

BAROSSA ASSESSMENT PANEL

Notice is hereby given that the fourteenth meeting of the Barossa Assessment Panel will be held at the Council Offices, 43-51 Tanunda Road, Nuriootpa on

Tuesday, 5 March 2019, commencing at 5:00 pm

Louis Monteduro
Assessment Manager



The Barossa Council

AGENDA

Please note that due to federal copyright law restrictions, attachments associated with the proposed development are available on our website for viewing only and are locked for printing or copying

NOTE: Plans contained in this agenda are subject to Copyright Laws.

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1.	WELCOME
2.	ATTENDANCE
2.1	Present
2.2	Apologies
2.3	Absent
3.	CONFIRMATION OF MINUTES

Recommendation

That the minutes of the Development Assessment Panel meeting held on Tuesday 5 February 2019 be received and confirmed. Refer *Attachment 1*.

3 Attachment 1

BAROSSA ASSESSMENT PANEL

MINUTES OF THE THIRTEENTH MEETING OF THE BAROSSA ASSESSMENT PANEL held on

Tuesday, 5 February 2019 commencing at 5:00pm

in the Council Chambers, 43-51 Tanunda Road, Nuriootpa



The Barossa Council

MINUTES

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1. WELCOME

The Presiding Member welcomed everyone, and opened the meeting at 5:03pm.

2. ATTENDANCE

2.1 Present

Panel Members

Bruce Ballantyne	Presiding Member
Rob Veitch	Member
Deirdre Reiman	Member
Grant Hewitt	Member
Richard Miller	Member

Council Staff

Louis Monteduro	Assessment Manager
Gary Mavrinac	Director, Development and Environmental Services
Janine Lennon	Senior Assessment Officer, Planning
Jake Boswell	Assessment Officer, Planning
Ashleigh Gade	Assessment Officer, Planning
Phil Harnett	Contract Planner
Steve Kaesler	Manager, Engineering Services
Chris Kruger	Minute Secretary

2.2 Apologies

Nil.

2.3 Absent

Nil.

3. CONFIRMATION OF MINUTES

Moved: G Hewitt

Seconded: R Miller

That the minutes of the Barossa Assessment Panel meeting held on Tuesday 4 December 2018 be received and confirmed.

CARRIED

4. BUSINESS ARISING

Nil.

5. DECLARATION OF INTEREST BY MEMBERS OF THE PANEL

The following disclosures have been made in relation to:

Item	Panel Member
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6.2 DA 960/504/2018 Mount Crawford Dressage Club (Installation of four light towers)	D Reiman
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Colleague and friend is a member
of the Mount Pleasant Dressage Club

6.4 DA 960/568/2018 Angaston Bowling Club	D Reiman
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Partner in a business that supplies
Lawn bowls, accessories and clothing.

6. REPORTS - APPLICATIONS FOR DECISION

6.1 960/476/2018 (54 Carlisle Street Williamstown)

Christopher and Nichola Richardson (Representors) provided a submission but did not attend to address the Panel.

Applicant

Elise and Benjamin Nelson answered questions from the Panel.

Recommendation

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.
- (b) That the proposed development is not seriously at variance with The Barossa Council Development Plan.

- (c) To REFUSE Development Plan Consent for Application No. 960/476/2018 by Elise and Benjamin Nelson to undertake Construction of a domestic outbuilding measuring 7.5m x 15m x 3.6m wall height at 54 Carlisle Street, Williamstown (CT 6052/910) for the following reasons:

The proposed development is contrary to:

- o General Section, Siting & Visibility Module Principles of Development Control 4(a) & 5.

Reason: Outbuilding will interrupt landscape views.

- o General Section, Design and Appearance Module Principles of Development Control 4(a) & 4(b)

Reason: Outbuilding will be highly visible from adjoining dwelling.

- o Township Zone Objectives 2 and 5 and Principle of Development Control 6

Reason: Outbuilding not consistent with the prevailing or desired small scale character of the Zone.

- o Residential Policy Area 7 Objectives 2

Reason: Outbuilding not consistent with the prevailing or desired small scale character of the Zone.

- o Residential Policy Area 7 and Principle of Development Control 6

Reason: Outbuilding not consistent with the quantitative parameters sought for outbuildings in this Policy Area.

Panel Decision

Moved: R Miller

Seconded: R Veitch

That the Barossa Assessment Panel defer considerations of application 960/476/2018 to enable the applicant to liaise further with Council officers in relation to height requirements of the building.

CARRIED

6.2 960/504/2018 (Allotment 329 Cowell Road Mount Crawford)

D Reiman left the meeting at 5:14pm due to a stated conflict of interest.

A Crouch (Representor) provided a submission but did not attend to address the Panel.

Representors

Judith Hodson addressed the Panel at 5:15pm, and answered questions from the Panel.

Applicant

Craig and Veronica Hannam of Mount Crawford Dressage Club addressed the Panel at 5:22pm, and answered questions from the Panel.

Recommendation

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.
- (b) That the proposed development is not seriously at variance with The Barossa Council Development Plan.
- (c) To GRANT Development Plan Consent for Application No. 960/504/2018 by the Mount Crawford Dressage Club to undertake the installation of four Light Towers (and associated generator) in association with an existing Equestrian Centre at Allot 329 Cowell Road, Mount Crawford (CT 5360/731) subject to the following reserved matter, conditions and advisory notes:

Reserved Matter

- (1) The provision of a noise management plan for events developed in conjunction with an acoustic engineer to identify potential impacts and suitable measures to reduce those effects.

Council Conditions

- (1) The development shall be undertaken in accordance with the listed endorsed plans and documentation (as amended) accompanying Application No. 960/504/2018 except where varied by any following condition(s):
 - Sports Lighting SA – preliminary lighting design – dated 2 August 2018
 - My Generator – generator specifications – dated 7 September 2018
 - Mount Crawford Dressage Club – Proposed New Site Map - undated
 - Mt Crawford Dressage Club statement dated 19 November 2018
 - Mt Crawford Dressage Club – Risk Management Policy dated September 2018

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by the Planning Authority.

- (2) The generator shall be housed in a suitably designed acoustic minimising structure.

Reason: To ensure that the proposal meets the requirements of the Environment Protection (Noise) Policy

- (3) The lights shall be turned off by 11:00 pm and shall not be turned on again prior to sunrise the next day.

Reason: To minimise the potential amenity impacts associated with the lighting.

Advisory Notes

- (a) The applicant is reminded of its general environmental duty, as required by Section 25 of the Environment Protection Act 1993, to take all reasonable and practicable measures to ensure that the activities on the whole site including during construction, do not pollute the environment in a way which causes or may cause environmental harm.

Panel Decision

Moved: R Veitch

Seconded: G Hewitt

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.
- (b) That the proposed development is not seriously at variance with The Barossa Council Development Plan.
- (c) To GRANT Development Plan Consent for Application No. 960/504/2018 by the Mount Crawford Dressage Club to undertake the installation of four Light Towers (and associated generator) in association with an existing Equestrian Centre at Allot 329 Cowell Road, Mount Crawford (CT 5360/731) subject to the following reserved matter, conditions and advisory notes:

Reserved Matter

- (1) The provision of a noise management plan for events developed in conjunction with an acoustic engineer to identify potential impacts and suitable measures to reduce those effects.

Council Conditions

- (1) The development shall be undertaken in accordance with the listed endorsed plans and documentation (as amended) accompanying Application No. 960/504/2018 except where varied by any following condition(s):

- Sports Lighting SA – preliminary lighting design – dated 2 August 2018
- My Generator – generator specifications – dated 7 September 2018
- Mount Crawford Dressage Club – Proposed New Site Map - undated
- Mt Crawford Dressage Club statement dated 19 November 2018
- Mt Crawford Dressage Club – Risk Management Policy dated September 2018

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by the Planning Authority.

- (2) The generator shall be housed in a suitably designed acoustic minimising structure.

Reason: To ensure that the proposal meets the requirements of the Environment Protection (Noise) Policy

- (3) The lights shall be turned off by 11:00 pm and shall not be turned on again prior to sunrise the next day.

Reason: To minimise the potential amenity impacts associated with the lighting.

- (4) No more than four events using supplemental lighting shall be held at the site per calendar year.

NOTE: If one event is to be held over multiple days, each day shall be considered to be an "event".

Reason: To minimise the potential amenity impacts associated with the events.

Advisory Notes

- (a) The applicant is reminded of its general environmental duty, as required by Section 25 of the Environment Protection Act 1993, to take all reasonable and practicable measures to ensure that the activities on the whole site including during construction, do not pollute the environment in a way which causes or may cause environmental harm.

CARRIED

D Reiman returned to the meeting at 5:42pm.

Representors

Tom and Leeanne Halfpenny addressed the Panel at 5:43pm, and answered questions from the Panel.

Rozlynn Seppelt addressed the Panel at 5:52pm, and answered questions from the Panel.

Applicant

Marco Forg addressed the Panel at 5:56pm, and answered questions from the Panel.

Recommendation

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.
- (b) That the proposed development is not seriously at variance with The Barossa Council Development Plan.
- (c) To GRANT Development Plan Consent for Application No. 960/501/2018 by Marco Forg to undertake Tourist Accommodation (Camp Ground) with associated car parking, toilet and use of barn for extreme weather refuge when needed at 263 Laubes Road, Springton (CT 5302/69) subject to the following conditions and advisory notes:

Council Conditions

- (1) The development shall be undertaken in accordance with the endorsed (stamped) plans and documentation accompanying the application as amended and including:
 - Untitled Plans
 - Undated letter from Marco and Evie

unless varied by the following conditions.

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by The Barossa Council.

- (2) A toilet shall be provided on-site for guests in accordance with the relevant environmental health legislation and situated:

- At least 50 metres from a bore well or watercourse identified as a blue line on a current series 1:50,000 government standard topographic map.
 - In areas that are not subject to inundation by a 1 in 100 year average return interval flood or sited on land fill that would interfere with the flow of such flood waters.
- (3) Prior to the issuing of Development Approval a wastewater **application and engineer's** report outlining the type and size of system to be installed to deal with effluent as per the *Public Health (Wastewater) Regulations 2011*, to the satisfaction of Council, must be submitted to and approved by Council. When approved, the plan will be endorsed and will then form part of this consent.

Reason: To ensure the land is developed in an orderly manner.

- (4) The use and development must be managed so that the amenity of the area is not detrimentally affected, to the satisfaction of Council, through the:
- Transport and storage of materials, goods or commodities to or from the land.
 - Appearance of any building, works or materials.
 - Emission of noise, artificial light, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, waste water, waste products, grit or oil.
 - Presence of vermin.

Reason: To ensure that there is no adverse amenity impacts on the locality.

- (5) No more than 30 guests shall reside on the land at any one time.

Reason: To ensure that there is no adverse amenity impacts on the locality.

- (6) No sound amplification equipment or loudspeakers are to be used for the purpose of announcement, broadcast, playing of music or similar purpose unless in the case of an emergency (ie bushfire warning).

Reason: To ensure that there is no adverse amenity impacts on the locality.

- (7) Rubbish, machinery or other goods (other than the personal items of campers) must not be stored or left exposed outside so as to be visible from any public road or thoroughfare, to the satisfaction of Council.

Reason: To maintain the open rural character and amenity of the locality.

- (8) A bushfire survival plan shall be prepared and supported by Council and the Country Fire Service (CFS) prior to commencement of the use and the issue of Development Approval.

Reason: To better ensure the safety of all occupants.

- (9) Grasses within the primary campground area shall be reduced to a height of 10cms during the Fire Danger Season.

Reason: To minimise bushfire risk and enhance safety.

- (10) Safe and convenient access/egress shall be provided to the primary campground area for fire-fighting vehicles as follows:

- Access shall be of all-weather construction, with a minimum formed road surface width of 4 metres and must allow forward entry and exit for large fire fighting vehicles.
- all dead end roads or tracks shall be constructed to allow large fire fighting vehicles to turn around with safety by use of either:
 - a) a turnaround area with a minimum formed road surface diameter of 25 metres; or
 - b) a "T" or "Y" shaped turnaround area with minimum formed road surface leg lengths of 7.5 metres and minimum inside road radii of 8.5 metres.
- All road curves shall have a minimum inside road radii of 8.5 metres.
- Solid crossings over waterways shall be provided to withstand the weight of large bushfire appliances (GVW 21 tonnes).
- Vegetation overhanging the access road shall be pruned to achieve a minimum vertical height clearance of 4 metres.

Reason: To enhance safety in the case of a fire and facilitate suitable maneuvering for fire fighting vehicles.

- (11) The subject land is located within a Medium Bushfire Risk area.

A dedicated and independent water supply shall be available at all times for firefighting purposes which;

- (a) Is located in a convenient location on the allotment and accessible to firefighting vehicles (safe and convenient access shall be provided), and
- (b) Comprises a minimum of 2000 litres of water where the property is connected to mains water, or 5000 litres in any

other case (any rainwater tank used for this purpose should be dedicated entirely for firefighting and shall be of non-combustible materials).

The provision of the dedicated water supply for fighting purposes shall comply with the **Ministers Specification SA 78 'Bushfire fighting equipment and water supply requirements in designated bushfire prone areas'**.

Reason: To ensure an available water resource in the case of a fire.

Advisory Notes

- (1) Please note that the subject land is affected by the *Native Vegetation Act 1991* and *Native Vegetation Regulations 2017* and as such further approval from the Native Vegetation Council may be required should any native vegetation be sought to be removed or adversely affected.
- (2) In accordance with the Fire and Emergency Services Act 2005 the owner or occupier of the land must, at all times, take reasonable steps to:
 - (a) Prevent or inhibit the outbreak of fire on the land.
 - (b) Prevent or inhibit the spread of fire through the land.
 - (c) Protect property on the land from fire.
 - (d) Minimise the threat to human life from a fire on the land.
- (3) The applicant is reminded of its general environmental duty, as required by Section 25 of the Environment Protection Act 1993, to take all reasonable and practicable measures to ensure that the activities on the whole site including during construction, do not pollute the environment in a way which causes or may cause environmental harm.

Panel Decision

Moved: R Veitch

Seconded: R Miller

That the recommendation be adopted.

CARRIED

6.4 960/568/2018 (Lot 21 Valley Road Angaston)

D Reiman left the meeting at 6:18pm due to a stated conflict of interest.

Representors

Peter Miles addressed the Panel at 6:20pm, and answered questions from the Panel.

Applicant

Graham Burns (Masterplan SA), on behalf of Angaston Bowling Club addressed the Panel at 6:25pm, and answered questions from the Panel.

Recommendation

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.
- (b) That the development proposal is not seriously at variance to The Barossa Council Development Plan.
- (c) To GRANT Development Plan Consent for Application No. 960/568/2018 by Angaston Bowling Club Inc. to undertake Construction of two bowling greens, clubhouse (community centre), six light towers, associated car parking, landscaping and entrance sign at allotment 21 Valley Road, Angaston (CT 5263/647) subject to the concurrence of the State Planning Commission, and subject to the following conditions and advisory notes:

Reserved Matters

- (1) A stormwater drainage design including a Stormwater and Site Management Plan with supporting computations must be submitted to and approved by Council prior to the issue of Building Rules Consent and to the satisfaction of Council. The stormwater drainage design shall comply with the requirements listed below.
 - The plan shall at least include existing contours, features, existing stormwater infrastructure, proposed site works details, levels and grading, proposed stormwater drainage system, details of detention facility including volumes and discharge controls, proposed building floor levels, proposed paving and connection details to and any upgrading if required of the existing external drainage systems.
 - Detention shall be provided to limit the 1% AEP post-development peak discharge to the 5% pre-development peak discharge from the site.
 - No stormwater runoff from the site shall be permitted to discharge onto any adjacent property or the footpath verge, however;
 - The controlled discharge from the site shall be connected safely to the adjacent watercourse, and shall be consistent with the capacity of the system.

- The discharge point to the watercourse shall incorporate scour protection measures and shall not obstruct flows in the watercourse.
 - All necessary approvals from the relevant authority must be sought for discharging into the watercourse.
 - Pollution control devices shall be incorporated within the development to provide for the removal of gross pollutants, silt, grease and oil and possible harmful chemical pollutants.
- (2) The development must be connected to the SA Water sewer system or a waste system that complies with the relevant public and environmental health legislation to the satisfaction of Council.

Prior to the issue of Building Rules Consent the applicant shall satisfy either 'a' or 'b' below:

- (a) Liaise with SA Water and provide written confirmation to Council that the proposal will be connected to the SA Water sewer system at the applicants expense.

Please note: It is understood that the subject land does not currently have a connection to the SA Water sewer. A connection may be available in the future however its timing and the possibility of connection based on the design is unknown.

- (b) Lodge and obtain approval for an on-site waste management and disposal system that complies with the relevant public and environmental health legislation.

- (3) Prior to the issue of Building Rules Consent and to the satisfaction of Council, the applicant shall provide a rubbish collection plan which clearly details:

- (a) The type and size of bins to be used and collected.
- (b) The location of their collection.
- (c) The contractor to be used, if not council collection.

Council Conditions

- (1) The development shall be undertaken in accordance with the endorsed plans and documentation accompanying the application, as amended and including:
- Statement of Support prepared by MasterPlan SA Pty Ltd dated October 2018.
 - Statement of Effect prepared by MasterPlan SA Pty Ltd dated 6 November 2018.
 - Coversheet, Perspective and Block Plan prepared by JBG Architects - Drawing Number A000 – Issue E.

- Site Plan prepared by JBG Architects - Drawing Number A002 – Issue E.
- Floor Plan Presentation prepared by JBG Architects - Drawing Number A100 – Issue E.
- Floor Plan prepared by JBG Architects - Drawing Number A101 – Issue D.
- Reflected Ceiling Plan and Roof Plan prepared by JBG Architects - Drawing Number A131 – Issue D.
- Elevations Presentation prepared by JBG Architects - Drawing Number A201 – Issue E.
- Sections prepared by JBG Architects - Drawing Number A301 – Issue D.
- Detail Plans prepared by JBG Architects - Drawing Number A401 – Issue D.
- Wet Area Details prepared by JBG Architects - Drawing Number A701 – Issue B.
- Perspectives Exterior prepared by JBG Architects - Drawing Number A901 – Issue D.
- Perspectives interior prepared by JBG Architects - Drawing Number A911 – Issue D

Unless varied by the following conditions.

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by The Barossa Council.

- (2) The premises shall not be used outside the hours of 6.00 am and 10.00 pm daily.

Reason: To maintain the amenity of the locality with respect to lighting and noise.

- (3) Any musical entertainment associated with the proposed use shall be contained indoors and limited to non-amplified acoustic music within the authorized hours of operation.

Reason: To minimise noise impacts upon the locality.

- (4) Any metal roof and wall cladding shall be of a 'Colorbond' type of finish (or a similar factory applied colour finish) in a muted green, brown, beige or other colour to blend with the natural features of the landscape or nearby buildings.

Reason: To ensure all buildings and structures are sympathetic to the locality.

- (5) All of the car park, driveway and vehicle maneuvering areas shall be sealed with bitumen, brick paving or concrete, line-marked and appropriately drained to ensure safe and convenient vehicle movements free of dust and mud, prior to the occupation of the use. For this purposes, the car park and vehicle maneuvering areas shall be maintained in suitable condition at all times.

Reason: To ensure safe and convenient vehicle movements that do not impact upon the amenity of the locality.

- (6) Each car parking space or area abutting a walkway, footpath, landscaped area or fence shall be provided with a vehicle wheel stop prior to the occupation of use of the development.

Reason: To ensure safe and convenient vehicle movements.

- (7) All lighting shall be directed and shaded in such a manner so as to cause no light spill nuisance to any person living in the vicinity of the subject land or to nearby vehicular traffic. Flood lights shall be turned off outside of the authorised operating hours (6.00am to 10.00 pm daily).

Reason: To prevent light nuisance to neighboring properties.

- (8) The landscaping as detailed in the application for development shall comprise locally indigenous species and be established prior to occupation/use of the development. Landscaping shall be maintained in good health and condition at all times with any such vegetation replaced if and when it dies or becomes seriously diseased with others of the same, or similar, respective varieties.

Reason: To enhance the appearance of the property and maintain the amenity of the locality.

- (9) Any battered land shall be planted with locally indigenous vegetation to stabilise soil from any erosion. The vegetation shall be planted prior to occupation/use of the development.

Reason: To prevent long term erosion and enhance the appearance of the resulting landform.

- (10) Dust emissions from the site shall be controlled by a dust suppressant or by watering regularly to the reasonable satisfaction of Council.

Reason: To minimize dust nuisance to surrounding properties.

- (11) During construction or installation of all works associated with the development and proposed roads and utility services:

- Dust generated at the site shall be reasonably controlled at all times to prevent nuisance to occupants of adjoining land.
- Noise generated at the site shall be kept to the minimum level that is reasonably practicable.
- Appropriate erosion control measures shall be employed to prevent soil removal from the site by stormwater runoff, and to prevent siltation of watercourses, to the reasonable satisfaction of Council's Director – Works and Engineering.

- Any dirt or debris from the site deposited onto existing roadways by the applicant's contactors or sub-contractors shall be cleared immediately.

Reason: To minimise nuisance to surrounding properties during construction.

- (12) Temporary debris and sediment control measures shall be installed to prevent debris and sediment from entering Council's drainage system during all construction stages. Control measures shall be in accordance with a Site Management Plan which shall provide such pollution prevention measures as required to comply with the "Environmental Protection Authority's Stormwater Pollution Prevention Codes of Practice".

- For the Community
- For Local, State and Federal Government
- For the Building and Construction Industry

Temporary debris and sediment control measures shall be in place prior to construction commencing and shall be maintained at all times during construction. Prior to a Development Approval being granted a copy of the site management plan shall be lodged with and approved by Council.

Reason: To prevent pollution to the nearby watercourse and to ensure sound site management practices.

Advisory Note

- (a) The applicant is reminded of its general environmental duty, as required by Section 25 of the Environment Protection Act 1993, to take all reasonable and practicable measures to ensure that the activities on the whole site including during construction, do not pollute the environment in a way which causes or may cause environmental harm.

Panel Decision

Moved: R Miller

Seconded: R Veitch

That the recommendation be adopted.

CARRIED

D Reiman returned to the meeting at 6:34pm.

