ and parts are subject to a bushfire overlay. Rezone to a suitable conversation or public use zone

Map reference G3 – Investigate ownership and current use of this land, and if suitable extend the FZ proposed in G1 to cover G3. G3 area has Sodosol soil type which may indicate soil suitable for agricultural production purposes

Land quality issues outside of these areas and existing use means current zoning RLZ is suitable.

4.7 Area H

4.7.1 Existing conditions

	Existing Conditions
Current Zoning	FZ
Flooding	None
Vegetation	Dense vegetation to the east of the precinct
Lot Sizes	Lots of around 8ha constrained by dense vegetation.
Fragmentation	Minimal Large, consolidated lots with existing large rural industry
Heritage	Area of aboriginal heritage culture
Potentially Contaminated Uses	Broiler farms and piggeries, processing factory buffers uncertain
Proximity to Towns Core	3-4 km
Utilities	Limited connection to power. No connection to water and sewerage
Access	St Arnaud-Wycheproof Rd & Charlton St Arnaud Rd are the main access roads. Some internal/private unsealed roads.
Soil type	Sodosols, Vertosols, Rudosols, Kurosols, Dermosols
Constraints	There are a several buffers within the area relating to a number of broiler farms, piggeries and a hay storage and processing facility
Bushfire risk	Low
Current agricultural activities	Mixed farming including broadacre cropping and grazing
Intensive agricultural uses	Broiler farms, piggeries and export hay facility
Topography	For the most part either flat to undulating with some hillier areas to the south and southwest boundaries
High value agricultural land	Likely, given existing activity and soil profile

Table 10 - Existing Conditions Area H

4.7.2 Area assessment

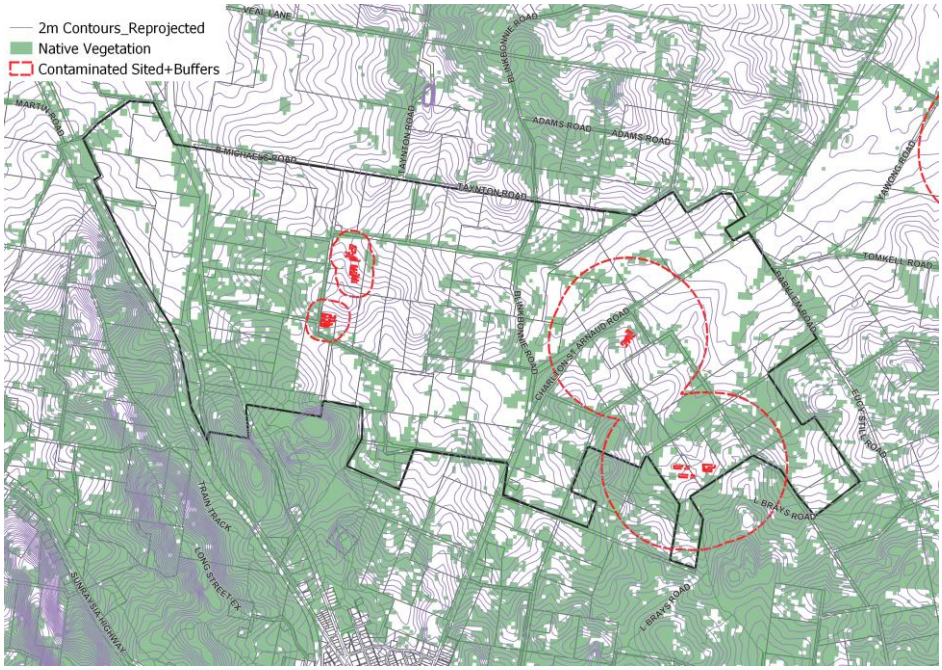

Figure 11 -Area H Land Assessment

4.7.3 Conclusion

Sodosols and dermosols are the predominate soil types, which are the most likely soil of the local types to support agricultural production. Future intensive agriculture should be accommodated in this area.

Current zoning accommodates the various buffer zone requirements of the intensive production facilities currently located within the area

Area H Is categorised as FZ which is appropriate given the mix of intensive and broadacre agricultural activity that takes place there.

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5. Recommendations

While St Arnaud is a service centre to a highly productive regional area with agriculturally significant land types, this is not necessarily the case with land within the town's immediate environs.

Given the considerations as outlined and what appears to be evidence of a retraction of past agricultural activity away from the study area, current zoning settings generally appear adequate to protect areas of current agriculturally significance with perhaps the following exceptions outlined in Figure 12 and detailed further below.

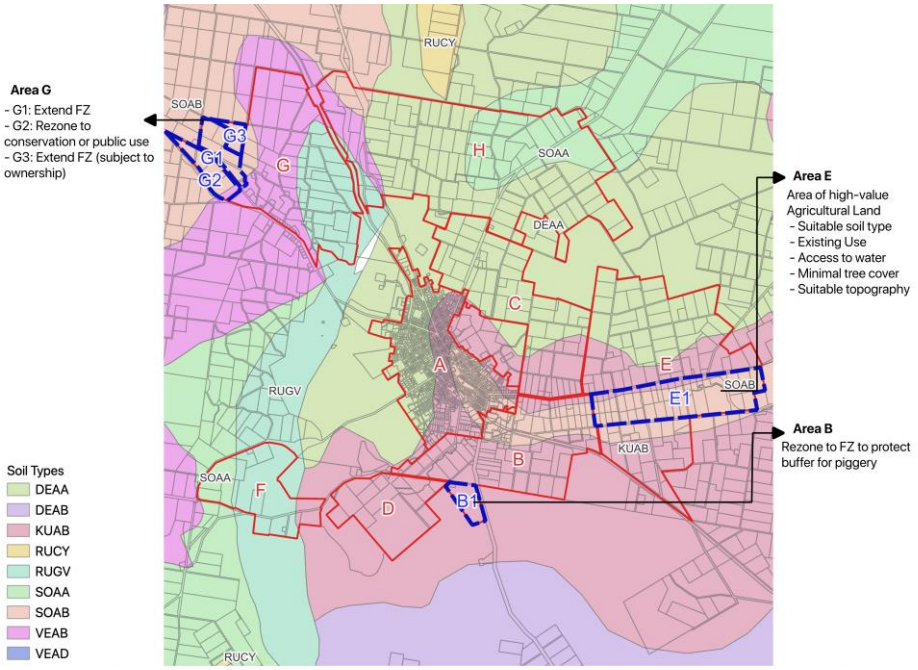


Figure 12 - Recommendation summary

5.1 Within Area B

1. Within area B1 - currently a piggery in the RLZ to the south of Lock Road with buffer zone limiting activity within area B1. Bushfire risk is also considered extreme (landscape type 4) in this area. Therefore, recommended to rezone to FZ, as the kurosols soil type will not impact current intensive agricultural production practices

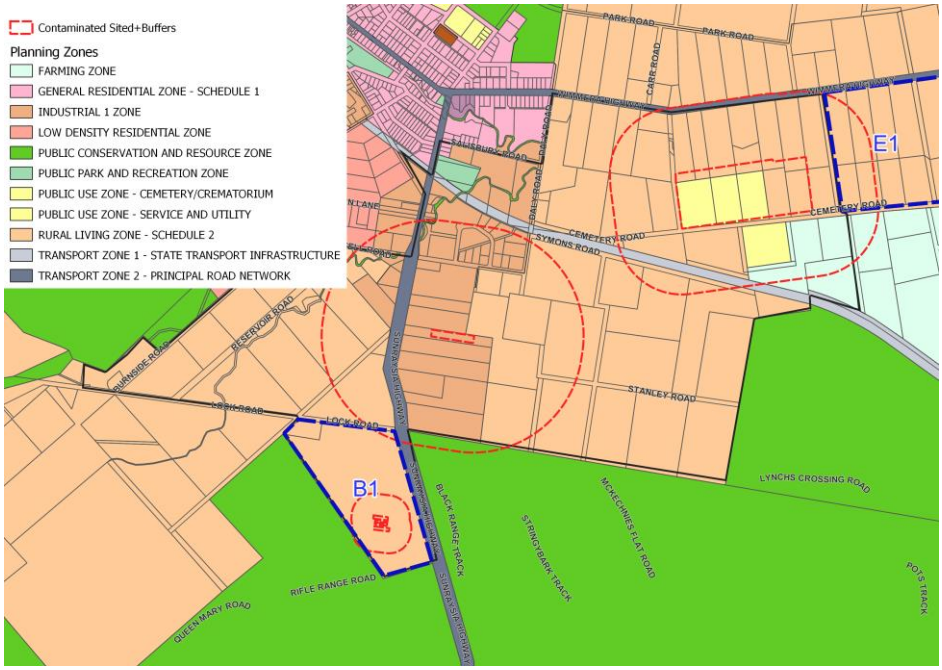


Figure 13 - Recommendation Area B

5.2 Within Area E

2. Map reference E1 - Protect high quality agricultural land running north of Cemetery Road and south of the Wimmera Highway through an expansion of existing FZ south of Cemetery Road. The E1 area exhibits production values which indicate soils suitable for arable agricultural production purposes