6.5 960/583/2018 (Piece 31 Steingarten Road Rowland Flat)

Recommendation

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.
- (b) That the development proposal is not seriously at variance to The Barossa Council Development Plan.
- (c) To GRANT Development Plan Consent for Application No. 960/583/2018 by Bryce Mark Neyland to Increase size of Existing Dam from 37.4 ML to 150 ML, 6.0 m high dam walls and relocation of associated pump station at Piece 31 Steingarten Road, Rowland Flat (CT 5157/647) subject to the concurrence of the State Planning Commission, and subject to the following conditions and advisory notes:

Council conditions

- (1) The development shall be undertaken in accordance with the endorsed plans and documentation accompanying the application as amended and including:
 - Statement of Effect prepared by Appius Pty Ltd (Bryce Neyland) – Revision A – 2018.11.20.
 - PER-ROW-EW-002 - Locality and Index prepared by Appius Pty Ltd – Revision B – 12.10.18.
 - PER-ROW-EW-002 - Dam Layout prepared by Appius Pty Ltd – Revision B – 12.10.18.
 - PER-ROW-EW-003 - Final Set Out Plan prepared by Appius Pty Ltd – Revision B – 12.10.18.
 - PER-ROW-EW-004 - Excavation Set Out Plan prepared by Appius Pty Ltd – Revision B – 12.10.18.
 - PER-ROW-EW-006 - Details prepared by Appius Pty Ltd – Revision B – 12.10.18.
 - Engineering Report/Technical Specification prepared by Appius Pty Ltd – Revision A – 2018.10.12.

Unless varied by the following conditions.

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by the Planning Authority

- (2) The capacity of the storage dam shall not exceed 150 ML.

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by the Planning Authority.

- (3) The dam and all associated works (including the spillway, the overflow channel) shall be designed by and constructed under the supervision of a suitably qualified and experienced engineer.

Reason: To ensure all components of the authorised development are suitably engineered, stable and safe.

- (4) The dam walls shall be constructed in accordance with sound engineering specifications and practice, being capable at all times to retain the designed capacity.

Reason: To ensure the authorised development is suitably engineered, stable and safe.

- (5) The spillway shall be designed to pass safely an estimated 1 in 100 year average recurrence interval flood.

Reason: To ensure the safe management of overflow water.

- (6) The spillway shall be constructed from non-erodible materials to the satisfaction of Council's Director – Works & Engineering.

Reason: To ensure the spillway remains in a suitable condition at all times and does not erode.

- (7) The walls of the dam (the batter) shall be planted with locally indigenous vegetation to minimise the visual impact of the dam walls and any erosion. The vegetation shall be carefully selected to prevent damage to the dam by way of root invasion, soil disturbance or plant overcrowding. The vegetation shall be planted within 3 months of the dams operation.

Reason: To enhance the visual appearance of the dam and minimise erosion.

- (8) Construction shall take place between 7.00 am and 7.00 pm Monday to Saturday and not before 9.00 am or after 5.00 pm on Sunday and public holidays and the builder must take all practicable steps to minimise the impact of noise emissions on neighboring properties.

Reason: To maintain the amenity of the locality.

- (9) Dust emissions from the site shall be controlled by a dust suppressant or by watering regularly to the reasonable satisfaction of Council.

Reason: To maintain the amenity of the locality.

- (10) Any metal roof and wall cladding shall be of a 'Colorbond' type of finish (or a similar factory applied colour finish) in a muted green, brown, beige or other colour to blend with the natural features of the landscape or nearby buildings.

Reason: To maintain the scenic qualities and visual appeal of the locality.

Advisory Notes

- (a) The applicant is reminded of its general environmental duty, as required by Section 25 of the Environment Protection Act 1993, to take all reasonable and practicable measures to ensure that the activities on the whole site including during construction, do not pollute the environment in a way which causes or may cause environmental harm.

Panel Decision

Moved: G Hewitt

Seconded: D Reiman

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.
- (b) That the development proposal is not seriously at variance to The Barossa Council Development Plan.
- (c) To GRANT Development Plan Consent for Application No. 960/583/2018 by Bryce Mark Neyland to Increase size of Existing Dam from 37.4 ML to 150 ML, 6.0 m high dam walls and relocation of associated pump station at Piece 31 Steingarten Road, Rowland Flat (CT 5157/647) subject to the concurrence of the State Planning Commission, and subject to the following conditions and advisory notes:

Council conditions

- (1) The development shall be undertaken in accordance with the endorsed plans and documentation accompanying the application as amended and including:
- Statement of Effect prepared by Appius Pty Ltd (Bryce Neyland) – Revision A – 2018.11.20.
 - PER-ROW-EW-002 - Locality and Index prepared by Appius Pty Ltd – Revision B – 12.10.18.
 - PER-ROW-EW-002 - Dam Layout prepared by Appius Pty Ltd – Revision B – 12.10.18.
 - PER-ROW-EW-003 - Final Set Out Plan prepared by Appius Pty Ltd – Revision B – 12.10.18.
 - PER-ROW-EW-004 - Excavation Set Out Plan prepared by Appius Pty Ltd – Revision B – 12.10.18.
 - PER-ROW-EW-006 - Details prepared by Appius Pty Ltd – Revision B – 12.10.18.
 - Engineering Report/Technical Specification prepared by Appius Pty Ltd – Revision A – 2018.10.12.

Unless varied by the following conditions.

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by the Planning Authority

- (2) The capacity of the storage dam shall not exceed 150 ML.

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by the Planning Authority.

- (3) The dam and all associated works (including the spillway, the overflow channel) shall be designed by and constructed under the supervision of a suitably qualified and experienced engineer.

Reason: To ensure all components of the authorised development are suitably engineered, stable and safe.

- (4) The dam walls shall be constructed in accordance with sound engineering specifications and practice, being capable at all times to retain the designed capacity.

Reason: To ensure the authorised development is suitably engineered, stable and safe.

- (5) The spillway shall be designed to pass safely an estimated 1 in 100 year average recurrence interval flood.

Reason: To ensure the safe management of overflow water.

- (6) The spillway shall be constructed from non-erodible materials to the satisfaction of Council's Director – Works & Engineering.

Reason: To ensure the spillway remains in a suitable condition at all times and does not erode.

- (7) The walls of the dam (the batter) shall be planted with locally indigenous vegetation to minimise the visual impact of the dam walls and any erosion. The vegetation shall be carefully selected to prevent damage to the dam by way of root invasion, soil disturbance or plant overcrowding. The vegetation shall be planted within 3 months of the dams operation.

Reason: To enhance the visual appearance of the dam and minimise erosion.

- (8) Construction shall not take place on any Sunday or Public Holiday or after 7pm or before 7am on any other day, and all practicable steps must be taken during construction to minimise the impact of noise emissions on neighboring properties.

Reason: To maintain the amenity of the locality.

- (9) Dust emissions from the site shall be controlled by a dust suppressant or by watering regularly to the reasonable satisfaction of Council.

Reason: To maintain the amenity of the locality.

- (10) Any metal roof and wall cladding shall be of a 'Colorbond' type of finish (or a similar factory applied colour finish) in a muted green, brown, beige or other colour to blend with the natural features of the landscape or nearby buildings.

Reason: To maintain the scenic qualities and visual appeal of the locality.

Advisory Notes

- (b) The applicant is reminded of its general environmental duty, as required by Section 25 of the Environment Protection Act 1993, to take all reasonable and practicable measures to ensure that the activities on the whole site including during construction, do not pollute the environment in a way which causes or may cause environmental harm.

CARRIED

6.6 960/279/2017 (Allotment 897 N Herbig Road Springton)

S Kaesler (Manager, Engineering Services) answered questions from the Panel.

Recommendation

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.
- (b) That the proposed development is not seriously at variance with The Barossa Council Development Plan.
- (c) To REFUSE Development Plan Consent for Application No. 960/279/2017 by JBG Architects to undertake a Detached Dwelling with verandahs under main roof and Domestic Outbuilding (shed) at Allot 897 N Herbig Road, Springton (CT 5641/642) for the following reasons:

The proposed development is contrary to:

- o General Section (Hazards) Objective 5

Reason: The current state of the proposed access road (N Herbig Road) is not considered suitable for all-weather, safe and convenient use.

- o General Section (Hazards) Principles of Development Control 1, 7, 8, 9(a)(b)(c)

Reason: The current state of the proposed access road (N Herbig Road) is not considered suitable for all-weather, safe and convenient use.

- o General Section (Transportation and Access) Objective 1

Reason: The current state of the proposed access road (N Herbig Road) is not considered suitable for all-weather, safe and convenient use.

- o General Section (Transportation and Access) Principles of Development Control 22

Reason: The current state of the proposed access road (N Herbig Road) is not considered suitable for all-weather, safe and convenient use.

Panel Decision

Moved: R Veitch

Seconded: D Reiman

That the Barossa Assessment Panel defer considerations of application 960/279/2017 to enable the applicant to liaise further with Council officers in relation to all weather access, and infrastructure provisions.

CARRIED

7. REPORTS – APPLICATIONS TO PROCEED/NOT TO PROCEED TO ASSESSMENT

7.1 960/461/2018 (3 Concordia Road Concordia)

Recommendation

The Barossa Assessment Panel, having considered the application, resolves that the development proposal is REFUSED without proceeding to make an assessment of the application pursuant to Section 39(4)(d) of the Development Act for the following reasons:

- (a) Contrary to the Desired Character of the Zone, the proposal is sited and sized to be prominent, particularly from the Barossa Valley Way, to the detriment of the open landscape character. On this basis, the proposal is contrary to the thrust and intent of the Zone's desired character despite not impacting upon primary production land uses.

- (b) Contrary to Objective 3 of the Zone, the size and appearance of the proposal is considered to detract from the scenic qualities of the surrounding rural landscape.
- (c) Contrary to General Section, Advertisements Principle 1, the proposal is prominently sited and of a size that is inconsistent with the predominant character of the surrounding landscape.
- (d) Contrary to General Section, Advertisements Principle 4, the proposal will advertise the sale of land within Springwood Estate, situated approximately 740 metres from the subject land. The proposal does not advertise information relating to the use of the subject land.
- (e) Contrary to General Section, Design and Appearance Principle 1, the proposal is of a size and scale that is not sympathetic to development in the locality. The advertisement is of a size that will dominate the surrounding character when travelling along the Barossa Valley Way.
- (f) Contrary to General Section, Design and Appearance Principle 11, the proposal is not considered to maintain or enhance the visual attractiveness of the locality which is primarily characterised by an open, undulating rural landscape.

Panel Decision

Moved: G Hewitt

Seconded: D Reiman

That the recommendation be adopted.

CARRIED

8. REPORTS - PANEL UPDATES

8.1 SCAP Concurrence Matters

Recommendation

That the report be received.

Panel Decision

Moved: D Reiman

Seconded: R Veitch

That the recommendation be adopted.

CARRIED

9. REPORTS - OTHER BUSINESS

Nil.

10. REPORTS – CONFIDENTIAL

Nil.

11. NEXT MEETING

Tuesday 5 March 2019 commencing at 5.00pm.

12. CLOSURE OF MEETING

The Presiding Member declared the meeting closed at 6:50pm.

Confirmed

Date: Chairman:

4. BUSINESS ARISING

5. DECLARATION OF INTEREST BY MEMBERS OF THE PANEL

The Minister's Assessment Panel Members – Code of Conduct requires that a member of an assessment panel who has a direct or indirect personal or pecuniary interest in a matter before the assessment panel (other than an indirect interest that exists in common with a substantial class of persons):

- a. must, as soon as he or she becomes aware of his or her interest, disclose the nature and extent of the interest to the assessment panel; and
- b. must not take part in any hearings conducted by the assessment panel, or in any deliberations or decision of the assessment panel, on the matter and must be absent from the meeting when any deliberations are taking place or decision is being made.

A member of an assessment panel will be taken to have an interest in a matter if an associate of the member (within the meaning of section 3(7) of the PDI Act) has an interest in the matter.

Any member that considers that they have an interest must notify the Presiding Member and have it recorded in the minutes as to the nature and extent of the interest.

6. REPORTS – APPLICATIONS FOR DECISION

6.1 960/533/2018 (41 Randalls Road Flaxman Valley)

APPLICATION DETAILS

PROPOSAL	Addition of Horse Keeping Activity (Three Horses) to an existing rural living property
APPLICANT	L and V Heath
OWNER	L and V Heath
APPLICATION NO	960/533/2018
CERTIFICATE(S) OF TITLE	CT 6121/385
AREA	4.11Ha
CURRENT USE	Rural Living
DEVELOPMENT PLAN VERSION	Consolidated 11 August 2016
ZONE	Primary Production – Baro/24
POLICY/PRECINCT AREA	Precinct 4 – Barossa Range
OVERLAYS	Barossa Valley Character Preservation District
APPLICATION TYPE	Merit
CATEGORY OF DEVELOPMENT	Category 3
REFERRALS	Nil
PREVIOUS APPLICATIONS	960/155/2014 – Demolition of Existing Dwelling and Construction of New Dwelling 960/117/2015 – Farm Building 960/431/2015 – Retention of former dwelling and conversion to Dependant Accommodation 960/309/2018 – Attached verandah 960/44/2019 – Change of use of structure attached to Dependant Accommodation, to a studio
ASSESSING OFFICER	Janine Lennon
RECOMMENDATION	That Development Plan Consent be GRANTED

BACKGROUND

In November 2017 Council received contact from a member of the public enquiring as to whether use rights existed for horse keeping activity at 41 Randalls Road, Flaxman Valley. A review of the site history showed no existing use rights for horse keeping and a site visit revealed five horses on the site as well as day yards, a round yard and dressage arena. Council approached the owners of the site who subsequently relocated two of the horses and have applied to keep three horses on the site.

Attachment 1 provides a copy of the application and associated documentation.

This application has been referred to the Barossa Assessment Panel for a decision for the following reason:

- (1) Where in the opinion of the sub-delegate, it is appropriate to refer the application to the Barossa Assessment Panel.

PUBLIC NOTIFICATION

The application is a Category 3 form of development pursuant to Section 38 and Schedule 9 of the *Development Act 1993* and Regulations 2008 and the Procedural Matters of the Primary Production Zone.

Representations: Two representations were received.

Persons wishing to be heard: No representors identified that they wish to address the Panel

Summary of Representations: The representors raised concern regarding the following matters:

- Land use conflict between horse keeping & viticulture

Applicant Response: The applicant's response to the representations is summarised below:

- Amended plans moving day yards away from vineyards
- Provision of a vegetated buffer between dressage arena and the adjoining vineyard
- Happy to work with neighbours regarding any future plans that they have regarding organic viticulture
- Additional screening planting proposed

An aerial view showing the representors properties is shown in *Figure 1*



Figure 1: Aerial of Representations Properties

A copy of the representor concerns and the applicant's response is contained in *Attachment 2*.

SITE AND LOCALITY

The subject land comprises Certificate of Title 6121/385. The subject land is currently used for rural living and contains a detached dwelling, dependant accommodation, farm building, a dam and numerous structures associated with horse keeping activities.

The site is accessed via Randalls Road and is an irregular shaped allotment measuring approximately 4.5ha in area with a 22 metre wide frontage width to Randalls Road.

The locality comprises a pleasant, undulating rural character. Surrounding allotments (adjoining and adjacent) vary in shape and size and are being used primarily for a mixture of rural living and viticulture purposes. Some dwellings and farm buildings are scattered throughout the locality along with remnant native vegetation and several watercourses.

The site is located within the Primary Production Zone, as shown in *Figure 2*.

The site is located within the Barossa Range Precinct 4 as shown in *Figure 3*.

The site is located within the Character Preservation Overlay as shown in *Figure 4*.

An aerial view of the locality and site are shown in *Figure 5* and *Figure 6*.

Site photos are provided in *Figure 7* to *Figure 9*.

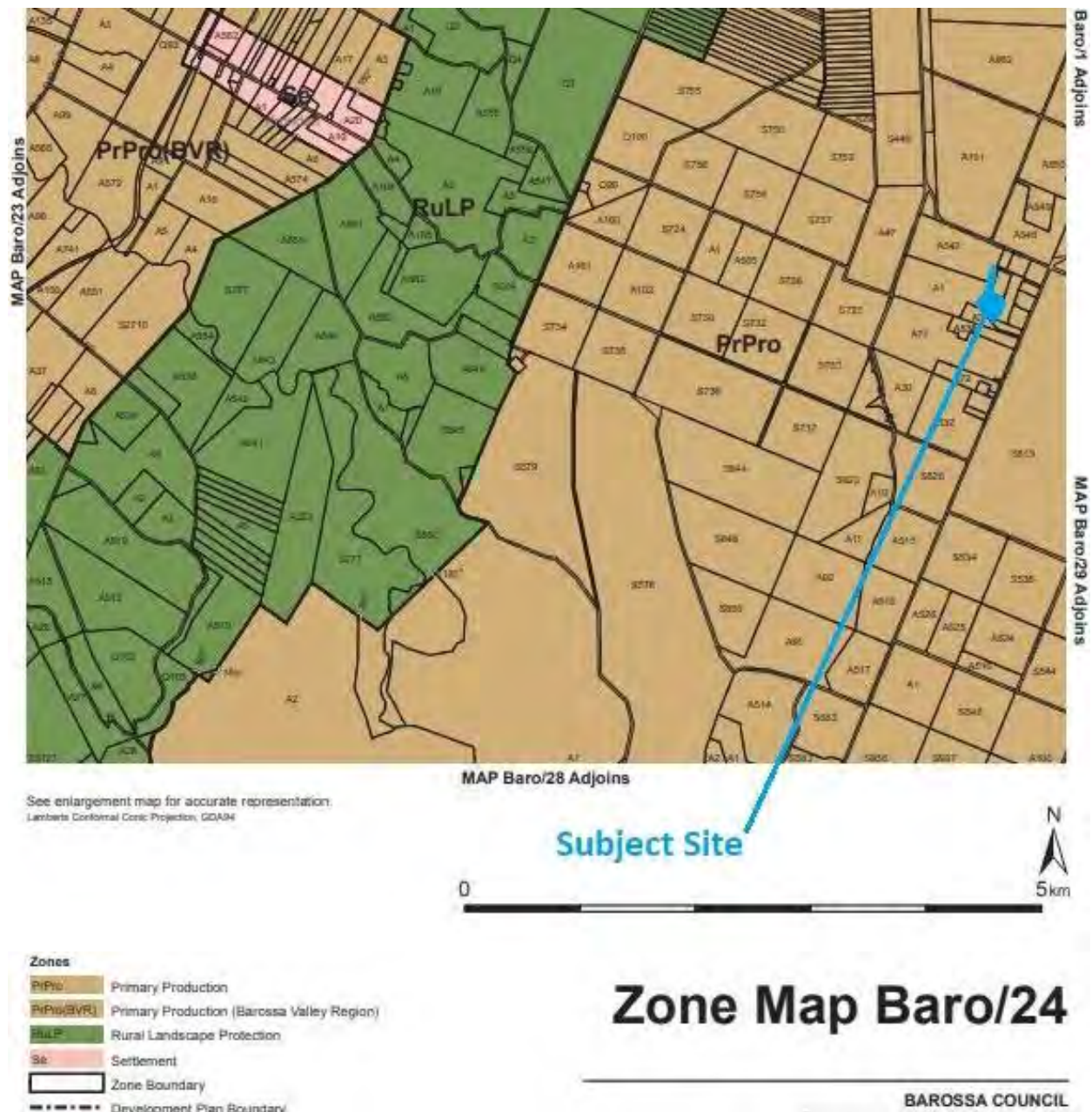


Figure 2: Zone Map

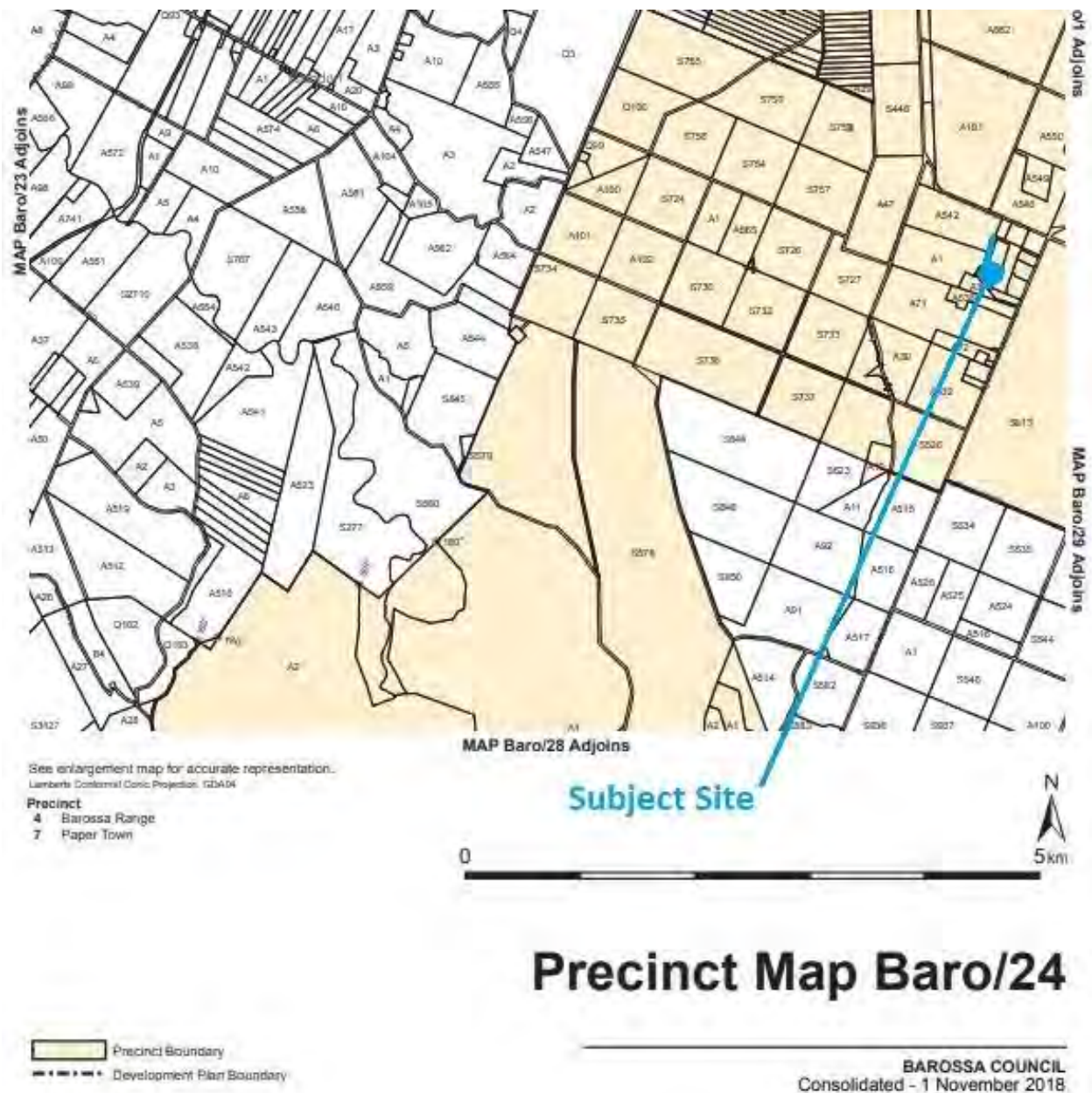


Figure 3: Precinct Map

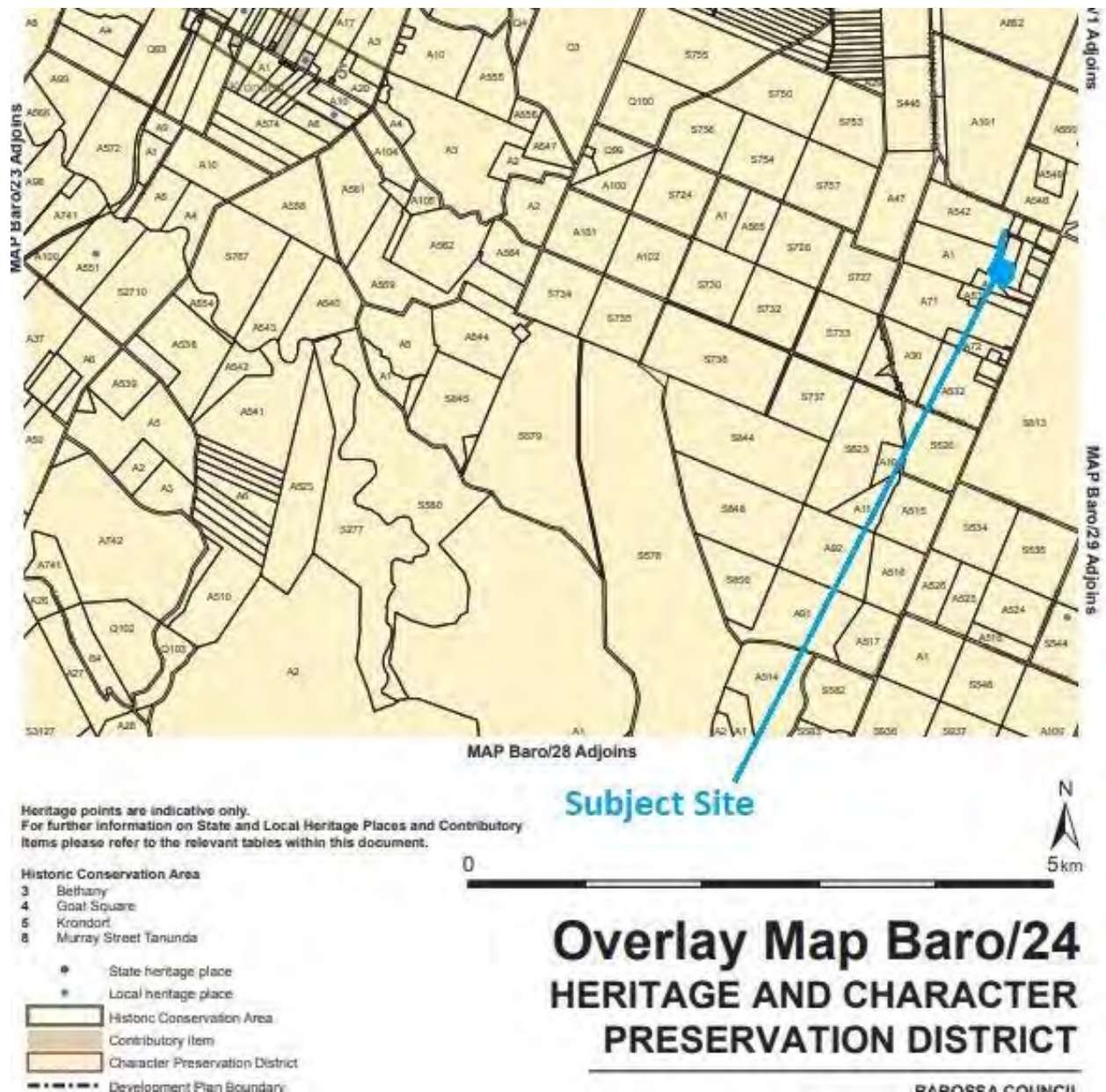


Figure 4: Overlay Map



Figure 5: Aerial – Locality



Figure 6: Aerial – Site



Figure 7: Site Photo – Spelling Paddock



Figure 8: Site Photo – Existing Day Yards (proposal specifies new location)



Figure 9: Site Photo – Round Yard

REFERRALS

No referrals are required under Schedule 8 of the Development Regulations 2008.

ASSESSMENT

Qualitative Criteria

The proposal is assessed for consistency with the qualitative requirements of the Development Plan as outlined below:

Overlay Section

Character Preservation
District

Objectives 1 (a-f), 2 and 3
PDCs 1

The structures associated with the proposed horse keeping activity are predominantly only visible from adjoining properties and are visually consistent with structures expected to be seen within the Character Preservation District. A vegetated buffer area is also proposed to be planted along each boundary adjoining a vineyard.

Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the assessing officer has had regard to the objects of the Act and, in determining this application, whether it seeks to further the objects of the Act.

Animal Keeping
Horse Keeping Dairies

Objectives 1, 2 and 3
PDCs 1, 2, 3, 4, 5, 6, 7, 8 and 9

PDC 5 Stables, horse shelters or associated yards should be sited:

- (a) at least 50 metres from a watercourse
- (b) on land with a slope no greater than 1-in-10.

Stables, shelters, associated yards and summer paddock are all located over 100 metres from the closest watercourse, a portion of the spelling paddock is within 50 metres of a watercourse.

Whilst portions of the property (not included in the horse keeping areas) exhibit some steep slopes, overall the property has a slope of 1-in-16 meeting the Development Plan's slope criteria.

PDC 6: A concrete drainage apron should be provided along the front of stables directing water from wash down areas onto a suitably vegetated area that can absorb all the water, or into a constructed drainage pit.

No designated wash down area has been detailed for the horses but the management plan advises that a shallow drain shall be installed around the day yards to interrupt flow of surface water.

PDC 7: Stables, horse shelters or associated yards should be sited at least 30 metres from any dwelling on the site and from the nearest allotment boundary to avoid adverse impacts from dust, erosion and odour.

Stables, horse shelters and day yards are all to be located a minimum of 30 metres from allotment boundaries and the dwelling on site. It is noted that the round yard and dressage arena are within 30 metres of an allotment boundary, but the horses will only be in this location whilst being ridden and vegetation screening has been proposed.

PDC 8: All areas accessible to horses should be separated from septic tank drainage areas.

Effluent disposal area is south of the dwelling and outside of any horse accessible areas.

PDC 9: Horse keeping should:

- (a) minimise soil erosion
- (b) minimise water pollution
- (c) not lead to an increase in pest plants and vermin
- (d) not result in any unreasonable impact on adjacent land users from odour
- (e) protect areas of significant native fauna and flora
- (f) maintain the visual appeal of the area where it is located.

The property management plan details how the horse keeping activity will be managed in accordance with this Principle including:

- Soil & pasture management
- Yards & exercise area management
- Mortalities
- Water supply
- Paddocks & fencing
- Manure management

PDC 10: Stables and horse shelters should have dimensions of at least four metres by four metres per horse and an accompanying horse holding yard should be not less than 50 sqm in area.

The horse shelters are proposed to be 3.8 metres x 3.8 metres, 1.5 sqm less than the minimum specified in the Principle, but the holding yards will each be 50 sqm in area, in accordance with the Principle.

All other Objectives and PDCs are deemed to comply.

Interface between Land
Uses

Objectives 1 and 2
PDCs 1(a) and 2

It is considered that by meeting the Objectives and Principles of the Animal Keeping module, development should not detrimentally affect the amenity of the locality or cause unreasonable interference through the emission of effluent, odour, smoke, fumes, dust or other airborne pollutants. The development has also substantially been sited and designed to minimise negative impact on existing and potential future land uses considered appropriate in the locality.

All other Objectives and PDCs are deemed to comply.

Orderly and Sustainable
Development

Objectives 3, 4 and 7
PDCs 1

The development is not considered to prejudice the development of a zone for its intended purpose.

All other Objectives and PDCs are deemed to comply.

Siting and Visibility

Objectives 1 and 2
PDCs 1(a-c), 6 and 9(b and c)

As detailed under the Character Preservation District heading, the structures associated with the proposed horse keeping activity are predominantly only visible from adjoining properties and are visually consistent with structures expected to be seen within the locality. A vegetated buffer area is also proposed to be planted along each boundary adjoining a vineyard, using the local indigenous species - the Drooping Sheoak, and the Western Australian species - Rottne Island Pine.

All other Objectives and PDCs are deemed to comply.

Waste Wastewater Waste Treatment Systems	Objectives 1 and 2 PDCs 1 (c, g) and 2
	The horse keeping use will be strictly segregated from the waste water system associated with the dwelling. The property management plan details how the manure from the horse keeping activity will be managed and removed from site when necessary.

All other Objectives and PDCs are deemed to comply.

Zone Section

Primary Production Zone	Objectives 1, 2, 3, 4 and 5
	Traditionally horse keeping is seen as being a compatible use with primary production. The intensity of the horse keeping activity is a factor and in this instance the keeping of three horses is considered to be compatible.

All other Objectives are deemed to comply.

Desired Character

The zone comprises a range of landscapes with varying soil quality, underground water supplies and rainfall levels. Development of grazing and broadacre farming land uses is the most appropriate form of agricultural use located within the zone, with limited opportunities for more intensive uses such as horticulture and viticulture located within the uplands areas of the zone such as the Barossa Range. Development will take into account the capability and suitability of the land for the intended use.

The zone comprises a pleasant rural character derived from the broadacre farming pattern and undulating, wooded pastures together with the isolated dwellings and scattered farm buildings. The landscape character generally consists of open, undulating terrain with sparsely scattered stands of native vegetation. There are pockets of the zone where steep slopes and stands of native vegetation are more predominant, such as the upland areas of the Barossa Ranges. Development will recognise the limitations imposed by such characteristics and prevent the further erosion of soils, or removal of native vegetation. It is expected that development will be carefully designed and located to complement the open landscape character.

It is anticipated that buildings in the zone will be limited to single-storey in height, be designed and located so that they are not visible from public roads, particularly the Barossa Valley Highway, scenic or tourist routes, or from vistas within townships. Buildings will be designed to minimise the disturbance to the natural ground levels, utilising design techniques to reduce bulk and massing and be constructed using materials and finishes of a low reflective nature and subdued colour to match those found located within the landscape in order to be inconspicuous in appearance.

Development will result in the conservation of existing stands of native vegetation and increase the planting of locally indigenous vegetation in important locations, such as along watercourses. Development involving the construction of buildings or structures will include the planting of additional locally indigenous species to increase biodiversity and habitats for fauna, as well as screen the buildings and structures from views in the locality.

Desired Character	<p>The subject site's size, dimensions and terrain mean that it is not suitable for broad scale agriculture, but the use of the site for horse keeping will not prevent adjoining land from meeting the agricultural potential of the zone.</p> <p>No existing native vegetation is proposed to be removed and native vegetation buffers are proposed to be planted.</p> <p>The structures in association with the horse keeping activity are small scale and will not be readily visible from any public roads.</p>
Land Use	<p>PDCs 1, 2 and 5</p> <p>The proposed horse keeping activity is neither an expressly envisaged use within the locality nor is described as generally inappropriate. As previously stated horse keeping is generally accepted as being compatible with primary production.</p> <p>All other Objectives and PDCs are deemed to comply.</p>
Form & Character	<p>PDCs 10</p> <p>As previously detailed the structures associated with the proposed horse keeping activity are predominantly only visible from adjoining properties and are visually consistent with structures expected to be seen within the locality.</p> <p>All other PDCs are deemed to comply.</p>
Precinct 4 Barossa Range	<p>PDCs 23(a-d)</p> <p>PDCs are not relevant to existing or proposed use.</p>

CONCLUSION

Not seriously at variance

The proposed development is not seriously at variance with the Development Plan.

Development Plan Consent should be granted

When assessed against the relevant provisions of the Development Plan it is considered that the proposed development, on balance, warrants Development Plan Consent subject to conditions recommended below.

RECOMMENDATION

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.

- (b) That the proposed development is not seriously at variance with The Barossa Council Development Plan.
- (c) To GRANT Development Approval for Application No. 960/533/2018 by L and V Heath to undertake the addition of horse keeping activity (three horses) to an existing rural living property at 41 Randalls Road, Flaxman Valley (CT 6121/385) subject to the following conditions:

Council Conditions

- (1) The development shall be undertaken in accordance with the endorsed site plan and property management plan (as amended) accompanying Application No. 960/533/2018 except where varied by any condition(s) listed below.

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by the Planning Authority.

- (2) A maximum of three horses shall be kept on the land at any one time.

Reason: Not to exceed the approved number of horses on the site and to be consistent with the carry capacity of the land in terms of soil and water quality for the zone.

- (3) Vegetation buffers shall be planted within the next planting season following Development Approval, dead trees shall be replaced and the buffers maintained in accordance with the approved site plan.

Reason: To improve the plant biodiversity and prevent soil erosion on the site.

- (4) All existing native trees on the site shall be retained and the health of the trees shall be maintained.

Reason: To prevent loss of biodiversity and habitat and retain the character of the locality.

- (5) Excess manure shall not stockpile on the site and shall be removed regularly.

Reason: To prevent odours and to maintain water quality.

- (6) Good pasture coverage shall be achieved on the site at all times.

Reason: To prevent soil degradation and maintain water quality.

- (7) The property management plan provided with the subject application shall be implemented.

Reason: To maintain soil and water quality and prevent weed infestation.

6.1 Attachment 1

DEVELOPMENT APPLICATION FORM



CONSENT TYPE APPLYING FOR (Please tick appropriate box)

- ☐ Development Plan Consent (Planning Only)
☐ Building Rules Consent (Building Only)
☒ Full Development Approval (Both Planning and Building Consent)

OFFICE USE ONLY

DEVELOPMENT NO.: 960/ /

PROPERTY NO.: /

VG NO.: /

Please use BLOCK LETTERS and Black or Blue ink so that photocopies can be made of your application

APPLICANT: LIONA & VICKIE HEATH
Postal Address: PO Box 364 AUGASTON **Post Code:** 5353
Phone: **Mobile:** 0438984423 **Fax:**
Email: landvheath@optusnet.com.au

OWNER:
Postal Address: **Post Code:**
Phone: **Mobile:** **Fax:**
Email:

ARE YOU GOING TO BE AN OWNER BUILDER? YES/NO

BUILDER:
Postal Address: **Post Code:**
Phone: **Mobile:** **Fax:**
Email: **Builders Licence No.:**

Please refer to attached fact sheet "Important Information for Owners and Builders".

CONTACT PERSON FOR FURTHER INFORMATION: Name: LIONA HEATH
Phone: **Mobile:** 0438984423 **Fax:**
Email:

DESCRIPTION OF PROPOSED DEVELOPMENT:
 KEEPING OF 3 HORSES AT 41 RANDALLS ROAD
 FLAXMAN VALLEY

EXISTING LAND USE:

AREA (m²) OF PROPOSED DEVELOPMENT:

LOCATION OF PROPOSED DEVELOPMENT:
House No: **Street:** **Town:**
Lot No: **Section:** **Hundred:**
Certificate of Title(s): **Volume:** **Folio:**

BUILDING RULES CLASSIFICATION SOUGHT: **Present Classification**
 If Class 5, 6, 7, 8 or 9 classification is sought, state the proposed number of employees: Male: . Female: .
 If Class 9a classification is sought, state the number of persons for whom accommodation is provided: .
 If Class 9b classification is sought, state the proposed number of occupants of the various spaces at the premises: .

DOES EITHER SCHEDULE 21 OR 22 OF THE DEVELOPMENT REGULATIONS 2008 APPLY? **YES/NO**
HAS THE CONSTRUCTION INDUSTRY TRAINING FUND ACT 1993 LEVY BEEN PAID? **YES/NO**

DEVELOPMENT COST (do not include any fit out costs): \$

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the Development Regulations 2008 and where public notification is required may be made available on Council's website. Details provided by the applicant, written representations and other technical reports form part of the reports attached to Council's Development Assessment Panel agendas. The agenda, minutes and accompanying report is made available on Council's website.

SIGNED: **Dated:** 21/9/18

DEVELOPMENT REGULATIONS 2008**DECLARATION OF APPLICANT**
(Pursuant to Clause 2A(1) of Schedule 5)

TO: The Barossa Council
43-51 Tanunda Road
PO Box 867
NURIOOTPA SA 5355

OFFICE USE ONLY

DEVELOPMENT NO.: 960/ _____ / _____

PROPERTY NO.: _____

APPLICANT: KIONG & VICKIE HEATH
 Postal Address: PO BOX 364 ANGASTON Post Code: 5353
 Phone: _____ Mobile: 0438984423 Fax: _____
 Email: landvheath@optusnet.com.au

DATE OF APPLICATION:/...../.....

LOCATION OF PROPOSED DEVELOPMENT:

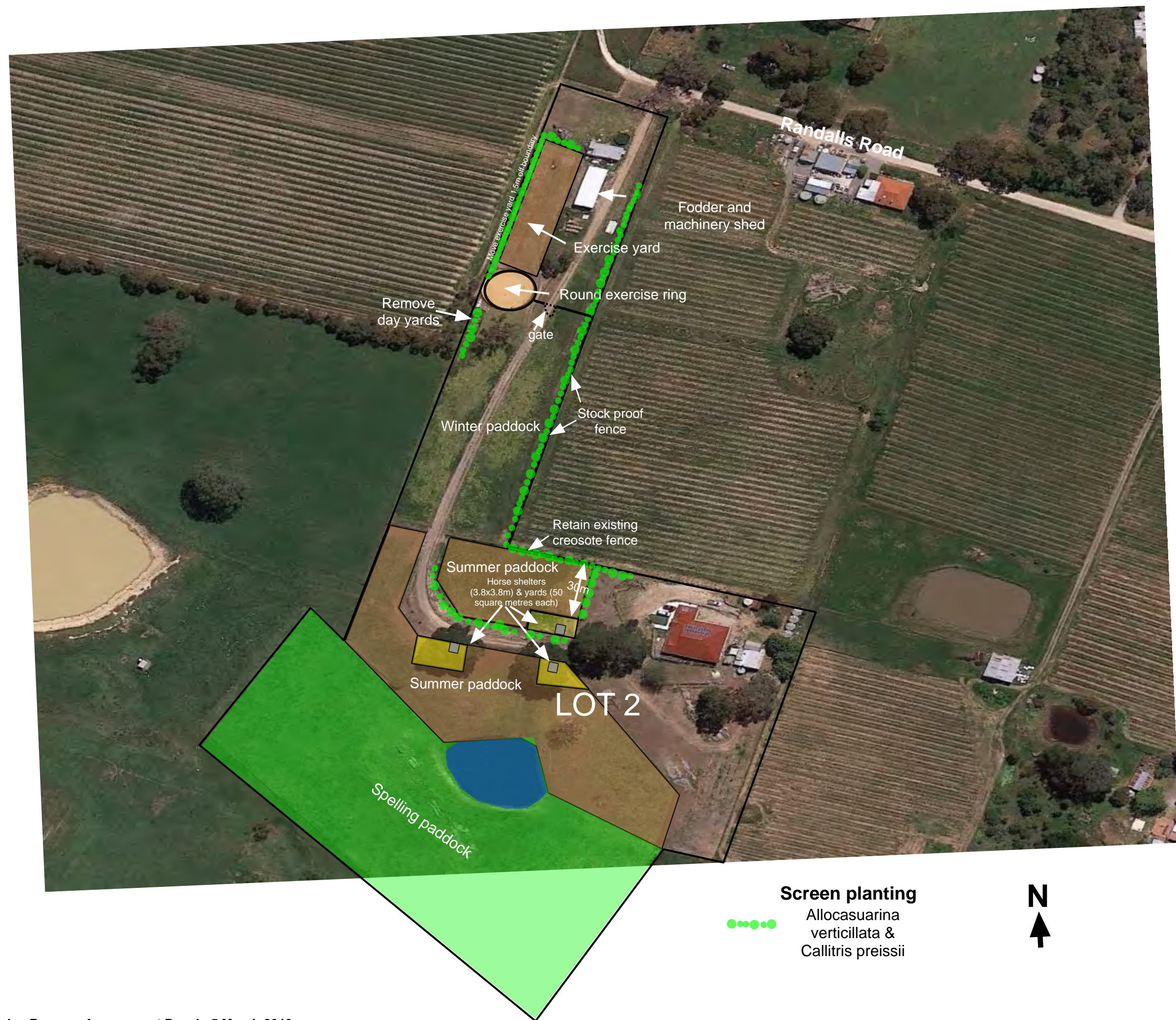
House No: 41 Street: RANDALLS RD Town: FLAXMAN VALLEY
 Lot No: _____ Section: _____ Hundred: _____
 Certificate of Title(s):Volume: _____ Folio: _____

NATURE OF PROPOSED DEVELOPMENT: _____

I Kiong & Vickie Heath.....(insert name) being the applicant/a person acting on behalf of the applicant (delete the inapplicable statement) for the development described above declare that the proposed development will involve the construction of a building which would, if constructed in accordance with the plans submitted, not be contrary to the Regulations prescribed for the purposes of Section 86 of the *Electricity Act 1996*. I make this declaration under Clause 2A(1) of Schedule 5 of the *Development Regulations 2008*.

Signed: _____

Date of Declaration: 21/9/18



PROPERTY MANAGEMENT PLAN

Property Details:

Allotment 2 Certificate of Title Volume 6121 Folio 385 Randalls Road
Flaxman Valley.

Owners:

Lionel and Vicki Heath

Proposed Enterprise:

Keeping of up to 3 horses

Rainfall:

Average Annual rainfall = 756 mm

Soil type:

Acidic sandy loam over grey clay on rock

Landscape Description:

The subject land is an irregular shaped allotment with a narrow 22m frontage to Randalls Road and widening out at a point about 220m into the property to 170m. The allotment is 4.2ha in area and is an undulating property with an elevation of 505metres at the northern end adjacent to the road and grading down to 475 metres adjacent to the southern boundary. The allotment is approximately 400m in length and 188m at its widest point.

A new dwelling and a granny flat are situated on the eastern side of the property and an old dairy and a new outbuilding are situated close to Randalls Road. An exercise area, a round yard, and a couple of day yards are situated adjacent to the western side boundary of the narrow section of the property.

There are no watercourses running through the property although a small dam is situated to the south of the dwelling.

The property is broken up into several paddocks including two summer paddocks and two winter paddocks plus a spelling paddock. The subject land is relatively devoid of native vegetation although some introduced trees are situated relatively close to the house yard.

Land Capability Class:

Land Class 2 requiring significant management input .