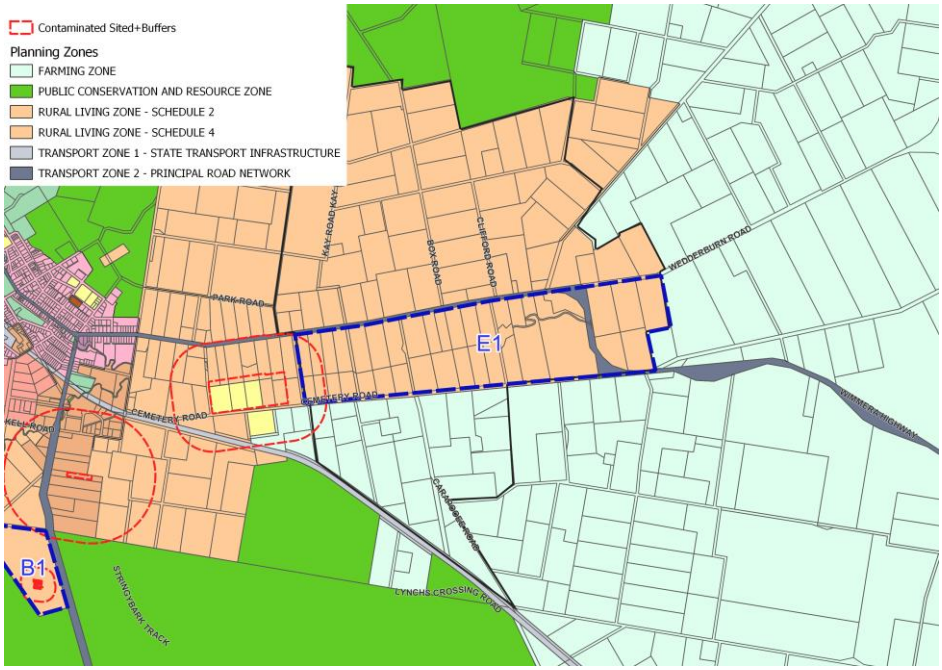


Figure 14 - Recommendation Area E

5.3 Within area G

3. Map reference – G1. Extend the FZ to the west to include land designated as G1. This will protect existing farming operations in this area and remove existing RLZ from the buffer from the nearby broiler farm. Current G1 land use appears consistent with a FZ
4. Map reference G2 – covers the reservoir and nearby St Arnaud Regional Park, all of which is under RLZ. Rezone to a suitable conversation or public use zone
5. Map reference G3 – Investigate ownership and current use of this land, and if suitable extend the FZ proposed in G1 to cover G3.

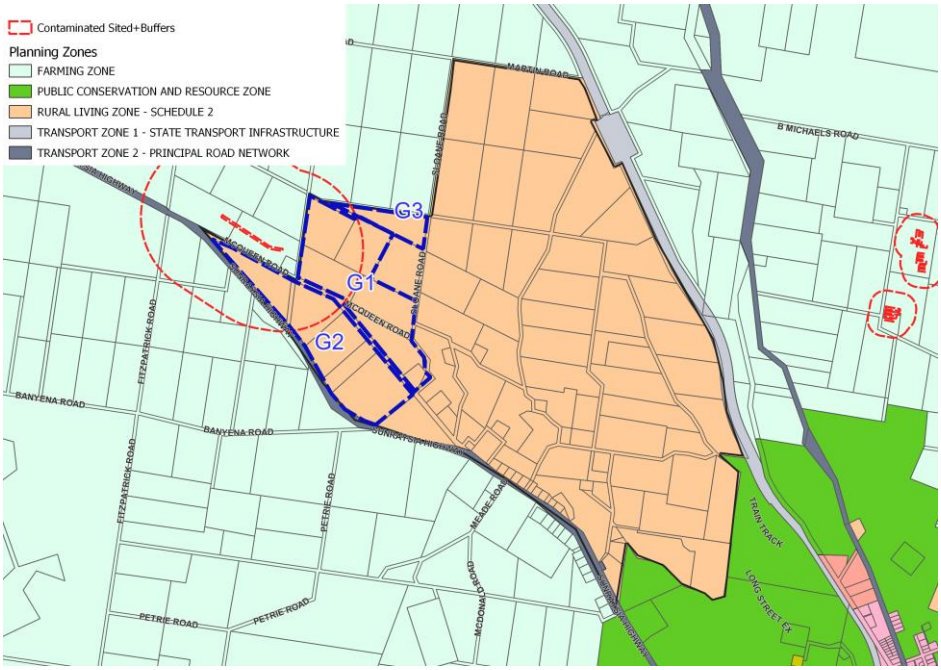


Figure 15 - Recommendation Area G

Appendix A - Relevant Soil Analyses LP 38

Location	Roughly 3 Kms SW of Town within the State Forest (In the vicinity of study area F)		
General Landscape Description	Upper slope of hillslope in State Forest. Vegetation includes Ironbark (Eucalyptus sideroxylon), Grey Box (E. microcarpa) and Golden Wattle (Acacia pycnantha).		
Australian Soil Classification	Acidic-Sodic, Eutrophic (nearly Magnesic), Red DERMOSOL		
Geology	Cambrian marine sediments (shale, quartz).		
Soil Profile Morphology	Surface Soil	A1 (0-5 cm)	Brown (7.5YR4/4); sandy clay loam; weakly structured; hardsetting surface condition; firm consistence dry; contains many (25%) siltstone fragments and a few (5%) quartz fragments; pH 5.1; clear change to:
		A2 (5-25 cm)	Yellowish red (5YR5/6) conspicuously bleached; light fine sandy clay loam; structureless; strong consistence dry; contains a common (15%) amount of siltstone and few (10%) quartz gravels; strong consistence dry; pH 4.9; clear and wavy change to:
	Subsoil	B21 (25-45 cm)	Yellowish red (5YR5/6); fine sandy clay loam; weak medium blocky structure; very strong consistence dry; contains few (10%) siltstone and very few (1%) quartz fragments; pH 5.3; wavy change to:
		B22 (45-55 cm)	Yellowish red (5YR5/6); fine sandy clay loam; moderate medium blocky structure; strong consistence dry; pH 6.0; wavy change to:
		C (55 cm +)	Weathering siltstone material; contains a 1 cm thick layer of yellowish red clay at 65 cm depth.
Key Profile Features	Lack of strong texture contrast between surface (A) horizons and subsoil (B) horizons.		
Key Profile Characteristics	Surface (A1 horizon)		Are strongly acid, have very low to medium salinity, are non-sodic, exhibiting no dispersion.
	Subsoil (25-45 horizon)		Are strongly acid, have very low salinity, are non-sodic, exhibiting moderate dispersion.
	Deeper subsoil (45-55 cm)		Are moderately acid, have very medium salinity, are sodic, exhibiting strong dispersion
Management Considerations:	Surface (A) Horizons		The surface soil is strongly acid. Aluminium becomes more soluble in soils at low pH levels. The level of exchangeable aluminium measured in the laboratory for this pit site I s reasonably high (i.e. > 50 ug/g) may restrict the growth of highly aluminium sensitive species. Deficiencies in the trace element molybdenum (Mo) are likely to occur in strongly acid soil. Soil adsorption of Mo increases as pH decreases, leading to reduced availability to plants. Deficiencies in other nutrients (e.g. potassium, phosphorus and calcium) may also occur. The surface horizons have a very low inherent fertility (based on the sum of the basic exchangeable cations).

	Subsoil (B) Horizons	The subsoil also has a low inherent fertility (based on the sum of the exchangeable basic cations). The subsoil has a high percentage of exchangeable magnesium in relation to other cations. Nutrient imbalances may occur as a result (e.g. calcium deficiency).

GLOSSARY

Base status	Is a ratio relating the major nutrient cations (Ca, Mg, K and Na) to the clay percentage in the soil. It is used as an indicator of soil fertility and is expressed in cmol (+) kg-1 clay. It is calculated by multiplying the sum of the reported basic cations by 100 and dividing by the clay percentage of the sample. Three classes are defined: dystrophic - if the sum is less than 5 (indicating low inherent fertility and/or strongly weathered profile); mesotrophic - if the sum is between 5 and 15 inclusive (indicating moderate inherent fertility and/or moderately weathered profile); and eutrophic if it is greater than 15 (indicating relatively high inherent fertility and/or low degree of profile weathering). It is used for some Great Group distinctions within the Australian Soil Classification (Isbell, 2002).
Dermosols	Soil Order of the Australian Soil Classification (Isbell, 2002). Soils that have structured B2 Horizons more developed than weak throughout the major part of the horizon. They also lack strong texture contrast between the A and B horizons
Dispersible Soils	Soils that are structurally unstable and disperse in water into basic particles i.e. sand, silt and clay. Dispersible soils tend to be highly erodible and present problems for successfully managing earth works (See Dispersion).
Dispersion	Dispersion is an indicator of sodic soils as it occurs when excessive sodium is present. When water is added, the sodium attaches to the clay and forces the clay particles apart. This results in a cloud of clay forming around the aggregate. The fine clay particles that have dispersed, clog up the small pores in the soil and degrade soil structure as well as restricting root growth and water movement. Dispersive soils usually have a high Exchangeable Sodium Percentage (ESP).