Management Objective:

Keeping up to 3 adult horses mainly for recreational use with supplementary feeding and rotational grazing for animal health and welfare and maintaining of pastures and ground cover.

Soil and Pasture Management:

Pastures will be managed primarily through rotational grazing of paddocks, supplementary feeding, and destocking of horses by keeping them in horse 50 square metre horse yards and associated shelters. Pastures are limited to the gently undulating slopes and the steeper sloping areas will only be grazed for short periods to reduce fuel load during bushfire Season.

A 12-month pasture management strategy will be implemented to maximize pasture retention and maintain cover to protect soils as per Table 1 below.

As seasonal conditions move into the summer management periods supplementary feeding will be increased and the horses will be kept in the day yards with associated shelters and occasionally grazed in the summer paddocks on lesser sloping ground. In summer they will be predominantly supplementary fed so as to reduce total grazing pressure and maintain adequate groundcover on pastures.

The owners have access to paddocks at their Eudunda property to destock and further reduce total grazing pressure on a needs basis.

Yards and Exercise Areas

The round yard and exercise arena will be used for exercising the horses. Special dust free sand for horses will be used in the exercise arena and round yard and replenished from time to time as the need arises.

The three individual horse yards each with a horse shelter will be covered with a 10 cm layer of compacted rubble and a 15 cm layer of sand and clay mix appropriate for horse yards. A shallow drain will be placed around the perimeter to prevent entry of surface water.

Mortalities:

Mortalities will be removed from the property and be disposed of in an appropriate manner.

Water Supply:

The subject land has an existing catchment dam with a holding capacity of approximately 5 megalitres. Water is pumped from the dam up to a tank near at the rear of the dwelling and is pumped from there to horse troughs around the property. Water is also pumped from the dam to a header tank at the front entrance for exclusive use for fire fighting purposes.

Paddocks and Fencing:

The property will be divided into fenced paddocks in accordance with the attached site plan. Fencing will comprise existing fencing where in good condition. New fencing will be provided to replace old fencing in conjunction with adjoining property owners. Internal fencing will be horse fencing.

Tree lines comprising *Allocasuarina Verticillata* (drooping sheoak) and *Callitris Preisii* (native pine) will be planted adjacent to the property boundaries of the adjoining vineyards.

Manure Management:

Manure within smaller yards and exercise areas will be collected daily and placed in a pile on top of a concrete platform to be situated to the south of the dwelling adjacent to the vegetable garden for reuse as manure or bagged up and given away. Manure from paddocks will be collected regularly to avoid a buildup of manure in clumps and to maintain the health of horses. Dung beetles will be released in paddocks to speed the breakdown of manure and return nutrients to the soil. Bags of manure will be kept in the shed at the front of the property until placed on the roadside for sale or given away to friends for use in gardens.

Reference:

Adelaide and Mount Lofty Ranges Natural Resources Management Board (2011) Best Practice Management Guidelines for Small Grazing Properties

Period	Management strategies
April	Fertilise according to soil test results
May/June	Inspect for weeds and spray for early broadleaf weeds if necessary Assess condition of pasture and either over sow or reestablish pasture as needed
July to Sept	Renovate pasture or establish new pasture
Sept to Dec	Rotational grazing management plan is implemented Monitoring of pasture to maintain adequate groundcover (70% for spelling paddock and 30% in other paddocks) Aim to have at least 10cm pasture cover by end of December.
January to March	Supplementary feeding increased to reduce total grazing pressure Monitoring of pasture to maintain adequate groundcover Soil test paddock to determine fertilizer rates

Table 1: Seasonal Management Calendar



**Regional Planning
Directions**

making the right decisions

21st September 2018

Sarah Davenport
Planner
Barossa Council
PO Box 867
Nuriootpa, SA 5355

PO Box 67, Springton SA 5235
p 08 8568 2037 m 0488 451 970
helen@regionalplanningdirections.com.au/
www.regionalplanningdirections.com.au
ABN 80 152 935 852

Dear Sarah,

**PROPOSAL TO KEEP UP TO 3 HORSES AT 41 (LOT 2) RANDALLS ROAD,
FLAXMAN VALLEY**

I write in support of the proposal by Lionel and Vickie Heath (my Clients) to keep up to 3 (3) horses on an existing hobby farming property at the above address.

Background

My Clients recently received a letter from Council advising that they need development approval for horse keeping on the subject land. A site plan and property management details were also requested. Although up to five horses were being kept on the property two have been removed to my Client's other property in Eudunda. The proposal is now for the keeping of up to 3 horses.

The Subject Land and Locality

The subject land is 41 (Lot 2) Randalls Road, is contained in Certificate of Title Volume 6121 Folio 385, and comprises a total area of 4.2 ha.

The subject land is an irregular shaped allotment with a narrow 22m frontage to Randalls Road and widening out to 170m at a point about 220m into the property. The allotment is 4.2ha in area and has an undulating topography with an elevation of 505 metres at the northern end adjacent to the road and grading down to 475 metres adjacent to the southern boundary. The allotment is approximately 400m in length and 188m at its widest point.

A central driveway extends from Randalls Road to the dwelling and a granny flat situated on the eastern side of the property. An old dairy, a large concrete water storage tank, and a new outbuilding for storing a tractor, horse float, and fodder are situated close to Randalls Road. An exercise area, a round yard, and a couple of day yards are situated adjacent to the western side boundary of the narrow section of the property.

There are no watercourses running through the property although a small dam is situated to the south of the dwelling.

The subject land is relatively devoid of native vegetation although some introduced trees are situated relatively close to the house yard.

Vineyards are situated on adjoining land on the northwestern side of the property and the northern and eastern side of the existing dwelling. A grazing property is situated on the southwestern side of the property. Several smaller hobby farms and associated dwellings are situated on the southern and eastern sides of the property.

Details of Proposal

The proposal is for the keeping of up to 3 horses on the subject land. The site plan below (see Figure 1 below) shows the layout of the property divided into summer and winter paddocks plus a spelling paddock at the lower end of the property. Two 3.8m x 3.8m three-sided horse shelters are to be provided with one in each of the the summer paddocks situated at least 33 metres east of the dwelling. A round exercise yard and a rectangular exercise area are situated at the northern end of the property adjacent to the eastern boundary. A Property Management Plan outlining management details for the horses is attached.

Nature of Proposal

The subject land is in the Primary Production Zone, Precinct 4 Barossa Range, and is in the Barossa Character Preservation District. The property is also within a High Bushfire Risk Zone.

Horse keeping is defined in Schedule 1 of the Development Control Regulations as follows:

horse keeping means the keeping or husbandry of horses where more than 1 horse is kept per 3 hectares of land used for such purposes or where hand feeding of a horse is involved;

As the proposal is for three horses on a 4.2ha property it exceeds the above ratio and is a form of development requiring the consent of Council. Horse keeping is not listed as a noncomplying form of development and as such an on merit assessment is required.

Although the proposal is not listed as a Category 1 or 2 development in the procedural section of the zone it is recommended that it be considered as a Category 1 Development not requiring public consultation. Council can do so if it determines the proposal as being of a minor nature only and will not unreasonably impact on owners or occupiers of land in the locality of the site in accordance with Clause 2 (g) of Part 1 of Schedule 9 of the Development Regulations.

PLANNING CONSIDERATIONS

The Development Plan provisions for the Barossa Council Consolidated on the 16th of August 2016 are relevant to an assessment of the application. A list of provisions relevant to this proposal is provided in Attachment 1 to this statement.

Animal Keeping

The proposal would be in accordance with Objectives 1 and 2 plus Principle 1 for Animal Keeping in that the number of horses kept and the rotational management of pastures with supplementary feeding as outlined in the Property Management Plan will ensure that the carrying capacity of the land is not exceeded and thereby avoiding any adverse effects.



Figure 1 Site Plan

Manure from horse yards and exercise areas will be removed daily and will be bagged up at the time of collection and stored in the shed near the front of the property until sold or given away along the roadside and would be in accord with Principle 2 (a) (b) (c).

The animal exercise areas have been surfaced to ensure that they are erosion and dust proof and are graded to ensure adequate surface runoff in accordance with Principle 3 (a) and (b).

Fencing of pastures will be a combination of normal stock proof rural fencing and electric fencing to contain the horses and protect newly planted trees from grazing by horses in accord with Principle 4 (a) (b) (c).

Horse yards would be well away from any watercourses and the portion of the property with slopes greater than 1 in 10 below the 485m contour will be fenced off as shown in the attached site plan and would be in accord with Principle 5 (a) and (b). Horse grazing would only be allowed for short periods in what has been termed the spelling paddock in order to control undergrowth and reduce fuel load.

The nearest horse yard would be at least 30 metres from the existing dwelling and all horse keeping areas would be separate from the septic tank drainage area in accord with Principles 7 and 8.

Management in accordance with the Property Management Plan will ensure that pasture cover is maintained at a minimum of 30% groundcover thereby ensuring compliance with Principle 9 (a) (b) (c) (d) (e) (f).

Although the horse shelters would be slightly less than 4m x 4m, the 3.8m x 3.8m design would be in accordance with accepted horse keeping practices and the shelters will be lined with rubber matting for kickboards. The paddock in question would exceed 50 square metres in accordance with Principle 10.

Design and Appearance

The central driveway would provide ready access to horse yards, paddocks, and exercise areas and will be easy to understand and navigate in accordance with Objective 2 and Principle 10. The horse shelters will be bronze olive colourbond and would be in accord with Principle 11.

Hazards

Although the subject land is in a high bushfire risk area it is adjacent to an all weather access road, provides a suitable designated water supply for fire fighting purposes, and has adequate access and turnaround area for CFS Vehicles. These matters were thoroughly assessed during the Development Application stage for the existing dwelling on the subject land. However it is intended that the horses will be evacuated if the property is threatened by an encroaching bushfire.

Interface Between Land Uses

Three horses on the subject land would be readily manageable for my Clients. The combination of maintenance of at least 30% minimum ground cover, a rotational grazing regime with supplementary feeding, manure management and removal, plus the planting of shelter belts comprising locally indigenous species of trees will ensure that the locality will not be detrimentally affected. In view of the above the proposal would be in accord with Objectives 1 and 2, and Principles 1 (a), 2, and 10.

Landscaping, Fences and Walls

Planting of locally indigenous native species will provide screening for horse yards and exercise areas, maximize shade, and minimize maintenance and watering requirements. Fencing into paddocks will be in accord with accepted standards for rural fencing, and for horse exercise areas and yards.

Natural Resources

A combination of the rotational grazing regime, fencing off of the section with the existing dam and slopes above 10%, plus supplementary feeding, horse yards and shelters, regular removal of waste, and the planting of locally indigenous trees will ensure that the horse keeping operations are environmentally sustainable and the quality of soil and water is maintained.

Orderly and Sustainable Development

Due to the orderly layout of horse paddocks and the use of a management regime to ensure the ecological sustainability of horse keeping the proposal is unlikely to have a detrimental affect on adjoining land use and would contribute to creating a safe convenient and pleasant place to live. As such the proposal would be unlikely to prejudice the provisions of the Development Plan for the Primary Production Zone. As such the proposal would be in accord with Objectives 1, 3, 4, and 7, plus principles 1 and 2 for Orderly and Sustainable Development.

Siting and Visibility

The visual impact of horse keeping will be minimized through the planting of tree corridors and by ensuring a continuous level of groundcover so as to avoid the appearance of a degraded landscape. The proposal is likely to ensure the maintenance of the picturesque rural landscape and be in accord with the relevant provisions for Siting and Visibility.

Sloping Land

A slope analysis was conducted using the contours of the land and the areas exceeding a slope of 10% will be fenced off and an appropriate management regime will be applied to this area to prevent overgrazing and soil degradation. As such the proposal would be in accord with the relevant provisions for Sloping Land.

Waste

The bagging up of manure from yards and exercise areas on a daily basis and storing them under cover will ensure that odours and fly problems are minimized. Dung beetles will be released in the larger paddocks to breakdown any clumps of manure and return nutrients to the soil. Bags of manure will either be sold on the roadside or given away for use in gardens.

Character Preservation District Overlay

The proposal is likely to preserve the scenic rural landscape in accordance with the provisions for the Character Preservation District provisions.

PRIMARY PRODUCTION ZONE

The proposed horse keeping operation is likely to be well managed in accordance with the Property Management Plan and would be in accord with Objective 3 and 5, and Principle 10 for the Zone. Although the proposal is not a form of primary production it does resemble a farming land use in that animal grazing is involved and as such would not be seriously at variance with Objective 1.

Grazing is a significant element of the Desired Character statement and the proposal would be in keeping with the rural character particularly with the use of rotational grazing

in paddocks and the provision of planting of corridors of locally indigenous trees along fence-lines. The proposal would also be sensitive to the slope of the land by fencing the area exceeding 10% slope and applying more sensitive grazing practices.

The property in itself is not large enough to be viable for farming. However horsekeeping is much like farming which is overtly envisaged as a land use in the zone. The only buildings proposed in conjunction with the proposal are the shelters and these would be grouped together on the horse yard to the west of the dwelling. The structures would be in accord with Principles 5 (a) (b), and 11 (a) and (b).

CONCLUSION

The proposal is for the keeping of 3 horses on a hobby farming property of 4.2 ha and containing an existing dwelling. It is in the Primary Production Zone and is a consent form of development. The proposal is likely to be of a minor nature and we recommend it to Council as a Category 1 form of Development not requiring public consultation.

An on merit assessment of the proposal establishes a close alignment with the general provisions in the Development Plan for the Barossa Council in relation to Animal Keeping, Design and Appearance, Hazards, Interface Between Land Uses, Landscaping Fences and Walls, Natural Resources, Orderly and Sustainable Development, Siting and Visibility, Sloping Land, Waste, and the Character Preservation District. The proposal would resemble farming in the form of grazing and combined with sensitive management is likely to be consistent with the desired character, objectives, and principles for the Primary Production Zone.

In view of the above I recommend the proposal to you for favourable consideration.

Should you require additional information or have any questions in relation to the proposal please do not hesitate to contact me on 08 85682037 or 0488451970 or via email on henri@regionalplanningdirections.com.au

Yours sincerely



Henri Mueller

DIRECTOR – REGIONAL PLANNING DIRECTIONS

ATTACHMENT 1: RELEVANT DEVELOPMENT PLAN PROVISIONS FOR THE BAROSSA COUNCIL (CONSOLIDATED 16TH AUGUST 2016)

General Section

Animal Keeping

OBJECTIVES

- 1 Animals not kept at a density beyond the carrying capacity of the land or water.
- 2 Animal keeping development sited and designed to avoid adverse effects on surrounding development.

PRINCIPLES OF DEVELOPMENT CONTROL

- 1 Animal keeping and associated activities should not create adverse impacts on the environment or the amenity of the locality.
- 2 Storage facilities for manure, used litter and other wastes should be designed and sited:
 - (a) to be vermin proof
 - (b) with an impervious base
 - (c) to ensure that all clean rainfall runoff is excluded from the storage area
- 3 Animal exercise areas should have:
 - (a) a surfaced area resistant to erosion or dust when used
 - (b) adequate control of surface water runoff.
- 4 Fences for animal keeping should:
 - (a) not detract from the appearance of the locality
 - (b) consist of materials of new or sound condition
 - (c) be of an open form to permit appropriate surveillance.

Horse Keeping

5 Stables, horse shelters or associated yards should be sited:

- (a) at least 50 metres from a watercourse
- (b) on land with a slope no greater than 1-in-10.

7 Stables, horse shelters or associated yards should be sited at least 30 metres from any dwelling on the site and from the nearest allotment boundary to avoid adverse impacts from dust, erosion and odour.

8 All areas accessible to horses should be separated from septic tank drainage areas.

9 Horse keeping should:

- (a) minimise soil erosion
- (b) minimise water pollution
- (c) not lead to an increase in pest plants and vermin
- (d) not result in any unreasonable impact on adjacent land users from odour
- (e) protect areas of significant native fauna and flora
- (f) maintain the visual appeal of the area where it is located.

10 Stables and horse shelters should have dimensions of at least 4 metres by 4 metres per horse and an accompanying horse holding yard should of not less than 50 square metres in area.

Design and Appearance

OBJECTIVES

2 Roads, open spaces, buildings and land uses laid out and linked so that they are easy to understand and navigate.

PRINCIPLES OF DEVELOPMENT CONTROL

10 Development should provide clearly recognisable links to adjoining areas and facilities.

11 Buildings, landscaping, paving and signage should have a co-ordinated appearance that maintains and enhances the visual attractiveness of the

locality.

Hazards

OBJECTIVES

- 1 Maintenance of the natural environment and systems by limiting development in areas susceptible to natural hazard risk.
- 2 Development located away from areas that are vulnerable to, and cannot be adequately and effectively protected from the risk of natural hazards.
- 5 Development located to minimise the threat and impact of bushfires on life and property.

PRINCIPLES OF DEVELOPMENT CONTROL

- 1 Development should be excluded from areas that are vulnerable to, and cannot be adequately and effectively protected from, the risk of hazards.

Bushfire

- 7 The following bushfire protection principles of development control apply to development of land identified as General, Medium and High bushfire risk areas as shown on the *Bushfire Protection Area BPA Maps - Bushfire Risk*.
- 8 Development in a Bushfire Protection Area should be in accordance with those provisions of the *Minister's Code: Undertaking development in Bushfire Protection Areas* that are designated as mandatory for Development Plan Consent purposes.

Interface between Land Uses

OBJECTIVES

- 1 Development located and designed to prevent adverse impact and conflict between land uses.
- 2 Protect community health and amenity and support the operation of all desired land uses.

PRINCIPLES OF DEVELOPMENT CONTROL

- 1 Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through any of the following:

- (a) the emission of effluent, odour, smoke, fumes, dust or other airborne pollutants

2 Development should be sited and designed to minimise negative impact on existing and potential future land uses considered appropriate in the locality.

10 Existing primary production uses and mineral extraction should not be prejudiced by the inappropriate encroachment of sensitive uses such as urban development.

Landscaping, Fences and Walls

OBJECTIVES

- 1 The amenity of land and development enhanced with appropriate planting and other landscaping works, using locally indigenous plant species where possible.
- 2 Functional fences and walls that enhance the attractiveness of development.

PRINCIPLES OF DEVELOPMENT CONTROL

- 1 Development should incorporate open space and landscaping and minimise hard paved surfaces in order to:
 - (c) screen service yards, loading areas and outdoor storage areas
 - (d) minimise maintenance and watering requirements
 - (e) enhance and define outdoor spaces, including car parking areas
 - (f) maximise shade and shelter
 - (k) complement existing vegetation, including native vegetation
 - (l) contribute to the viability of ecosystems and species
 - (m) promote water and biodiversity conservation.
- 2 Landscaping should:
 - (a) include the planting of locally indigenous species where appropriate
- 3 Landscaping should not:

(d) increase the risk of bushfire

4 Fences and walls, including retaining walls, should:

(b) be compatible with the associated development and with existing predominant, attractive fences and walls in the locality

Natural Resources

OBJECTIVES

1 Retention, protection and restoration of the natural resources and environment.

2 Protection of the quality and quantity of South Australia's surface waters, including inland and underground waters.

3 The ecologically sustainable use of natural resources including water resources, including groundwater, surface water and watercourses.

6 Development sited and designed to:

(c) protect water quality, including receiving waters

(g) protect stormwater from pollution sources.

9 Restoration, expansion and linking of existing native vegetation to facilitate habitat corridors for ease of movement of fauna.

10 Minimal disturbance and modification of the natural landform.

11 Protection of the physical, chemical and biological quality of soil resources.

12 Protection of areas prone to erosion or other land degradation processes from inappropriate development.

13 Protection of the scenic qualities of natural and rural landscapes.

4 Development should be appropriate to land capability and the protection and conservation of water resources and biodiversity.

7 Development should be sited and designed to:

(c) prevent soil erosion and water pollution

Soil Conservation

37 Development should not have an adverse impact on the natural, physical, chemical or biological quality and characteristics of soil resources.

38 Development should be designed and sited to prevent erosion.

39 Development should take place in a manner that will minimise alteration to the existing landform.

Orderly and Sustainable Development

OBJECTIVES

1 Orderly and economical development that creates a safe, convenient and pleasant environment in which to live.

3 Development that does not jeopardise the continuance of adjoining authorised land uses.

4 Development that does not prejudice the achievement of the provisions of the Development Plan.

7 Development of rural land primarily for primary production and other uses compatible with maintaining rural productivity.

PRINCIPLES OF DEVELOPMENT CONTROL

1 Development should not prejudice the development of a zone for its intended purpose.

2 Land outside of townships and settlements should primarily be used for primary production and conservation purposes.

Siting and Visibility

OBJECTIVES

1 Protection of scenically attractive areas, particularly natural and rural landscapes.

2 The protection and enhancement of the area's visual amenity and landscape quality, including land visible from tourist routes.

PRINCIPLES OF DEVELOPMENT CONTROL

1 Development should be sited and designed to minimise its visual impact on:

- (a) the natural, rural or heritage character of the area
- (b) areas of high visual or scenic value, particularly rural areas
- (c) views from public reserves, tourist routes and walking trails.

2 Buildings should be sited in unobtrusive locations and, in particular, should:

- (a) be grouped together

3 Buildings outside of urban areas and in undulating landscapes should be sited in unobtrusive locations and in particular should be:

- (a) sited below the ridgeline
- (b) sited within valleys or behind spurs
- (c) sited in such a way as to not be visible against the skyline when viewed from public roads, *and especially from the Mount Lofty Ranges Scenic Road as shown on Overlay Maps - Transport*
- (d) set well back from public roads, particularly when the allotment is on the high side of the road
- (e) be located in a setting where landscape features such as trees, vegetation and landforms provide an enclosing space, setting or screen.

6 The number of buildings and structures on land outside of urban areas should be limited to that necessary for the efficient management of the land.

9 Development should be screened through the establishment of landscaping using locally indigenous plant species:

- (a) around buildings and earthworks to provide a visual a screen as well as shade in summer, and protection from prevailing winds

Sloping Land

OBJECTIVES

1 Development on sloping land designed to minimise environmental and visual impacts and protect soil stability and water quality.

PRINCIPLES OF DEVELOPMENT CONTROL

2 Development and associated driveways and access tracks, including

related earthworks, should be sited, designed and undertaken in a manner that:

- (a) minimises their visual impact
- (b) reduces the bulk of the buildings and structures
- (e) does not cause or contribute to instability of any embankment or cutting
- (f) avoids the silting of watercourses
- (g) protects development and its surrounds from erosion caused by water runoff

Waste

OBJECTIVES

- 1 Development that, in order of priority, avoids the production of waste, minimises the production of waste, reuses waste, recycles waste for reuse, treats waste and disposes of waste in an environmentally sound manner.
- 2 Development that includes the treatment and management of solid and liquid waste to prevent undesired impacts on the environment including, soil, plant and animal biodiversity, human health and the amenity of the locality.