Appendix B – Soil Analysis

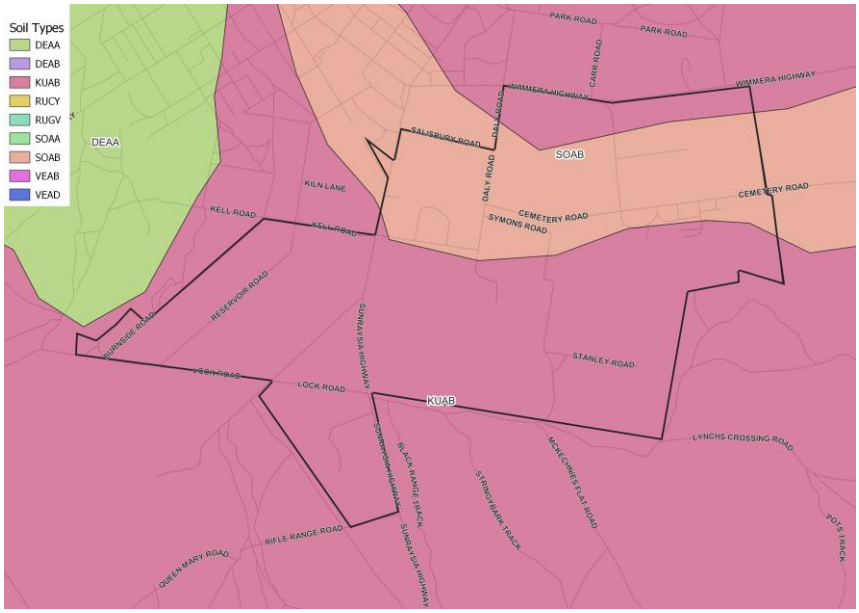
Abbreviations as outlined in accompanying Soil Maps

Study Area	Code		Class	Suborder, Great Group and Subgroup	
B, C, E & H	DEAA	DE	Dermosols	AA	Red
B, D, E & F.	KUAB	KU	Kurosols	AB	Brown
F & H.	SOAA	SO	Sodosols	AA	Red
B, E, G & H	SOAB	SO	Sodosols	AB	Brown
G, F & H	RUGV	RU	Rudosols	GV	Lutic
G, F & H	VEAA	VE	Vertosols	AA	Red

Glossary

Classification	Definition	General agricultural production characteristics
Dermosols	Soils with structured B2 horizons and lacking a strong texture-contrast between the A and B horizons. Although there is some diversity within the order, it brings together a range of soils with some important properties in common.	Dermosols generally have high agricultural potential with good structure and moderate to high chemical fertility and water-holding capacity with few problems
Kurosols	Soils with strong texture contrast between A horizons and strongly acid B horizons. Many of these soils have some unusual subsoil chemical features (high magnesium, sodium and aluminium).	The surface of Kurosol soils are often acidic. They generally have very low agricultural potential with high acidity (pH < 5.5) and low chemical fertility
Sodosols	Soils with strong texture contrast between A horizons and sodic B horizons which are not strongly acid. Australia is noteworthy for the extent and diversity of sodic soils (Isbell 1995).	Generally, sodosols have very low agricultural potential with high sodicity leading to high erodibility, poor structure and low permeability. These soils have low to moderate chemical fertility and can be associated with soil salinity
Rudosols	This order is designed to accommodate soils that have little, if any, pedologic organisation. They are usually young soils in the sense that soil forming factors have had little time to pedologically modify parent rocks or sediments. The component soils can obviously vary widely in terms of texture and depth; many are stratified and some are highly saline. Data on some of them are very limited.	Generally, are considered to have low fertility because of their coarse texture, very low clay content and minimal organic matter accumulation at the surface. The soils are strongly acid and have a low water holding capacity due to the coarse texture, abundant stones and shallow depth.
Vertosols	Clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular peds. Although many soils exhibit gilgai microrelief, this feature is not used in their definition. Australia has the greatest area and diversity of cracking clay soils of any country in the world.	These soils have moderate agricultural potential with moderate chemical fertility and water-holding capacity. They can be susceptible to soil acidification and soil structure decline. Vertosols are clay-rich soils (>35%) of uniform texture