PRINCIPLES OF DEVELOPMENT CONTROL

- 1 Development should be sited and designed to prevent or minimise the generation of waste (including wastewater) by applying the following waste management hierarchy in the order of priority as shown below:
 - (a) avoiding the production of waste
 - (b) minimising waste production
 - (c) reusing waste
 - (d) recovering part of the waste for re-use
 - (e) (g) disposing of waste in an environmentally sound manner.
- 2 The storage, treatment and disposal of waste materials from any development should be achieved without risk to health or impairment of the environment.
- 3 Development should avoid as far as practical, the discharge or deposit of waste (including wastewater) onto land or into any waters (including processes such as seepage, infiltration or carriage by wind, rain, sea spray, stormwater or by the rising of the water table).

Character Preservation District Overlay

OBJECTIVES

1 A district where:

- (a) scenic and rural landscapes are highly valued, retained and protected

PRINCIPLES OF DEVELOPMENT CONTROL

Form of Development

1 Development should be consistent with the Objectives for the district.

Primary Production Zone

OBJECTIVES

- 1 Economically productive, efficient and environmentally sustainable primary production.
- 3 Protection of primary production from encroachment by incompatible land uses and protection of scenic qualities of rural landscapes.
- 5 Development that contributes to the desired character of the zone.

DESIRED CHARACTER

The zone comprises a range of landscapes with varying soil quality, underground water supplies and rainfall levels. Development of grazing and broadacre farming land uses is the most appropriate form of agricultural use located within the zone, with limited opportunities for more intensive uses such as horticulture and viticulture located within the uplands areas of the zone such as the Barossa Range. Development will take into account the capability and suitability of the land for the intended use.

The zone comprises a pleasant rural character derived from the broadacre farming pattern and undulating, wooded pastures together with the isolated dwellings and scattered farm buildings. The landscape character generally consists of open, undulating terrain with sparsely scattered stands of native vegetation. There are pockets of the zone where steep slopes and stands of native vegetation are more predominant, such as the upland areas of the Barossa Ranges. Development will recognise the limitations imposed by such characteristics and prevent the further erosion of soils, or removal of native vegetation. It is expected that development will be carefully designed

and located to complement the open landscape character.

PRINCIPLES OF DEVELOPMENT CONTROL Land Use

1 The following forms of development are envisaged in the zone:

- farming

5 Buildings should primarily be limited to farm buildings, a detached dwelling associated with primary production on the allotment and residential outbuildings that are:

- (a) grouped together on the allotment and set back from allotment boundaries to minimise the visual impact of buildings on the landscape as viewed from public roads
- (b) screened from public roads and adjacent land by existing vegetation or landscaped buffers.

Form and Character

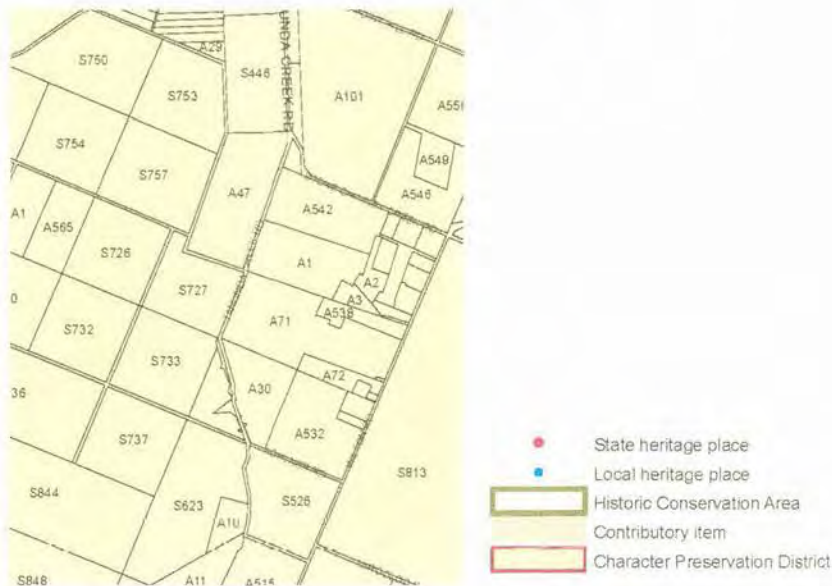
10 Development should not be undertaken unless it is consistent with the desired character for the zone.

11 Buildings should be unobtrusive in appearance, not detract from the open natural character of the zone and, in particular should:

- (a) be single storey
- (b) be of a low profile with roof lines that complement the natural form of the land



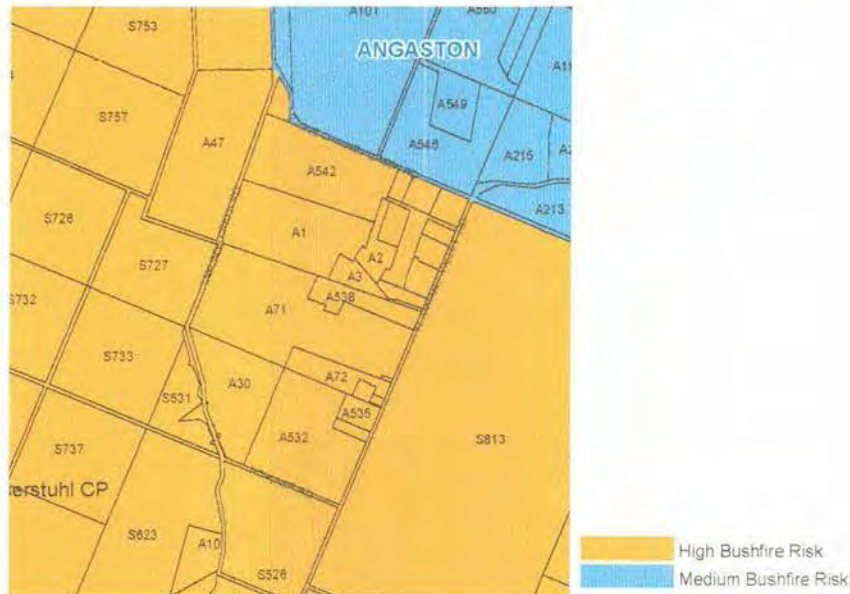
Zone Map Baro/24



Overlay Map Baro/24 HERITAGE AND CHARACTER PRESERVATION DISTRICT



Precinct Map Baro/24



Bushfire Protection Area BPA Map Baro/9 BUSHFIRE RISK

6.1 Attachment 2

14/11/18

Dear Chief Executive Officer – Barossa Council

Emma and I write to you in regard to the development application (960/533/2018) lodged with you recently by our neighbours, LJ Heath and VR Heath. (Lionel and Vicki)

We are an adjoining resident. Their property spans our entire western boundary (227m) and our entire southern boundary (124m).

They are seeking council approval to keep up to 3 horses on their 4Ha property at 41 (Lot 2) Randalls road in Flaxman Valley.

Introduction

We are proud of the effort we have made to commence and sustain good relations with all of our neighbours including Lionel and Vicki since moving to this very special part of the Barossa 5 years ago. There is a very strong sense of community up here, commencing long before the applicants and ourselves moved to the area relatively recently by comparison.

We feel incredibly privileged to join the already globally recognised brands of Chris Ringland Vintners, Hobbs Vintners, Flaxman wines, Yalumba's Heggies and Pewsey vale vineyards, Peter Lehmann's Wigan Riesling vineyard and Pernod Ricards' Steingarten Riesling to mention just a few, with our own small landholding (2.8Ha) of 80+ year old Riesling, Shiraz, Semillon and Muscat vines grown organically here at 500m elevation in Flaxmans valley. We hold a very strong belief that there is something extremely unique about this small area high in the Eden valley. The combination of very old vines grown at around 500m elevation in the Keynes subgroup of early Cambrian 541-509million year old rock is something that cannot be replicated anywhere in the world. In short time Emma and I have been very lucky to receive high praise for our small production wines under our Ruggabellus label. As we restore our old vineyard we are excited to be making single vineyard wines direct from our property. The first few of these have been extremely well received by both wine writers and highly regarded sommeliers around the world. Recently, Mike Bennie wrote of our latest release "this is the best suite of Australian wines I've seen all year" and "Flaxman's Valley could righteously be its own thing in Eden Valley and boasts a collective of high profile winemakers honing in on the parish. Abe Gibson and family have planted roots there, and their home block vineyard, rolling right out the back door of their house, has been carefully rehabilitated by Abe et al to allow this, a single puncheon, single vineyard release of Syrah. Haunting wine for its memorable, distinct, aromas and flavours, 96+points"

Content

We are concerned by a number of points made by the applicant in their development application to keep three horses adjacent to our 80+ year old vineyard here on Randalls road.

1. We are concerned that the proposed horse fences will have considerable visual impact and are not in keeping with the predominant unobtrusive sheep fences that are the norm in the locality. The applicants have already constructed some of these fences on parts of their property. Thankfully they are yet to install them on the uphill side of our vineyard. As well as the visual concern mentioned above, we have serious concern about their choice of material. The timber material previously chosen has been treated with creosote. The 'off-gassing' of this treatment is highly un-pleasant, discovered first hand by us as the prevailing wind for our property is from the direction of the applicants property. It is already widely accepted that creosote is a carcinogen. Creosote timber has been given the highest hazardous rating H6 for timber and can cause serious harm to humans much less to the ground water and soil life we are slowly restoring with the organic principles used in our old vine vineyard. We have already seen the issues with disposal of CCA (permapipe) posts locally and given the momentum in Europe toward the banning of these types of substances, we feel strongly that the applicant reconsider their choice of fencing material to both fit in visually and to be free of contaminants.

2. We are concerned with the aroma from urine and faeces that would be associated with such intensive horse keeping. As mentioned above our prevailing wind is from the direction of Lionel and Vicki's farm. We are winemakers. Every now and then we receive wine journalists and highly regarded sommeliers to taste our wines and visit our vineyard. There is a commonly known fault in winemaking called 'horsey'. This is an aromatic compound created by non favourable bacteria during the wine making process. As you could imagine it is very important that we train our senses to recognise this fault. The presence of these types of aromas coming from the applicants property could compromise our ability to detect the fault.
3. We are concerned about the incompatibility of land use between viticulture and intensive horse keeping. As well as the above points mentioned we are concerned with regards to use of pesticides and herbicides required to sustain the applicants farm management plan. For us this has the potential for two major issues;
 - a. the prospect of damage to our vines with spray drift if the applicants poorly time the use of a chemical herbicide in an attempt to improve their pasture for their horses.
 - b. there is strong movement in many overseas markets to ban the use of wine with traces of glyphosate. According to the local BGWA, "MRL (Maximum residue limits) for glyphosate are likely to get stricter, so wine grape growers of exported wines may need to change practices." Ruggabellus currently exports wine and has the potential to grow this to new markets. Given that we farm with organic principles and are looking for organic certification in the future - we ask appropriate measures be in place to stop any toxic substances being used to manage weeds, and any fencing materials (ie creosote posts) entering our property, both airborne and subterranean.
4. We are concerned with the potential biosecurity issues from the introduction of weed seeds in the feed needed to import to sustain the higher feed requirement of keeping three times as many horses as is currently allowed in the Barossa Council development plan. We would like to see a prevention policy in place alongside rigorous soil management practices, as we believe this is vital to stop the spread of diseases and weed seeds. It is our concern that the type of intensive farming proposed will lead to a reliance on chemicals for weed and pest/vermin control.
5. We are concerned about the likelihood of airborne dust from damage to the applicants pasture from a high concentration of hard hooved horses, as mentioned previously we would more than likely receive this due to the prevailing direction of the wind up here. Given the actual area of paddocks designated to grazing for a significantly higher than recommended number of horses, we find it hard to believe they can maintain sufficient ground cover through the long hot dry summers of South Australia.
6. It is of utmost importance to us that Lionel and Vicki have the energy and resources to adhere to, continually monitor, evaluate and adjust their Management strategies as needed, given the potential for conflict and related stress. We do not wish to be in a position where we feel we have to monitor their actions. Currently our Ruggabellus business is the sole income for our family, our vineyard is integral to our business and reputation. We also choose to live and bring up our family here and feel privileged to call such a beautiful inspiring environment home.

Summary

For the application to go ahead we would like to see:

- Establish adequate screening along whole length of our West boundary or movement of all horse permanent fixtures and activities to an area well below our southern boundary. Including the use of appropriate locally indigenous species. With the aim to both screen visually as well as reduce odour and other airborne pollutants.
- Bio security measures in action to prevent spread of weeds and disease (ie, appropriate vehicle wash area) . The horse transportation vehicle is also located in the service shed and it is currently cleaned on the road adjacent to our boundary.
- Odour controlled from urine and manure – Manure management practice in place
- Visual impact minimized (fencing in keeping with local traditions) – the current configuration of two winter paddocks would see 4 rows of fencing that has a potential to have a great visual impact and a stark change from the current paddocks visual appearance. Particularly if they continue to use the same style fence that has already been put in place throughout their property.
- Screen the shed service areas and outdoor storage areas to prevent visual impact, odour, rodents and potential biological contaminants – the service shed is currently open along the whole eastern side – hay is stacked up inside and outside this shed, and other material and equipment is scattered around. This is all in a direct line of site of where we live.
- Minimal and appropriate chemical usage (ie taking into account wind direction ie. drift and timing with vineyard dormancy, potential effect on our wines MRL's to prevent issues for us exporting our wines and adverse impact and conflict between land uses
- Any activities to not impact on possible future bore water resources. An old bore is located on the south end of our West boundary. Given we are currently totally reliant on rainwater, or buying in water, we are interested in the potential of resurrecting the old bore and/or drilling a new one.

Please do not hesitate to contact us for clarification of any of the above matters

Kind regards

Abel, Emma, Bailin and Rouille

33 Randalls road
Flaxmans valley

Abel m 0412 773 536

abel@ruggabellus.com.au

STATEMENT OF REPRESENTATION
Pursuant to Section 38 of the Development Act 1993

TO **Chief Executive Officer**
The Barossa Council
PO Box 867
NURIOOTPA SA 5355



The Barossa Council

DEVELOPMENT No.	960/533/2018 L J Heath and V R Heath					
Name of Person(s) making Representation	Ben Zander on behalf of Wroxton Investments Pty Ltd					
Address	POSTAL: PO Box 81, Angaston SA 5353 RESIDENTIAL: 270 Flaxmans Valley Road, Angaston					
Email Address	ben@wroxton.com.au					
Phone Number	0418834675					
Nature of Interest Affected by Development <small>(eg adjoining resident, landowner nearby, on behalf of organization or company)</small>	Adjoining Landowner					
Reasons for Representation	See attached					
My Representation would be Overcome by <small>(state action sought)</small>	See attached	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> RECEIVED 14 NOV 2018 The Barossa Council </div>				
<p>You must indicate below if you wish to be heard by Council's Development Assessment Panel in respect to your representation :</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;">I WISH TO BE HEARD IN RESPECT TO THIS REPRESENTATION – NO – ONLY IF THEY WISH TO HEAR FROM ME</td> <td style="width: 30%;"></td> </tr> <tr> <td colspan="2">I WILL BE REPRESENTED BY <small>(if applicable):</small></td> </tr> </table>			I WISH TO BE HEARD IN RESPECT TO THIS REPRESENTATION – NO – ONLY IF THEY WISH TO HEAR FROM ME		I WILL BE REPRESENTED BY <small>(if applicable):</small>	
I WISH TO BE HEARD IN RESPECT TO THIS REPRESENTATION – NO – ONLY IF THEY WISH TO HEAR FROM ME						
I WILL BE REPRESENTED BY <small>(if applicable):</small>						

SIGNED


Agenda - Barossa Assessment Panel - 5 March 2019

DATED 13th November 2018

10 November 2018

Chief Executive Officer

The Barossa Council

PO Box 867

Nuriootpa SA 5353

Please find on the following pages, the representations and concerns we would like to raise in regards to Development Number 960/533/2018 at 41 Randalls Road Flaxman Valley, which is currently under assessment by The Barossa Council.

To facilitate ease of reading and negate the need to constantly swap from reading our submission, and then back to applicant's development submission to cross reference what we are referring to, within this document you will see sections of text **shaded yellow**. These sections of text are copied from the applicant's development submission, and then our discussion on that text is immediately below without any shading.

Background Information:

Our family has owned and operated a mixed farming operation in the Flaxman Valley area of the Barossa Ranges for 98 years continuously. This family farm is based at our main property, a few kilometres north of the applicant's location, but includes allotments 1 and 542, both being part section 812 in the hundred of Moorooroo. These two allotments border the applicant's property on its western side. The entire western boundary of the applicants land is a boundary fence with our landholdings, as is approximately 50% of their northern most boundary (adjacent to Randalls Road).

Our property adjoining the applicant's is used for viticulture and sheep grazing. The grapes produced from these vineyards, which adjoin the applicant, significantly contribute to two world famous and iconic Eden Valley Riesling wines. Namely the Peter Lehmann Wines – Wigan Riesling and the Jacob's Creek Wines – Steingarten Riesling labels. In some years these wines are made as single vineyard wines, made solely from the grapes produced on our property. We also sell the grapes grown on this property to other notable wineries such as RieslingFreak, Yalumba, Ruggabellus and Hobbs.

It is relatively common place for these wineries to bring VIP guests, and world class sommeliers out to our vineyards such that they can taste the wine in the vineyard from which it is sourced from and learn the full story of the wine from vineyard to bottle.

We have already had two wineries express verbal concerns to us regarding the horse related infrastructure being located so close to our vineyards.

Our comments and concerns on the development application (both the proposal and the property management plan) as submitted to council are as follows:

Proposal Page 1: An old dairy, a large concrete water storage tank, and a new outbuilding for storing a tractor, horse float, and fodder are situated close to Randalls Road. An exercise area, a round yard, and a couple of day yards are situated adjacent to the western side boundary of the narrow section of the property.

- Whilst it doesn't specifically relate to this development application, regarding the new outbuilding mentioned in this paragraph, I was of the understanding that the Barossa Council Development Plan required such buildings to be made from materials and colours such as to harmonize and blend with the natural and rural character of the land.
This new outbuilding is clad with bright zincalume sheeting and stands out like the proverbial. There is not another zincalume structure in the nearby vicinity nor is there one visible from the location of this outbuilding which makes it even more obvious.
Footnote – I note that we also currently have a DA in progress for the building of a zincalume shed here on our home property – but this is for a zincalume shed amongst an assortment of other zincalume sheds all in a tight cluster - and not a single shed on the top of hill with no other zincalume structures nearby, as is the case for the applicants new outbuilding built within the last four or so years.
- Regarding the exercise area, round yard and day yards situated adjacent to the western boundary, this is obviously the shared boundary with us. The day yards are located 0.9 metres from our shared boundary fence. The round yard is located 1.9 metres from our shared boundary fence. The exercise yard is located on our shared boundary. Over the last few years the day yards and round yards were erected without our prior knowledge or consideration.
Excavation work, fill work and associated site levelling for the exercise yard was also done without our prior knowledge or consideration. After this stage, we were asked by the applicants about the construction of a retaining wall along this section of our shared boundary – which we allowed to proceed as it didn't appear to be in contradiction to council plans, given its height was less than 1.2m. Since the construction of the wall, the area has been sheeted, and now hosts a whole set of horse jumping rails and associated items which further detracts from the visual amenity.
- From page 8 of the applicant's submission (which in-itself is copied from the Barossa Council Development Plan):

7 Stables, horse shelters or associated yards should be sited at least 30 metres from any dwelling on the site and from the nearest allotment boundary to avoid adverse impacts from dust, erosion and odour.

- We interpret this principle of development control existing for the purpose of buffer zones between property boundaries. We interpret it in this manner due to the buffer zone requirements we need to undertake when planting or replanting new vineyards, which is an area we are more familiar with and understand rather than horse related buffer zones.
If our interpretation on this 30 metre distance being a buffer zone requirement, then all "associated yards" should be located more than 30 metres from the allotment boundary, and we would propose that both of the day yards, the exercise yard and the round yard do not meet these buffer zones and thus shouldn't be in existence in their current location. Their current location immediately against our property boundary also places them immediately adjacent to one of the iconic Riesling vineyards as mentioned in my background information section. The odour impact from this is of concern to us and our winemaking customers.



Image 1: The view from the middle of our vineyard looking east towards the applicant's property and zincalume outbuilding.



Image 2: The view from the middle of the same vineyard looking west towards one of our remnant patches of native vegetation.



Image 3: The location of the round yard compared to the shared property boundary. The corner of square day yards is just visible past the small garden shed and IBC.



Image 4: The location of the square exercise yard on the property boundary and the rails and horse jumping equipment scattered across the yard.

Proposal Page 2: Two 3.8m x 3.8m

three-sided horse shelters are to be provided with one in each of the the summer paddocks situated at least 33 metres east of the dwelling. A round exercise yard and a rectangular exercise area are situated at the northern end of the property adjacent to the eastern boundary.

- We are a little confused on a couple of points within this paragraph. We assume it is just a typo error, but the round and rectangular exercise yards are located adjacent the western boundary as discussed above and not the eastern boundary.
- The paragraph indicates that a 3-sided horse shelter would be provided in each of the summer paddocks, yet "Figure 1 Site Plan" in the proposal shows both shelters being built in a single summer paddock. Some clarity on the applicant's actual intentions would be appreciated.
- We might also note, relating to the previous discussion point on buffer zones, that perhaps these shelters need to be located more than 30 metres from not only the applicant dwelling, but also from the allotment boundary. To achieve this 30 metre buffer zone, it may be that the horse shelters need to be located on the southern side of the applicants driveway
- From page 8 of the applicant's submission (which in-it-self is copied from the Barossa Council Development Plan):

10 Stables and horse shelters should have dimensions of at least 4 metres by 4 metres per horse and an accompanying horse holding yard should of not less than 50 square metres in area.

- We note that the proposed dimensions of these shelters is smaller than that proposed in the Barossa Council Development Plan, but also note that the plan specifies "per horse". For the keeping of three horses, does that mean a third shelter would need to be constructed, or the proposed shelters enlarged to 48 square metres to achieve the 16 square metres per horse?

Proposal Page 2: Horse keeping is defined in Schedule 1 of the Development Control Regulations as follows:

horse keeping means the keeping or husbandry of horses where more than 1 horse is kept per 3 hectares of land used for such purposes or where hand feeding of a horse is involved;

As the proposal is for three horses on a 4.2ha property it exceeds the above ratio and is a form of development requiring the consent of Council.