Soil B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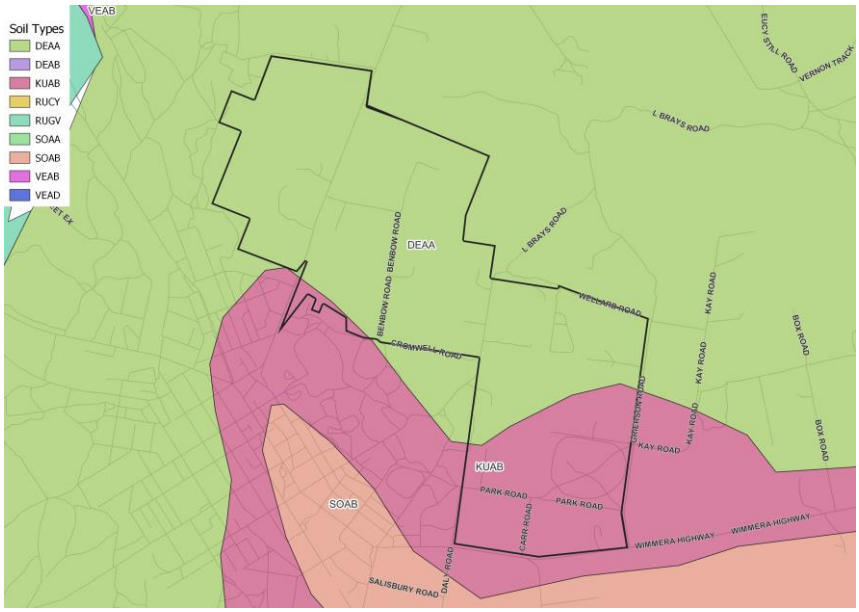
DEAB
KUAB
RUCY
RUGV
SOAA
SOAB
VEAB
VEAD
PARK ROAD
CARR ROAD
WIMMERA HIGHWAY
SALISBURY ROAD
DALY ROAD
SOAB
CEMETERY ROAD
SYMONS ROAD
KILN LANE
KELL ROAD
RESERVOIR ROAD
SUNRAYSIA HIGHWAY
STANLEY ROAD
LOCK ROAD
KUAB
LYNCHS CROSSING ROAD
BLACK RANGE TRACK
STRINGYBARK TRACK
MCKECHNIES FLAT ROAD
RIFLE RANGE ROAD
QUEEN MARY ROAD
POYS TRACK

Soil C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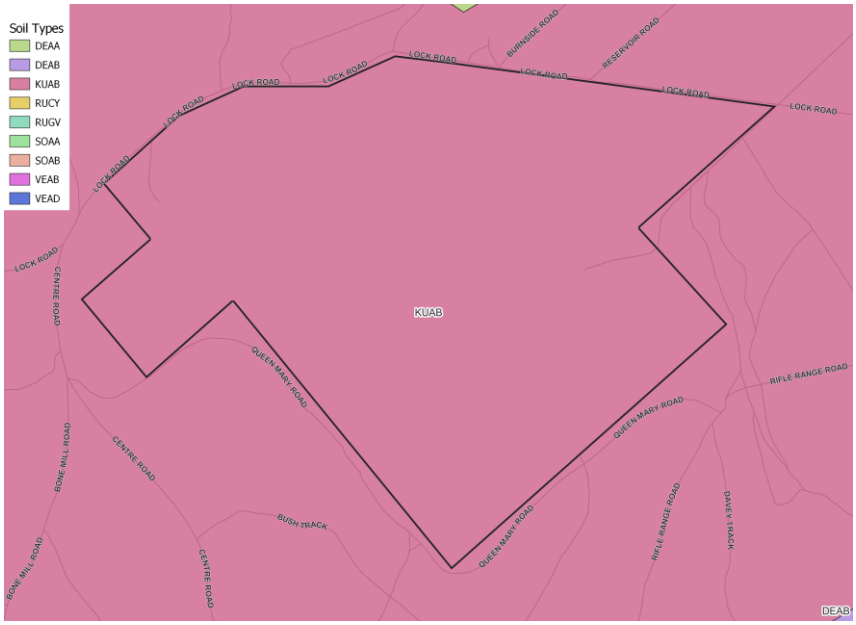
RUCY
RUGV
SOAA
SOAB
VEAB
VEAD
L BRAYS ROAD
BENBOW ROAD
DEAA
L BRAYS ROAD
WEDDERB ROAD
KAY ROAD
BOX ROAD
CROMWELL ROAD
KUAB
SOAB
PARK ROAD
CARR ROAD
WIMMERA HIGHWAY
SALISBURY ROAD
DALY ROAD
VERNON TRACK