- Whilst the applicant states their property size as 4.2 hectares, we observe the comment "land used for such purposes" above. We note that as per "Figure 1 Site Plan" the proposed combined area of "winter paddocks" is approximately 0.41Ha, the proposed combined area of "summer paddocks" is approximately 0.84Ha, with a proposed spelling area of approximately 1.52Ha. This gives a proposed grazing paddock area for 3 horses over the course of a year of approximately just 1.25 hectares – plus the 1.52 hectares of spelling paddock.

Proposal Page 2: **Animal Keeping**

The proposal would be in accordance with Objectives 1 and 2 plus Principle 1 for Animal Keeping in that the number of horses kept and the rotational management of pastures with supplementary feeding as outlined in the Property Management Plan will ensure that the carrying capacity of the land is not exceeded and thereby avoiding any adverse effects.

- It is widely accepted (reference B - page 63) that an appropriate stocking rates for animal husbandry in the local area is 3 to a maximum of 4 DSE (dry sheep equivalent) per hectare on unimproved pastures. It is also widely accepted (reference B - page 57) that the DSE rating of a horse is between 10 and 18 DSE, but commonly considered approximately 13.5 DSE per horse. Thus it can be calculated that 3 horses have a grazing requirement of approximately 40 DSE. Given

a combined summer and winter grazing area, this equates to a stocking rate of approximately 32.5 DSE for the entire 1.25 hectares of frequently grazed land – which is ten times higher than accepted stocking rates in the locality.

For the winter grazed paddocks (40 DSE in 0.41 Ha), so grazed at 100 DSE per hectare, or 30 times accepted stocking rates, it is hard to understand how rotational management with just two paddocks and supplementary feeding will ensure “the carrying capacity of the land is not exceeded and thereby avoiding any adverse effects”

Footnote – in Appendix 3, I have tagged many pages within the document that have relevance to the applicant’s intentions. These tags are higher up on the pages and may include entire chapters of information. The three references pages I refer to are tagged lower on the page and labelled “Ref”.

Proposal Page 3: Manure from horse yards and exercise areas will be removed daily and will be bagged up at the time of collection and stored in the shed near the front of the property until sold or given away along the roadside and would be in accord with Principle 2 (a) (b) (c).

- Whilst in principle this proposal sounds good, we are concerned about the plan to store bagged manure “in the shed near the front of the property”. We would propose that any storage of bagged manure should only be considered more than 30 metres from the allotment boundary (buffer zone). Both sheds at the northern end of the property are within 30 metres of the allotment boundary and there are vineyards planted on neighbouring properties on both sides of these sheds.

Proposal Page 4: Fencing of pastures will be a combination of normal stock proof rural fencing and electric fencing to contain the horses and protect newly planted trees from grazing by horses in accord with Principle 4 (a) (b) (c).

- “Normal stock proof rural fencing” in the immediate area of the applicant generally consists of steel or wooden posts at four to six metres intervals, with associated cyclone, plain or barbed wires. Such fencing is predominantly see through and unobtrusive to the visual amenity or landscape. Even other properties holding horses in the nearby Flaxman Valley area utilise this type of fencing. The closest horse keeping property we can think of that has horse specific fencing would be the former Lindsay Park property on the Angaston – Eden Valley Road. Since the addition of horses to the applicant’s property, a number of fences have been added that are post and wooden creosote treated rails (approximately 20cm width). Many of these fences are only part finished, but I believe the intention is to have three rails per fence. If all of the proposed fencing around the winter and summer paddocks is planned to be of this post and rail type, it will be a significantly different visual aesthetic to what is currently present and what was present historically.



Image 5: The look of the post and rail fencing proposed by the applicant. I believe a third lower rail is planned to be added to this fence. The fence in the background (the boundary fence is a more traditional rural stock fence in the area, with just the posts visible (although I believe the applicants intend to add three rails to this fence also.



Image 6: The view from our property looking east, across the skinny park of the applicants property (planned winter pastures) to the next neighbours vineyard. The applicants have approximately 43 metres of property width at this point, and may have plans to install up to 4 or 5 post and rail fences running left to right between our property and vineyard on the other side, based upon horse fences they have constructed thus far.

Proposal Page 4: Management in accordance with the Property Management Plan will ensure that pasture cover is maintained at a minimum of 30% groundcover thereby ensuring compliance with Principle 9 (a) (b) (c) (d) (e) (f).

- On flat and sloping land acceptable minimum groundcover percent is more appropriately valued at 60% to 75%, rather than the proposed 30%. (reference B - page 72) At 30% groundcover in a high rainfall area such as the Barossa Ranges, significant soil erosion by water is highly likely, as is some wind erosion. This may be accentuated by the nature of the horses hooves and their effect on the stability of the soil surface. To ensure compliance with Principle 9 as the applicant has indicated – we are of the belief that 70% minimum groundcover targets would be more appropriate. The proposal correctly states there are no watercourses running through the property, but it should be noted that the 2009 Barossa Water Allocation Plan shows that there is a first order stream, which contributes to the North Para River system immediately south of the applicant's southern boundary – and running full length of the applicant's southern boundary (Figure 5 from WAP Included as appendix 1).

Proposal Page 4: **Hazards**

Although the subject land is in a high bushfire risk area it is adjacent to an all weather access road, provides a suitable designated water supply for fire fighting purposes, and has adequate access and turnaround area for CFS Vehicles.

- We note the comment here regarding “a suitable designated water supply for fire fighting purposes”, yet contrasting comment in “Water Supply” section of the submitted Property

Management Plan that water will be reticulated from the stated “dedicated water supply for fire fighting” to horse troughs to be located in paddocks around the property. Does this imply that there is no longer any dedicated water facility for fire fighting purposes which I would assume would have been part of the parameters to allow the new dwelling to be built under a previous development application?

Proposal Page 4: **Interface Between Land Uses**

Three horses on the subject land would be readily manageable for my Clients. The combination of maintenance of at least 30% minimum ground cover, a rotational grazing regime with supplementary feeding, manure management and removal, plus the planting of shelter belts comprising locally indigenous species of trees will ensure that the locality will not be detrimentally affected

- We have already mentioned our concerns regarding a target groundcover of 30%. To date we are not aware of any attempts by the applicants to plant or encourage shelter belts around their property, and in fact on our boundary this would be near impossible to achieve with day yards, round yards and exercise yards located so close and even on the property boundary. We have noticed since the applicants acquired this property and began personalising it to their wishes that their neighbour to their east on the northern skinny section of the property, who is also the northern neighbour near the dwelling location has chosen to remove at least one row of vines against the dwelling part of the boundary and chosen to replace it with trees and shrubs as a shelter belt to attempt to lessen the visual and odour impact on their own property. Likewise they have shortened almost every single row of vines on the western side of their vineyard to do likewise with trees and shrubs as a shelter belt. Some of these vines were up to 80 years old!

Proposal Page 4: **Landscaping, Fences and Walls**

Planting of locally indigenous native species will provide screening for horse yards and exercise areas, maximize shade, and minimize maintenance and watering requirements.

- Relating to the previous point, it is difficult to plant native species to provide screening for horse yards and exercise areas when they are on or so near the property boundary. If these yards and exercise areas were located 30 metres from the allotment boundary as a buffer zone, as discussed earlier, the ability to plant native shelter belts and screening is facilitated in a much easier manner.

Proposal Page 5: We could copy and paste sections from each of the titled paragraphs of: Natural Resources, Orderly and Sustainable Development, Siting and Visibility, Waste and Primary Production Zone with a discussion on what is in the proposal. In essence, this would be a repeat of much of what has been written previously in this submission.

Property Management Plan (PMP) Page 1: **Rainfall: Average Annual rainfall = 756 mm**

- We would be interested to know how this value was determined? Having kept on property rainfall records at our home property for over 45 years, we have factual data that indicates average annual rainfall of less than 700mm per year. 655 mm over a forty plus year period, and a last ten years average of just 622mm. The applicant's property is approximately 3km south of our recording site, and at higher elevation, but the quoted rainfall value is unrealistic. The 2009 Barossa Water Allocation Plan further support this, indicating the applicants property is mid way between the 700mm and 650mm isohyet (Figure 11 from WAP Included as appendix 2).

PMP Page 1: The property is broken up into several paddocks including two summer paddocks and two winter paddocks plus a spelling paddock. The subject land is relatively devoid of native vegetation although some introduced trees are situated relatively close to the house yard.

- The current site plan is presumably a futuristic plan of what the applicants aim to achieve. Currently, both proposed winter paddocks are combined into a single paddock. Currently the northern summer paddock is a separate paddock, but the southern summer paddock and spelling paddock are combined as a single paddock. It may be noted that the horses have lived the majority if not entirety of the last four of five months in the combined southern summer paddock/spelling paddock.

PMP Page 2: **Soil and Pasture Management:**

Pastures will be managed primarily by ensuring stocking rates are kept at sustainable levels, through rotational grazing of paddocks, and supplementary feeding. Pastures are limited to the gently undulating slopes and the steeper sloping areas will only be grazed for short periods to reduce fuel load during bushfire Season.

- As discussed earlier, the sustainable stocking rate for unimproved pastures in the local area is widely considered to be between 3 and 4 DSE per hectare. This would equate to between 1 and 2 horses being kept on the entire applicants property.

PMP Page 2: As seasonal conditions move into the summer management periods supplementary feeding will be increased and the horses will be kept in the yards on lesser sloping ground and will be predominantly supplementary fed so as to reduce total grazing pressure and maintain adequate groundcover on pastures.

- Although the use of summer and winter grazing paddocks is broadly described throughout the applicant's proposal and property management plan, this paragraph indicates that the horses would then be based in the yards for extended periods of time - possibly the months of January to June when pasture feed is very limited. Given these yards are located immediately adjacent to our shared boundary, this adds extra concern to the lack of buffer zones used between any infrastructure for the horse keeping and the allotment boundary.
- We believe there would also be a significant risk of pest weed and plant incursion onto the applicants land, and potentially our land as well, given the applicant will be so heavily reliant in bringing in fodder from a third party for supplementary feeding.

PMP Page 3: **Paddocks and Fencing:**

The property will be divided into paddocks in accordance with the attached site plan. Treelines comprising *Allocasuarina Verticillata* (drooping sheoak) and *Callitris Preissii* (native pine) will be planted in the space between the double fence-lines and adjacent to internal fences.

- We would query the choice of native pine as a planted species given they are uncommon in the immediate vicinity of the applicants property. Within our property we have two significant stands of relatively unmodified native vegetation – which would be akin to the quality of remnant vegetation in Kaiserstuhl Conservation Park. Even within these patches of remnant vegetation on our property, we are not aware of any native pines present.

HORSE KEEPING VERSUS INTENSIVE ANIMAL KEEPING

In reviewing the Barossa Council Development Plan there are obviously guidelines within this document that the applicants have discussed in their submission and are discussed above. We would assume that these guidelines are relevant and applicable where the keeping of horses is done at a stocking density of 1 horse per 3 hectares.

Where a stocking density exceeds 1 horse per 3 hectares, we would assume that the "Intensive Animal Keeping" guidelines would be relevant.

Given the applicants propose to keep 3 horses on a total property size of 4.2 hectares (but only utilise 1.25 hectares for regular grazing – with 1.52 hectares of spelling paddock), this would seem to us to be a form of "Intensive Animal Keeping" and the appropriate sections in the Development Plan would be applicable and not just the "Horse Keeping" sections. The applicants have stated in their submission that during summer management periods the horses will be predominately supplementary fed, which in itself implies an intensive animal keeping enterprise.

Principle 13 of Development Control within the Animal Keeping section is as follows:

Intensive Animal Keeping

- 13 Intensive animal keeping operations and their associated components, including holding yards, temporary feeding areas, movement lanes and similar, should not be located on land within any of the following areas:
- (a) 800 metres of a public water supply reservoir
 - (b) the 1-in-100 year average return interval flood event area of any watercourse
 - (c) 200 metres of a major watercourse (third order or higher stream)
 - (d) 100 metres of any other watercourse, bore or well used for domestic or stock water supplies
 - (e) 2000 metres of a defined and zoned township, settlement or urban area (except for land based aquaculture)
 - (f) 500 metres of a dwelling (except for a dwelling directly associated with the intensive animal keeping facility).

Principles 14 and 15 may also have relevance to the applicants.

At a minimum, from Principle 13, sections (d) and (f) above would have relevance to the application.

- (d) Given the undulating nature of the Barossa Ranges, there are many dams both small and large regularly dotting the landscape. Almost every paddock surrounding the applicant's property has a dam, bore or well on it and many of these are within 100 metres of the applicant's boundary. There is also the watercourse at the southern boundary of the applicant's property as previously mentioned.
- (f) There are a minimum of eight dwellings within close proximity to the applicants property (excluding their own dwelling). The image below shows a 500 metre radius circle overlaid on the local area. The circle is centred approximately where the applicant proposes to build the two new horse shelters. Circled in red are eight dwellings not on the applicant's property but within the 500 metre radius circle.

I'm uncertain who has been advised via the Council's public notification process, but perhaps all of owners/residents of these eight dwellings should be notified of an "Intensive animal keeping" application for a property nearby?

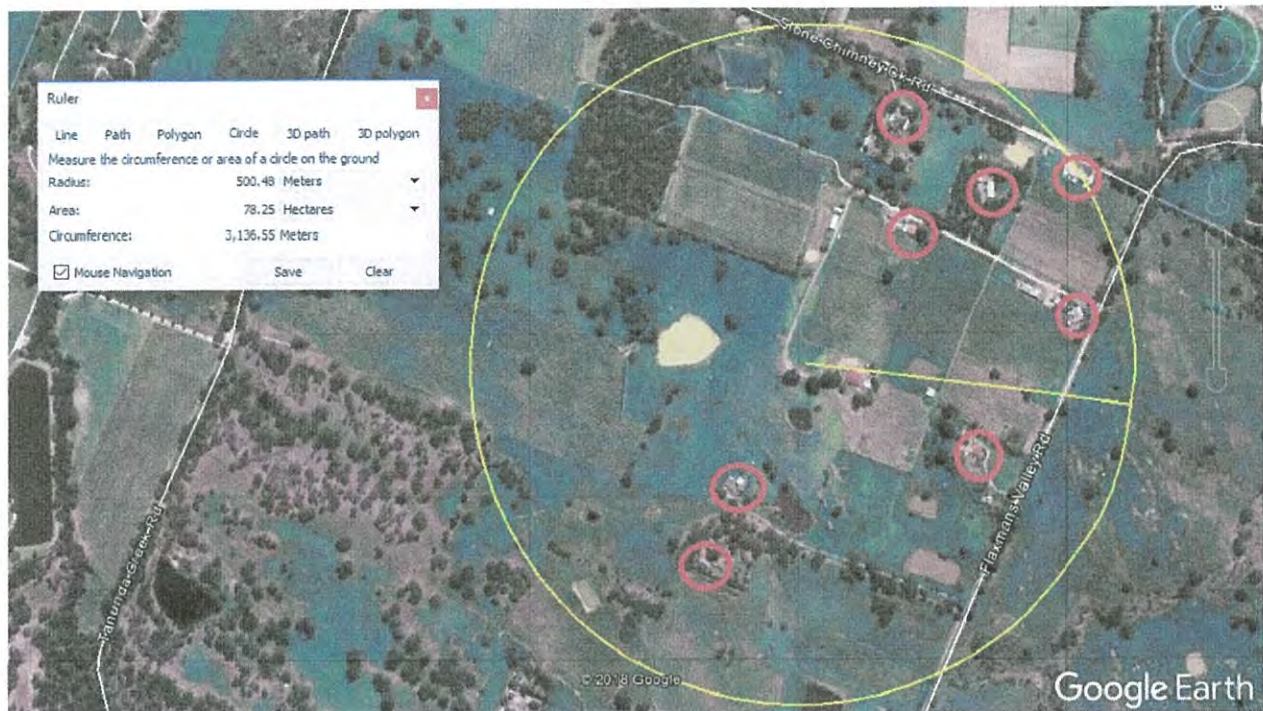


Image 8: A google earth image showing a 500 metre radius from approximately the centre of the applicants property. Circled in red are dwellings within this 500 metre radius circle.

- From an “intensive animal keeping” point of view, it could also be a discussion point if the two winter paddocks and the smaller summer paddock are in-fact considered to be paddocks, or at less than 0.2 hectares each – more so a yard?

CONCLUSION

Given all issues discussed in this submission, we are not in favour of The Barossa Council approving Development Application 960/533/2018 as submitted.

We believe it is an “Intensive Animal Keeping” development, and not appropriate on such a small allotment zoned rural living within a greater area zoned primary production.

We believe that the applicant has already developed associated yards for horse keeping without the consideration of buffer zones as stipulated in the development plan. This then raises the question of should these yards be allowed to stay in their current location, or should they be relocated to meet the 30 metre offset from allotment boundaries?

Our representation would be overcome by the applicants having more regards to their neighbours and the local area with regards to the visual aesthetics, and the following of Development Plan guidelines for the siting of stables, shelters and associated yards.

Given the 3 hectares per horse guideline, this allows the applicant to keep 1.4 horses on the property. We would suggest that two horses should be the absolute maximum number allowed to be kept on such a small and - in parts of the property - such a narrow landholding.

FINAL CONCERN

It was mentioned above that there was one other concern in the submitted proposal we had concerns about.

Proposal Page 1: Although up to five horses were being kept on the property two have been removed to my Client's other property in Eudunda. The proposal is now for the keeping of up to 3 horses.

- We found this an interesting beginning to the submission. Shortly after the date that the applicant's development application was submitted to council (24th Sep), we did in fact observe that the applicants had destocked two of the usual horses that had resided there. Coincidentally at the same time, another neighbour on the northern side of Randalls Road (directly opposite the entrance gate of the applicant) acquired two new horses and it has been confirmed that these are the two horses removed from the applicant's property. The nett result being there are 3 horses residing on the applicants 4.2 hectare property and two horses residing across the road on a 1.5Ha property.
- Neither property now meets my understanding of the principles of development control in the Barossa Council Development Plan for Rural Living allotments whereby 3 hectares of land is required per horse, for the purpose of horse keeping.
- We find it disappointing that such a false statement regarding the relocation of two horses to the applicant's Eudunda property is made on the opening page of the applicant's proposal. We do have to wonder if there are other false promises or false future plans written into the proposal or property management plan – just to get the application approved.
- Given these two horses have not been relocated to Eudunda, it does make us wonder if the intention is for them to return to living on the applicant property, after the development application process has been completed.

Update: 13/11/18

I note that sometime over the last weekend, the two horses mentioned above are back on the premises of the applicant, and no longer across the other side of Randalls Road on a neighbour's property as per above description

We are back to having 5 horses on the property – even though the applicant's proposed that two had been moved to Eudunda – which it is clear they haven't.



Image 9: A photo taken from the applicants front gate looking north across Randalls road. The gravel road leading to the bottom left of the photo is the applicants driveway. The gravel road going left to right across the photo is Randalls Road. The two horses that have supposedly been relocated to Eudunda are clearly seen in the neighbouring property on the other side of Randalls Road.

We ask that The Barossa Council give consideration to all the points raised above in making a determination on the relevant development application.

Please feel free to contact us if you have any further queries on our submission.

Thanks and regards

Ben Zander on behalf of

Wroxton Investments Pty Ltd being the owner of allotments 1 and 542, both being part section 812 in the hundred of Moorooroo.

References:

- A. Adelaide and Mount Lofty Ranges Natural Resources Management Board (2017) Best Practice Management Guidelines for Small Grazing Properties
(included in its entirety as appendix 3)
- B. Adelaide and Mount Lofty Ranges Natural Resources Management Board (2009) Water Allocation Plan – Barossa Prescribed Water Resources Area
(the references pages from this document are included as appendices 1 and 2)

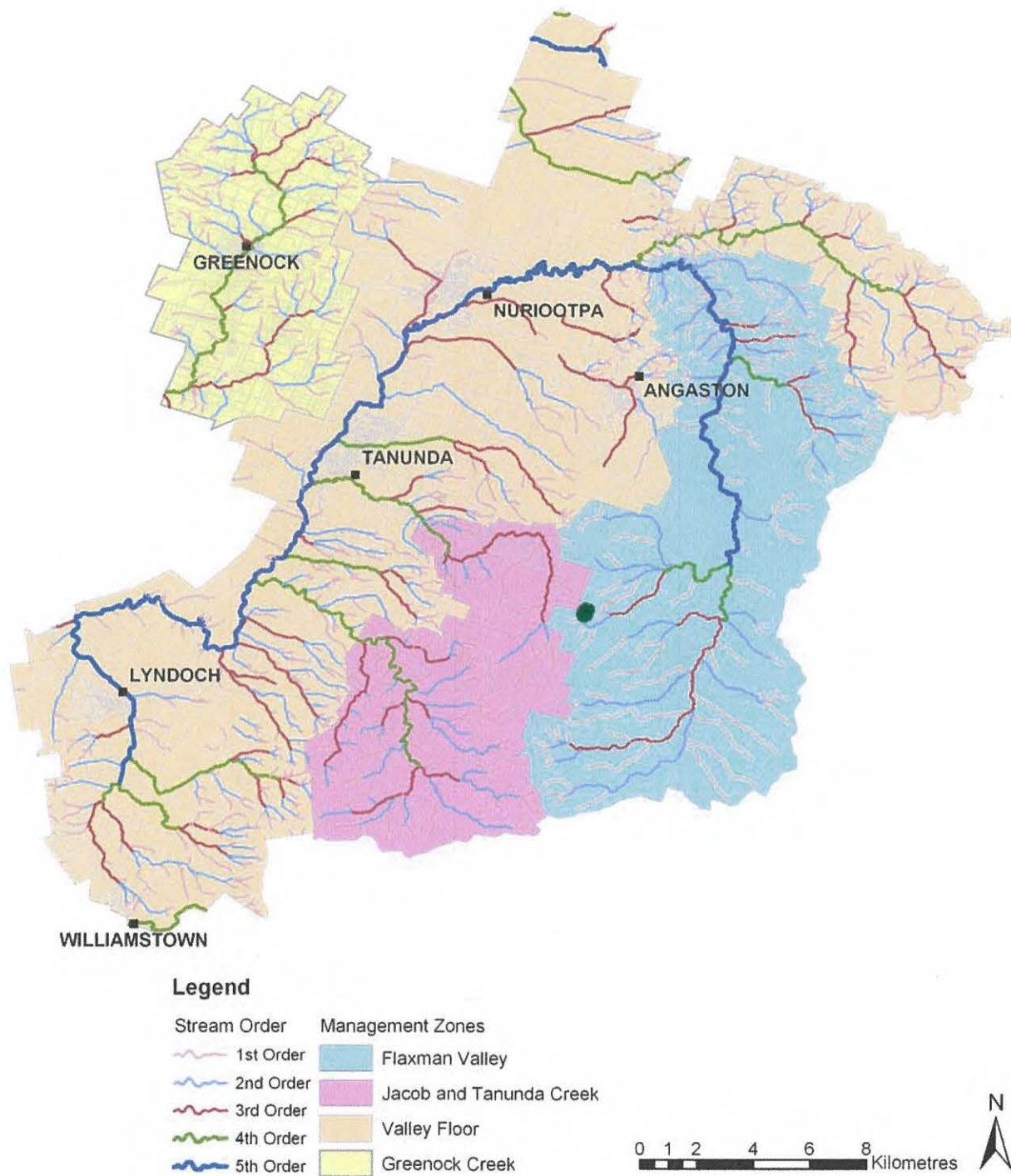


Figure 5
Stream Order in the Barossa Prescribed Water Resources Area

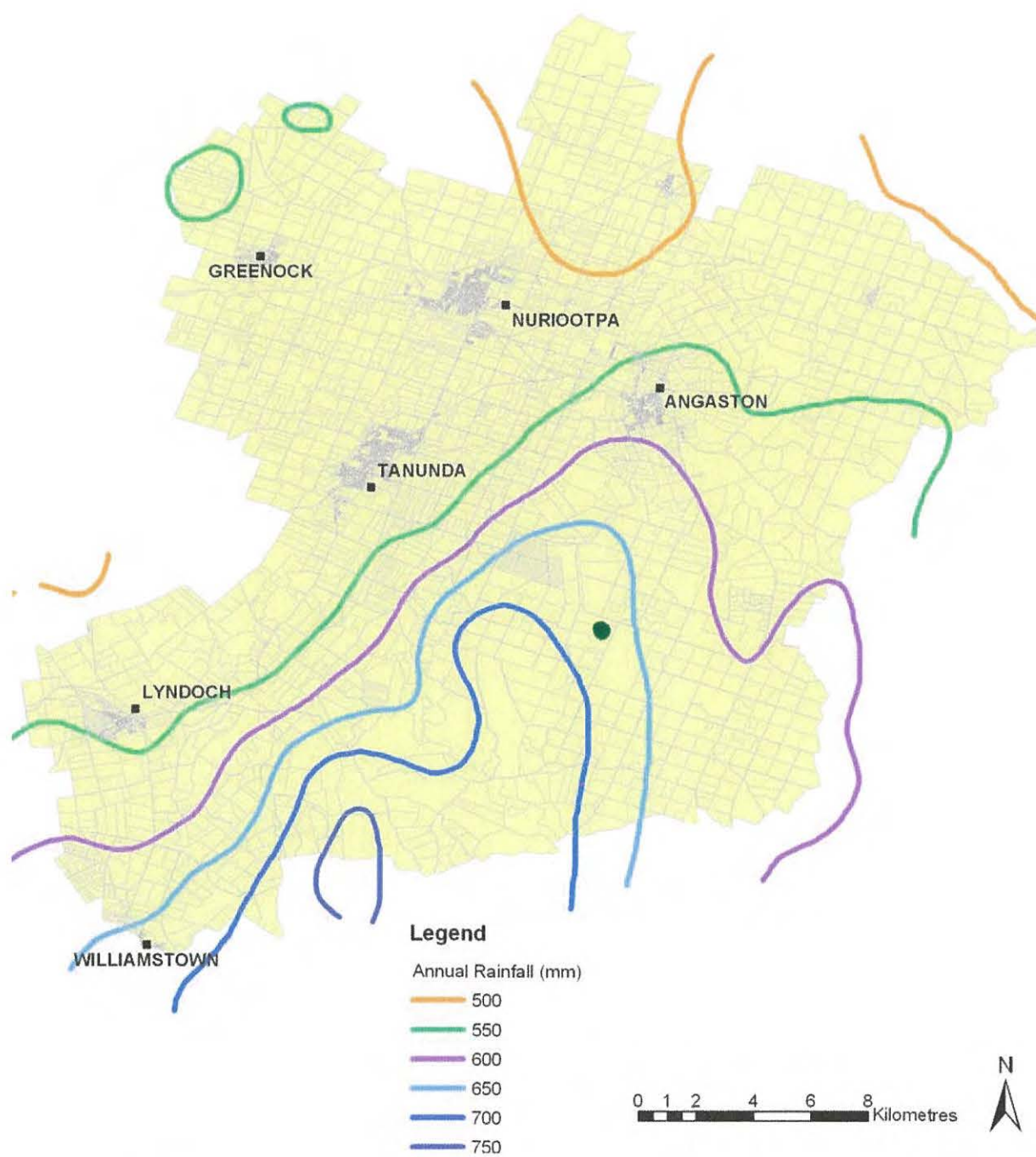


Figure 11
Rainfall in the Barossa



Best practice land management guidelines for small grazing properties

In the Adelaide and Mount Lofty Ranges Natural Resources
Management region



Compiled by Andy Cole (B.Ag.Sc. Dip.Ed.), Land Management Advisory Service, 2011.

Edited by Katrina Hewitt, Regional Landcare Facilitator, Natural Resources Adelaide and Mount Lofty Ranges, 2017.

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Australian Government

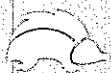
**National
Landcare
Programme**



November 2011. Revised December 2017.

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Natural Resources

Best practice land management guidelines for small grazing properties

In the Adelaide and Mount Lofty Ranges Natural Resources Management region



Government of South Australia

Adelaide and Mount Lofty Ranges
Natural Resources Management Board

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Jan Rowland Department of Environment, Water and Natural Resources (DEWNR), formerly the Department of Environment and Natural Resources (DENR) provided rainfall data sets, and developed grid maps representing regional soil groups.

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Soil and rainfall maps and data

Maps produced by the Science Resource Centre, DEWNR, formerly DENR

Soil data supplied by the Soil and Land Program, DEWNR, formerly DENR

Soil profiles photographs (and information) supplied courtesy of Soil and Land Program (2007) DVD

Photographic benchmarks depicting herbage mass 'food on offer'

Courtesy of the Appila/Bundaleer Pasture Group and Primary Industries and Resources SA

Disclaimer

Natural Resources Adelaide and Mount Lofty Ranges and the Government of South Australia and their employees do not warrant or make any representation regarding the use or results of use of the information contained herein as to its correctness, accuracy, currency or otherwise.

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1. Introduction

1.1 About this manual

The purpose of producing this *Best practice land management guidelines for small grazing properties* is to promote sustainable integrated land management and to encourage landholders to adopt best practice when managing livestock.

The guidelines were written in association with industry and contain technical information that will be of benefit to landholders and others throughout the region, who are seeking information on improving grazing practices.

The guidelines take into account the impacts of different soil types, irrigated and dryland grazing, as well as differences in livestock behaviour. Soil, topography and rainfall data is collated to determine baseline indicative stocking rates for non-commercial livestock enterprises. It is a comprehensive tool which focuses on sustainable land management practices and encourages landholders to better manage livestock to avoid land degradation.

The project addresses overgrazing issues in the region that potentially lead to soil loss, acidification, reduction in water quality, sedimentation of waterways, loss of biodiversity with a reduction of soil biota and native grasses.

This document is part of a larger project funded by the Australia Government.

How will this manual assist land managers?

This manual provides information and resources on key aspects of managing a small grazing property. It provides recommendations on a range of practical land management issues which will encourage better decision making, and lead to an improvement in the condition of the region's natural resources.

It is expected that landholders will be able to:

- understand threats to key natural resources of the region
- develop a property management plan
- conserve soil
- adopt an integrated approach to weed control
- combat soil acidity
- grow more productive pastures
- adopt suitable stocking rates and grazing strategies
- apply suitable grazing pressure without degrading land
- improve water quality
- understand the benefit to grazing enterprises of adopting best practice
- utilise links to further information.

1.2 The Natural Resources Management Act

The *Natural Resources Management Act 2004* (the NRM Act) identifies soil, water, native flora and fauna, geological features and ecosystems as natural resources that require protection and, in some cases rehabilitation to restore ecosystems to a healthy condition. The NRM Act requires that these natural resources are managed within the principles of ecologically sustainable development.

The Adelaide and Mount Lofty Ranges Natural Resources Management Board (the board) has identified a range of strategies and actions in its *Adelaide and Mount Lofty Ranges Natural Resources Management Plan* to encourage communities to achieve sustainable development and protect the region's natural ecosystems. Details of these strategies can be found in 'Volume 1 Strategic plan for the region 2014–15 to 2023–24 part 1 and 2' at www.naturalresources.sa.gov.au/adelaidemtloftyranges.

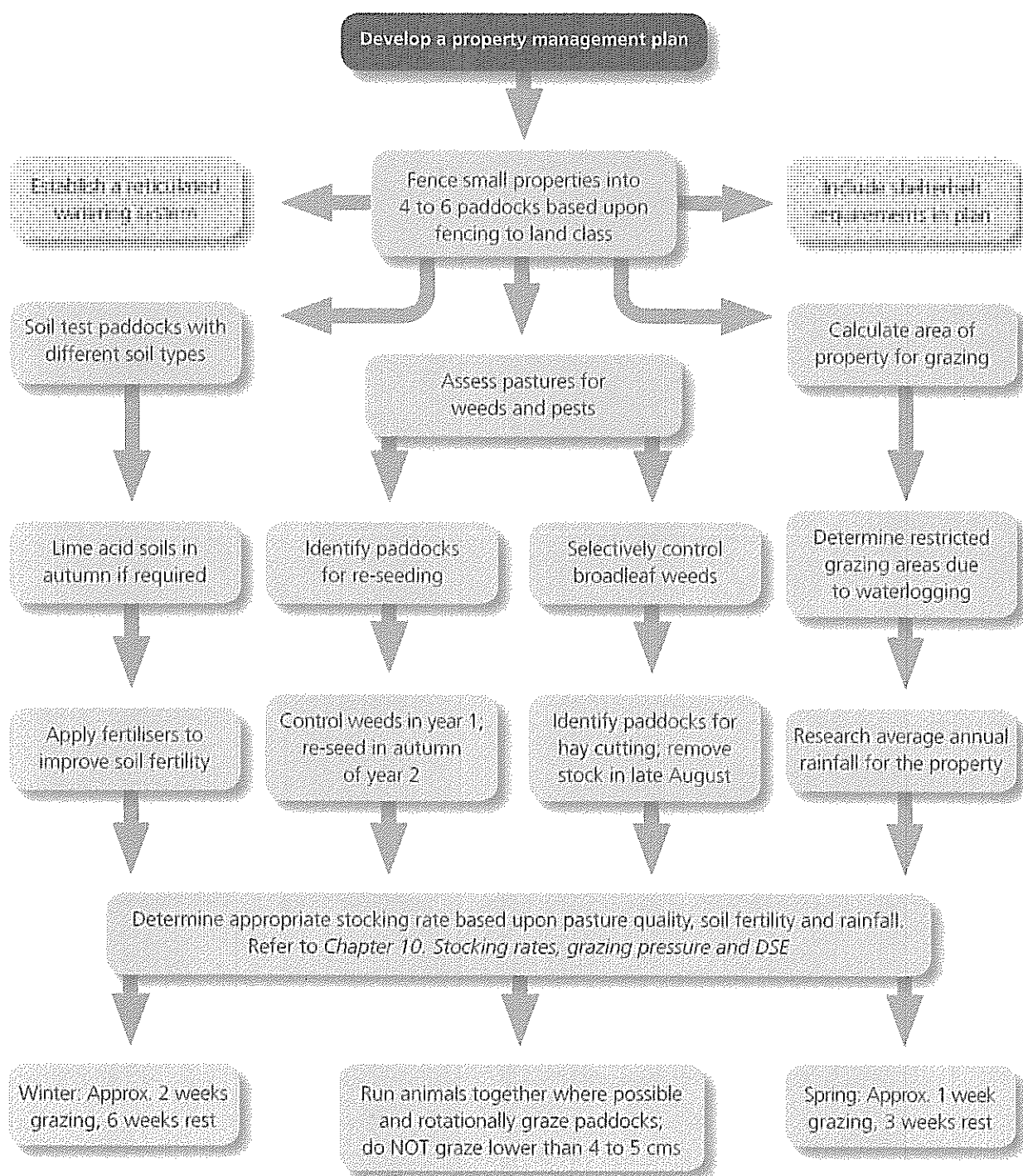


Figure 1. Grazing land on the Fleurieu Peninsula

Community groups, industry and a range of other organisations play a vital part in implementing initiatives to manage natural resources. However, it is the individual landholder who has a 'duty of care' under the NRM Act to manage natural resources. This duty of care is an important principle which underpins the land management objectives of improving water quality, rehabilitating watercourse ecosystems, preventing erosion, protecting biodiversity and reversing agriculturally induced soil acidity.

2. Summary of guidelines

This summary chart steps landholders through a series of actions to improve soil, pasture and grazing management. These actions support 'best practice' land management and are explained in further detail in this manual.



3. The region

The Adelaide and Mount Lofty Ranges Natural Resources Management Board's region supports a mosaic of bushland remnants, farming land, urban development, rolling hills and plains, diverse marine environments and more than 200 km of spectacular beaches and coastline.

Covering nearly a million hectares, just over half of which is land, the region extends from the Barossa Valley to the Fleurieu Peninsula. It follows the ridge of the western Mount Lofty Ranges (to 800 m) and takes in metropolitan Adelaide and the Adelaide Plains. The region extends up to 30 km into Gulf St Vincent and includes ecosystems that are found nowhere else in the world.

As the most biologically diverse region in South Australia, it is home to half of the State's species of native plants and three-quarters of its native birds. It also contains some of the State's most productive primary industries supplying local and international markets and contributing to South Australia's economic and social wellbeing.

Average annual rainfall ranges from 400 mm to the north of Adelaide to 1200 mm at Mount Lofty.

The region has a wide range of soil types, with the more common being low fertility ironstone soils over deeply weathered rock, acidic sandy loams and loamy soils over rock.

Livestock grazing on perennial and annual pastures is a major enterprise in the higher rainfall districts. Perennial horticulture and viticulture is significant in the Barossa Valley, central ranges and McLaren Vale, while seasonal horticulture is prevalent on the Northern Adelaide Plains and in the high rainfall area of Piccadilly Valley. Mixed farming with cereal, pulse and oilseed crops and livestock grazing on annual pastures, occurs in the Gawler, Two Wells and Mallala farming district (Figure 2).

In 2001 the population of the region was 1.13 million people and in 2016 it was estimated at 1.32 million.

In recent years there has been:

- a decrease in young people aged 15–24 years
- a decrease in people aged 25–34 years
- an increase in people aged 40 plus.

These changes are consistent with national demographic trends which include less people having children and an ageing population.

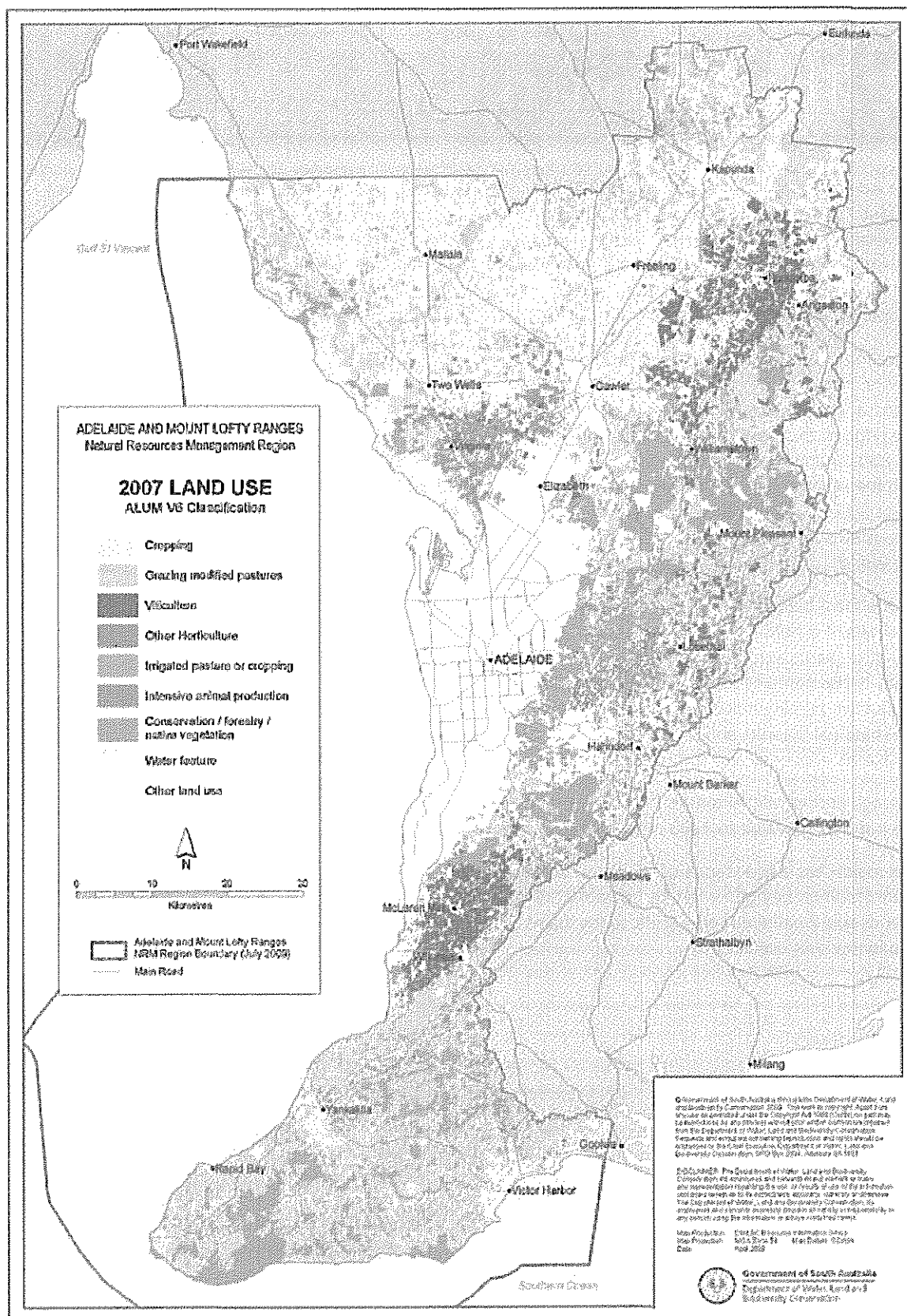


Figure 2. Land use in the Adelaide and Mount Lofty Ranges NRM region

4. Impacts of grazing on natural resources

Poor grazing management can have a significant impact on natural resources resulting in declining water quality, degraded aquatic ecosystems, increased soil acidity and a loss of top soil. In severe situations, gully erosion can lead to significant losses of prime agricultural land.

Furthermore a loss of biodiversity is a common occurrence when livestock are permitted to graze remnant native vegetation, or overgraze native grass pastures, and it is not uncommon to find well established native trees destroyed when they are ring-barked by livestock.

Environmental problems are also encountered when poor grazing management promotes the spread of weeds, many of which are classified as 'declared' plants or weeds of national significance.

4.1 Soil erosion

Where grazing pressure is excessive a loss of ground cover can cause erosion (Figure 3) resulting in soil loss and sedimentation in watercourses. In addition, there is the potential for gully erosion to occur at these sites.

Losing even small amounts of topsoil is considered significant on the shallow soils of the Mount Lofty Ranges. The loss of 1 mm of topsoil over a hectare represents 10 to 12 tonnes per hectare of actual soil.

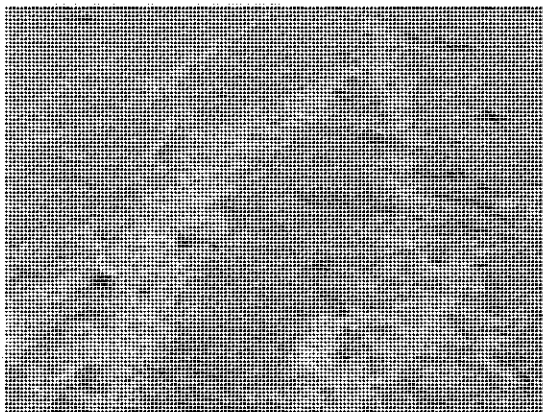


Figure 3. Erosion caused by overgrazing

The greatest potential for water erosion is on sandy textured soils on steep slopes. Contributing further to the risk of erosion is the degree of surface disturbance resulting from the trampling effects of livestock.

Cultivation of hilly land when re-seeding pastures is discouraged in the region because of the potential for significant erosion during heavy rainfall events, consequently direct drilling of pasture seed is advised.

Livestock tracking along fence lines can also create serious gully erosion on sloping land, so placement of new fences requires careful consideration.

While most landholders recognise the need to protect watercourses, the practice of grazing livestock through these sites still occurs on some properties. Unfortunately significant environmental damage results when vegetation is destroyed. Banks become unstable and the risk of mass erosion is increased, especially during severe rainfall events. In these situations many tonnes of soil can enter the watercourse in a single event (Figure 4), so fencing off watercourses to exclude livestock should be a priority for all landholders.

Preserving aquatic plants such as the common reed (*Phragmites australis*) and rushes (*Juncus* spp.) should be a key objective of landholders managing watercourses since these plants are very effective in holding soil together.

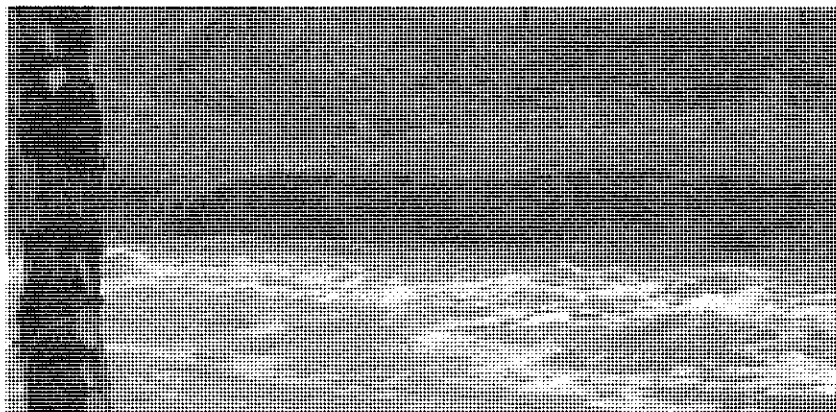


Figure 4. Streambank erosion on the Onkaparinga River at Oakbank

4.2 Soil acidity

Acidic soils can be detrimental to plant growth because they restrict the availability of nutrients thereby limiting plant growth which can lead to a lack of ground cover. Increased weed growth and erosion is often a consequence.