Soil D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KUAB
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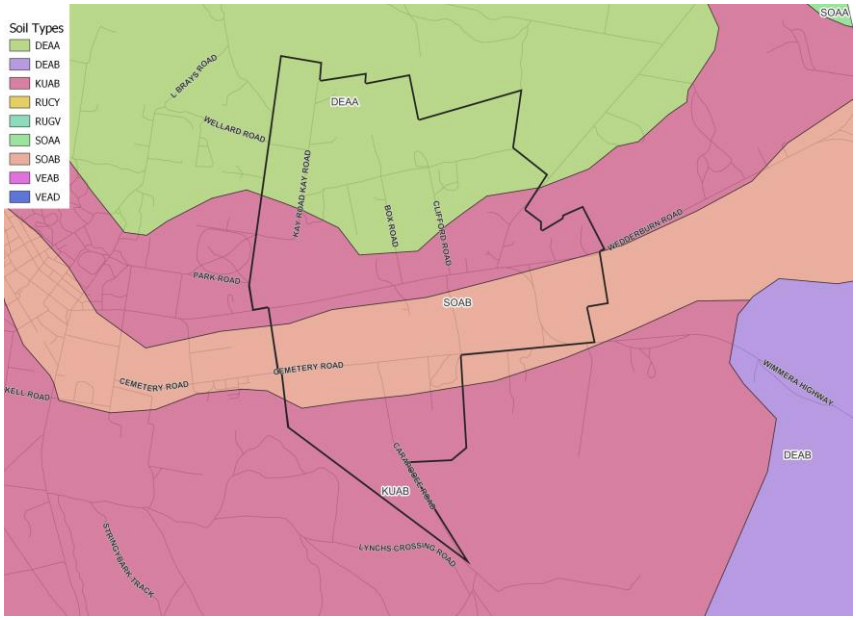
VEAD
LOCK ROAD
BURNSIDE ROAD
RESERVOIR ROAD
CENTRE ROAD
QUEEN MARY ROAD
RIFLE RANGE ROAD
BONE MILL ROAD
BUSH TRACK
DAVEY TRACK
KUAB
DEAB

Soil E


Soil Types
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VEAD
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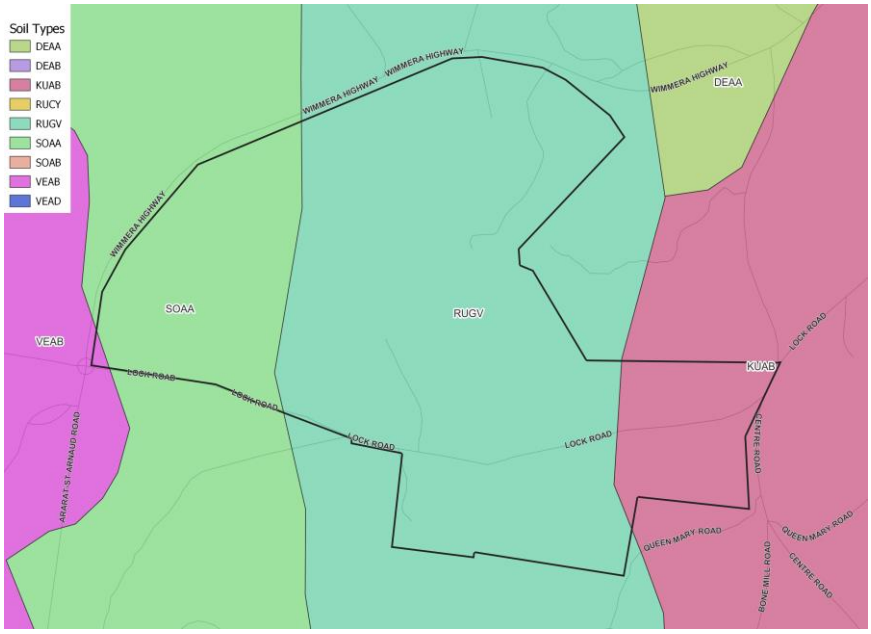
KAY ROAD
BOX ROAD
CLIFFORD ROAD
WILDFERBURN ROAD
PARK ROAD
CEMETERY ROAD
WIMMERA HIGHWAY
LYNCHS CROSSING ROAD
STRINGYBARK TRACK
DEAA
SOAB
KUAB
DEAB
SOAA

Soil F


Soil Types
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KUAB
RUCY
RUGV
SOAA
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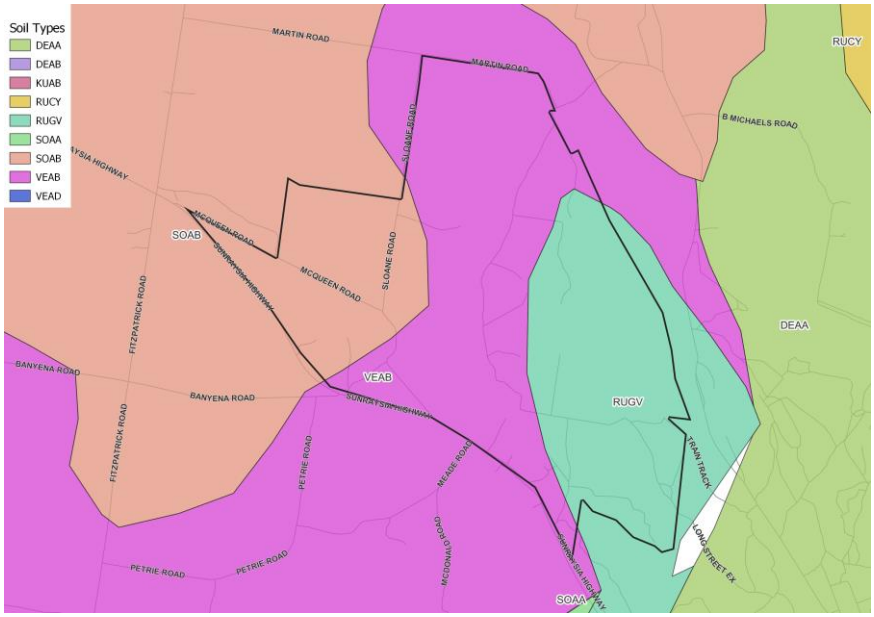
VEAD
WIMMERA HIGHWAY
SOAA
RUGV
DEAA
VEAB
KUAB
LOCK ROAD
ARARAT-ST ARNAUD ROAD
QUEEN MARY ROAD
CENTRE ROAD
BONE MILL ROAD

Soil G


Soil Types
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VEAB
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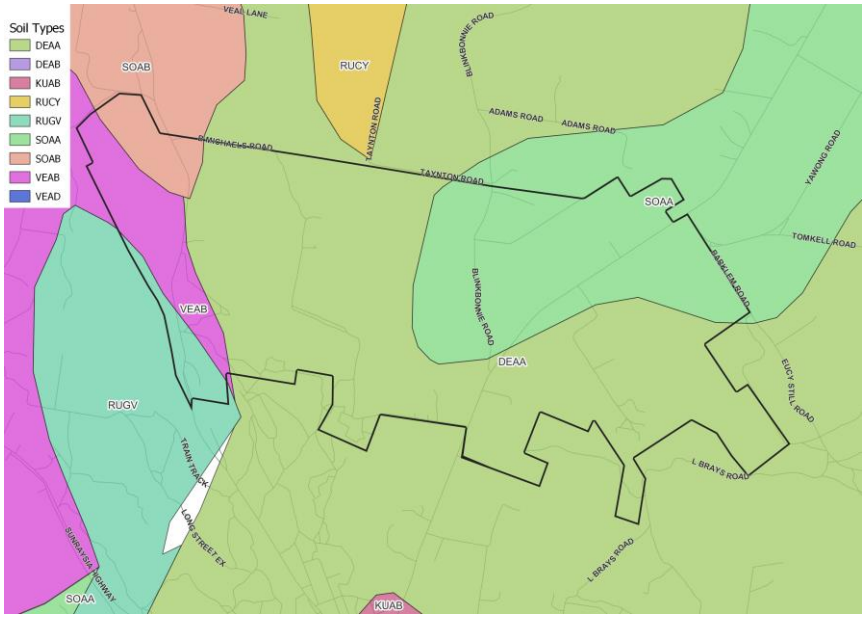
RUCY
B MICHAELS ROAD
SLOANE ROAD
SOAB
MCQUEEN ROAD
FITZPATRICK ROAD
DEAA
BANYENA ROAD
VEAB
RUGV
PETRIE ROAD
MEARS ROAD
TRAM TRACK
LONG STREET EX
SOAA

Soil H


Soil Types
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RUCY
RUGV
SOAA
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VEAB
VEAD
VEAB LANE
SOAB
RUCY
BLIMBONNIE ROAD
TAYNTON ROAD
ADAMS ROAD
ADAMS ROAD
RAMSHAELS ROAD
TAYNTON ROAD
SOAA
YAWONG ROAD
TOMKELL ROAD
BLIMBONNIE ROAD
VEAB
DEAA
RUGV
EUCY STILL ROAD
L BRAYS ROAD
TRAIN TRACK
LONG STREET EX
L BRAYS ROAD
SOAA
KUAB

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