Soil acidification is a natural process of soil formation and is the result of millions of years of weathering. However, it can be greatly accelerated by the following agricultural practices:

- intensive legume based pasture production (clovers and medics)
- removal of nutrients in farm products (e.g. hay and silage)
- adding nitrogen fertilisers such as urea, ammonium sulphate and ammonium nitrate.

While the relationship between soil acidity and poor plant growth is generally well known, there are other significant environmental impacts:

- clay will eventually breakdown in highly acidic soils with a potential decline in soil structure and increased sedimentation of waterways
- survival of soil microbes (bacteria and fungi), earthworms and some insects is poor in acidic soils
- acidity is also harmful to fish and other stream biota.

4.3 Soil structure

A decline in soil structure can be attributed to over cultivation, loss of organic matter and a decline in soil organisms. Poorly structured soils generally exhibit poor drainage, contain limited oxygen for root growth and can easily be eroded. Trafficking wet soil can also lead to compaction of surface soil and sub-surface soil, which inhibits plant growth resulting in less vegetative cover.



Figure 5. Well-structured soils encourage good plant growth

5a: No structure. Sandy soil. Lacks organic matter.

5b: Good structure. Allows water and air into soil.

5c: Poor structure. Heavy impermeable clay. Improved by organic matter.

4.4 Water quality

The greater Adelaide area sources, on average, 60% of its drinking water from the Mount Lofty Ranges Water Protection Area (the Watershed) which is proclaimed under the *Environment Protection Act 1993*.

Approximately 90% of the watershed consists of privately owned land, much of which is used for grazing. This land use can have a direct impact on water quality by degrading ecosystems which creates a health hazard for the human population.

Cryptosporidium and Giardia are water-borne pathogens which are found in our rivers and reservoirs. Contamination through faeces occurs when livestock, especially young sheep and cattle, have free access to watercourses. These pathogens can cause serious illness with symptoms similar to gastro-enteritis, so costly water treatment is required to provide safe drinking water. Excluding livestock from watercourses reduces pathogen numbers and minimise the risk to human health.

Correcting poor soil nutrient levels by applying fertiliser is important in most grazing systems, however, overuse of fertiliser can be a source of water pollution (eutrophication). Applications of phosphorus and nitrogen in excess of plant requirements can be potentially damaging to the aquatic environment. This nutrient build up can create problems of excessive plant growth and lead to blooms of algae and weeds. It is also now recognised that high nutrient levels are the primary cause of seagrass loss in the Adelaide metropolitan waters, so testing soils to determine appropriate fertiliser requirements is good practice.

Even small quantities of sediment entering a watercourse can affect the growth of aquatic plants by reducing the amount of light they need for photosynthesis and growth. Fish can swallow large quantities of sediment, causing illness, reduced growth and eventual death. Sediment is also harmful to the gills of fish, clogging gill mucus and causing asphyxiation (Figure 6). Deposited sediment can smother whole stream beds and reduce the variation of habitats and flows. Recent studies on several species of native fish have found that all of their eggs die, even when lightly coated in fine sediment. Invertebrates (such as mayflies) use gills for respiration which in silt-laden water become clogged and are less effective.

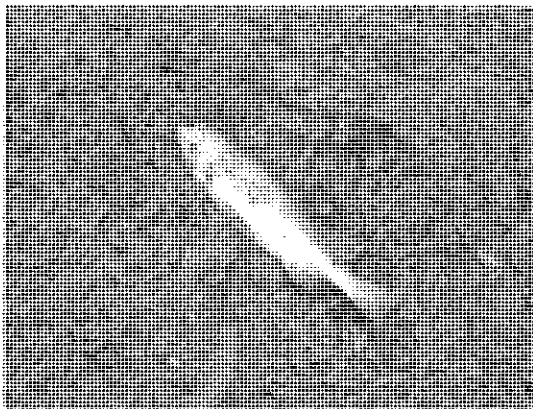


Figure 6. Fish species are susceptible to nutrient pollution from soil erosion

4.5 Biodiversity

Since Europeans arrived, the native vegetation of the region has been subjected to broadscale clearance and disturbance. Approximately 14% of the pre-European native vegetation cover remains today. The most common vegetation type was grassy woodland dominated by the smooth-barked gums: river red gum (*Eucalyptus camaldulensis*), SA blue gum (*Eucalyptus leucoxylon*) and manna gum (*Eucalyptus viminalis*). For decades these species were targeted for clearance leaving only scattered trees and small, isolated weed-infested remnants.

Where remnant native vegetation sites exist on private land, considerable damage can be done by grazing livestock, especially to understorey, consequently fencing off these sites is recommended.

The continued loss of native grass pastures due to overgrazing is a further issue. Kangaroo grass (*Themeda triandra*) does not survive well when subjected to high grazing pressures and will quickly disappear from the landscape. Some native grasses can be quite intolerant of fertiliser, however grasses such as weeping rice grass (*Microlaena stipoides*) and wallaby grass (*Austrodanthonia* spp.) will respond to rotational grazing and low levels of phosphorus and nitrogen applications. In general, native grasses adapt well to dry conditions and provide good ground cover in times of drought compared with some introduced pasture species such as perennial ryegrass (*Lolium perenne*).

5. Climate of the region

Table 1. Average monthly maximum temperature (degrees centigrade) – Roseworthy 1997–2017

January	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Lowest	24.8	23.9	24.4	20.9	17.2	14.4	13.8	14.2	16.4	18.9	24.0	21.1
Highest	36.2	34.8	34.5	29.0	24.9	17.7	16.8	18.8	22.6	28.6	33.5	24.6

Table 2. Average monthly maximum temperature (degrees centigrade) – Mount Barker 1863–2017

January	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Lowest	23.2	22.0	20.8	16.4	13.5	11.7	10.8	11.4	13.4	15.7	19.3	18.4
Highest	34.0	31.7	30.1	25.4	20.2	14.5	13.5	14.6	16.5	19.5	24.5	22.1

Table 3. Average monthly minimum temperature (degrees centigrade) – Roseworthy 1997–2017

January	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Lowest	11.4	11.9	10.0	6.6	4.5	3.4	4.6	2.5	5.0	6.2	7.9	6.9
Highest	17.8	18.4	16.7	12.9	11.2	8.3	6.7	6.6	9.3	10.6	14.7	10.4

Table 4. Average monthly minimum temperature (degrees centigrade) – Mount Barker 1862–2017

January	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Lowest	8.9	7.7	7.4	4.0	3.9	1.7	1.9	2.1	2.6	4.7	6.5	4.8
Highest	14.9	15.2	13.8	11.4	10.1	6.7	7.4	7.3	9.5	10.3	13.6	9.7

Topography and altitude vary throughout the region with quite marked differences in temperature and rainfall. Piccadilly, Aldgate and Uraidla, in the Mount Lofty Ranges, all have an average annual rainfall in excess of 1000 mm while the average annual rainfall at Gawler is 388 mm, and Two Wells 408 mm. Maximum temperatures can also be 5 degrees centigrade cooler at high altitude.

The risk of frosts is moderate to high in most areas which are inland from the coast, with areas at high altitude being particularly susceptible.

Seasonal rainfall has a significant influence on agricultural enterprises with autumn rains signifying the start of the growing season which extends through to November. This is followed by 4 to 5 months of dry weather interspersed with isolated rainfall events.

Evaporation can be over 1000 mm per annum with evaporation exceeding rainfall during summer. In winter, when rainfall exceeds evaporation, pasture growth can slow due to cold temperatures and waterlogged soils.

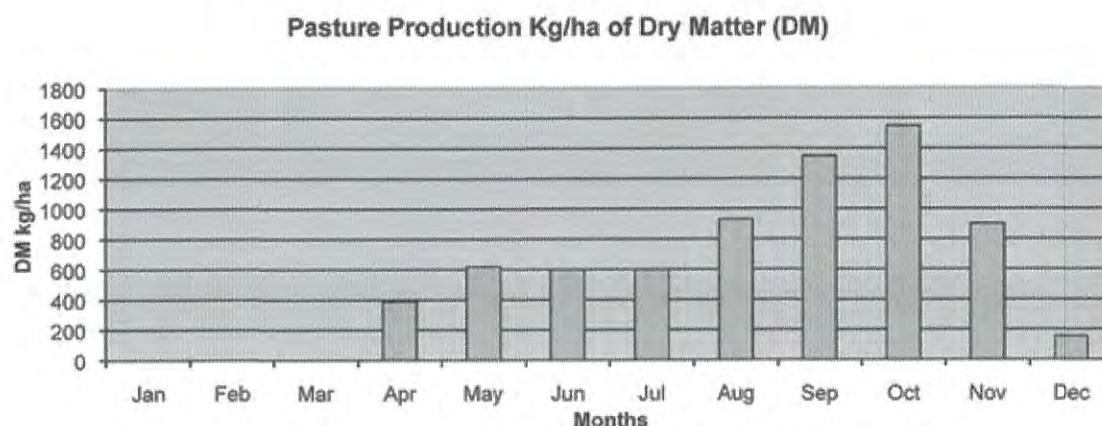


Figure 7. Typical monthly pasture production chart for high rainfall areas of the region (>650 mm p.a.)

5.1 Implications on pasture growth

Rainfall, temperature and sunlight all play a part in determining pasture productivity, with rainfall being the biggest influence on pasture dry matter production (i.e. plant matter excluding moisture) (Figure 7).

Temperature

When soil temperatures drop below 8 degrees, most commonly in June and July, pastures cease growing and enter a semi-dormant phase until August when temperatures rise and trigger further growth.

Frost can impact severely on some pasture species such as native kangaroo grass (*Themeda triandra*) causing older leaves to be severely damaged. Frost tolerant varieties include perennial ryegrass (*Lolium perenne*), phalaris (*Phalaris aquatica*), wallaby grass (*Rytidosperma* spp. previously *Austrodanthonia* spp.) and weeping rice grass (*Microlaena stipoides*).

Rainfall

The timing and intensity of rainfall events can have a marked impact on how effective rain is for pasture production (Figures 8, 9 and 10). Run-off may vary according to the nature of ground cover, slope and soil type, but on average this accounts for approximately 10% of the rain that falls.

In an area which receives 700 mm of rain in a particular year, 70 mm will be lost as run-off, and a further amount will be lost through evaporation. This figure can be as high as 50 mm during the growing season, and much higher during the warmer months of summer. Consequently only 580 mm will be available to promote pasture growth during winter and spring.

Sunlight

Pastures are directly affected by the amount of sunlight they receive. Increased day-length in spring will promote more active growth whilst cloudy days will inhibit pasture production. On hilly properties north facing slopes will often produce the most productive pastures.

5.2 Rainfall distribution at three key regional sites

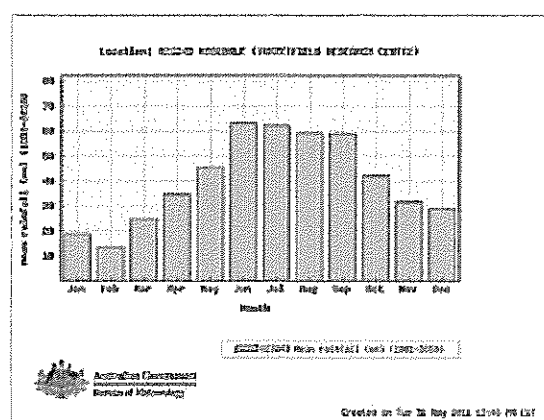


Figure 8. Average annual rainfall at Rosedale (between Gawler and Lyndoch) 483 mm
Source: Bureau of Meteorology 2011a

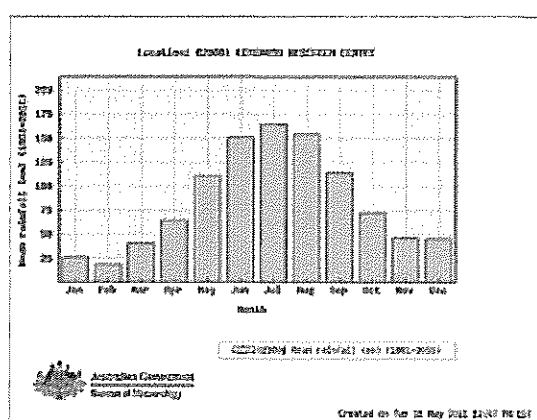


Figure 9. Average annual rainfall at Lenswood 1009 mm
Source: Bureau of Meteorology 2011b

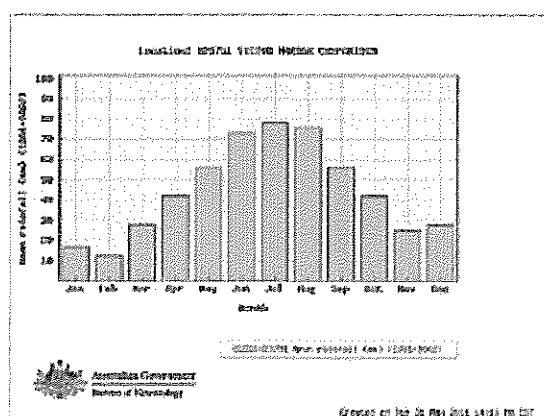


Figure 10. Average annual rainfall at Victor Harbor 528 mm
Source: Bureau of Meteorology 2011c

5.3 Average annual rainfall across the region

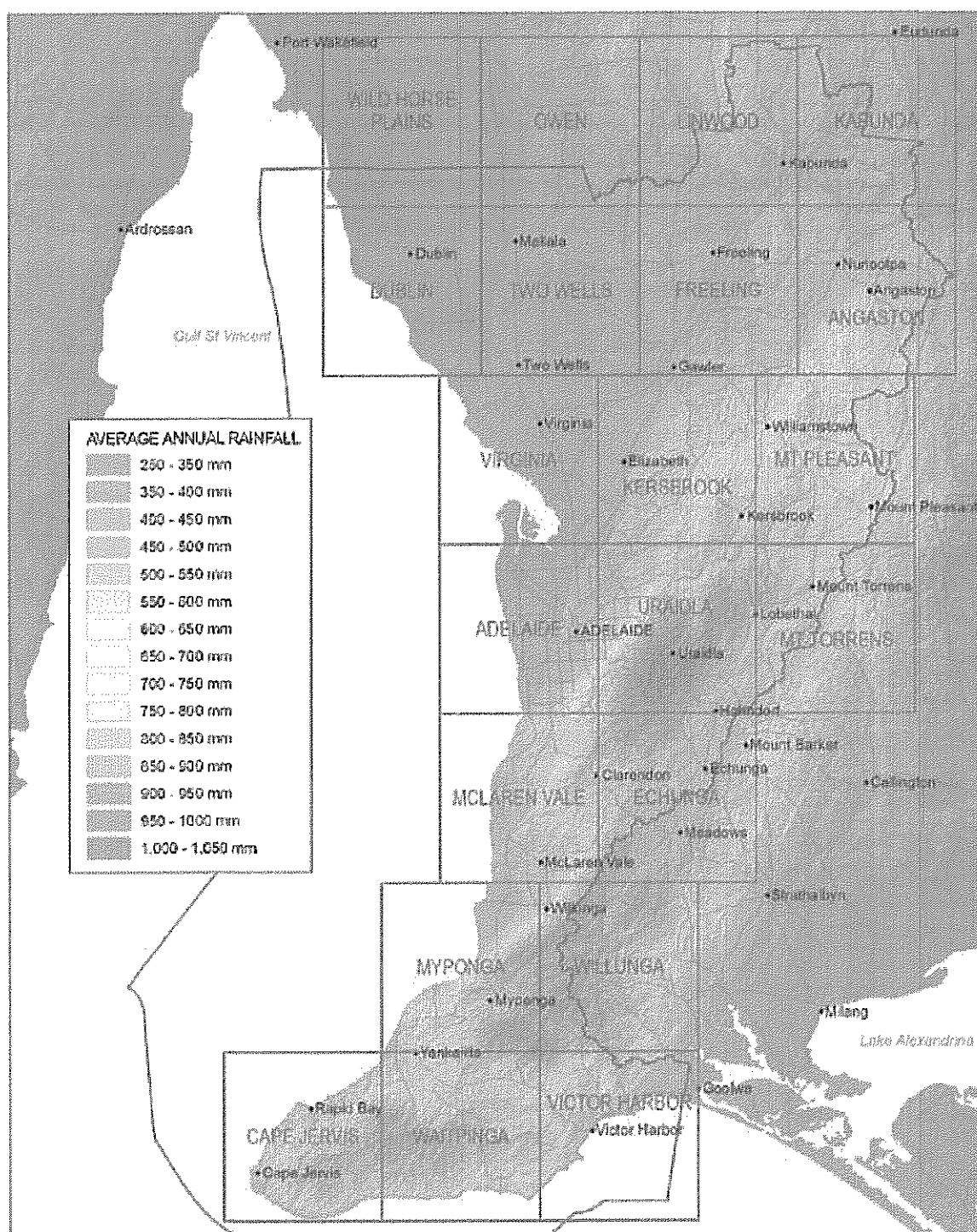


Figure 11. Long term average annual rainfall in the AMLR NRM region.

Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

Average annual rainfall should always be considered as a guide only since actual rainfall can vary significantly from year to year. Landholders should understand that this variability will directly affect the amount of feed produced by pastures.

The statistics in Table 5 highlight the variability in rainfall for two locations in the region over a six year period from 2005 to 2010. From this one can see that 2006 was a significantly dry year. Pasture growth would have been considerably less, resulting in the land supporting fewer animals. In this situation livestock numbers should be reduced to avoid overgrazing.

Table 5. Variability in annual rainfall for Adelaide and Lenswood 2005–10

Location	2005	2006	2007	2008	2009	2010	Average annual rainfall 1970-2010
Adelaide (Kangaroo Island)	630	288	983	400	517	502	540
Lenswood	1154	690	913	835	1103	1071	1022

Table 6. Average annual rainfall for locations in the AMLR NRM region

Source: Science Resource Centre, Department of Environment and Natural Resources, June 2011

Location	Central Victorian NRM region average annual rainfall	South-eastern NRM region average annual rainfall
Lenswood Research Centre	1137	1102
Lenswood	985	987
Adelaide Conservation Park	895	899
Barossa	617	615
Georgetown Forest	930	934
Cherry Gardens	833	823
Adelaide	833	833
Griffiths Creek	817	828
Mount Charles Flora Reserve	814	777
Mahomed	720	650
Clarendon	714	613
Exchange	703	606
Castlemaine	703	707
Hamilton	691	691
Yarrawalla	623	609
Woodville	610	604
Blackwood	607	707
Edinburgh	604	720
Hyattsville	601	601
Wellington	600	600
Upper Heathcote	600	645
Lower Heathcote	618	642
Yillamby	608	646

Table 6. continued

Property	Annual rainfall (mm)	
	1981-2010	1991-2020
Adelaide (Alan Corneall)	603	613
Second tube	601	609
Argenton	549	555
Adelaide (Rand Bavin)	544	549
Baranula	531	541
Larchmont	530	557
Archer Plains	528	535
Edmunds #6	517	523
Greenock	511	511
East	505	494
Kayakhat	496	513
Kasorda	484	494
Port Elliot	483	501
Fiddlers	483	485
Eudunda	480	480
Talbot	480	470
Horsley Bridge	450	463
Strommont	440	444
Gawler	434	456
Belair	403	415
Oven	404	416
Two Wells	391	399
Mallala	387	401
Trueman Lodge	380	386
Port Pirie	324	330

5.4 Climate change

Climate change is likely to influence how we manage land in the future. In this region, average annual rainfall is expected to decrease by up to 10% by 2030, while temperatures are predicted to rise by up to 1.2 degrees. These changes may result in a greater frequency of extreme climatic events, in particular more intense rainfall episodes. More variable breaks in the winter growing season coupled with changes in flowering times and insect breeding cycles are all likely to create additional land management challenges in the future.

Maintaining current pasture mixes could be difficult with less rainfall, since pasture cultivars have a minimum annual rainfall requirement. Some new varieties of perennial ryegrass (*Lolium perenne*) need a minimum of 700 mm rainfall per annum. In a drying climate there may be a need to swap to more drought tolerant varieties such as cocksfoot (*Dactylus glomerata*) or phalaris (*Phalaris aquatica*).

6. Soils of the region

Australian soils are some of the oldest in the world having experienced severe weathering and leaching over millions of years. As a consequence nutrient and organic matter levels can be low. The inherent features of a soil are usually determined by the type of parent rock and the nature of environmental exposure over time. Features such as soil colour, layers, texture, and to some extent structure, are used to describe a soil type.

6.1 Soil profiles

There are many different soil types which have quite distinctive characteristics such as colour, texture, structure and fertility. When assessing a soil it is important to examine the soil profile which consists of a series of layers or 'horizons' (Figure 12). The features of these horizons depend very much on the age of the soil, the nature of

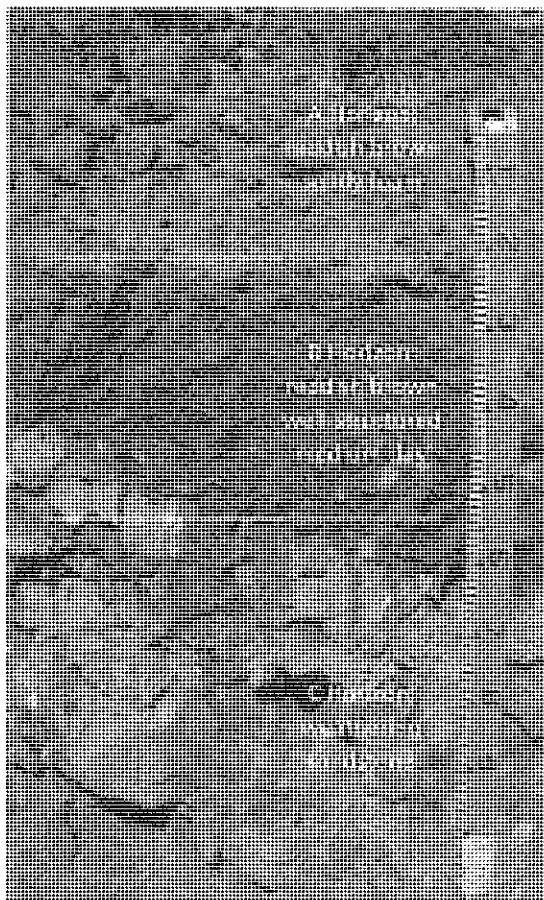


Figure 12. Hard red-brown texture contrast soils with highly calcareous lower subsoils

the parent material, climate, slope, vegetation and chemical reactions in the soil. Some profiles consist of quite shallow soils over parent rock. Others can be deep sands with little horizon differentiation. Knowledge of soil profiles is important when deciding what plants to grow. Most pastures have roots which only grow to a depth of approximately 10 to 15 cm, while perennial horticultural crops may penetrate to a depth of one metre or more. An examination of soil profiles may reveal limitations to growth such as waterlogging, salinity or acidity, and physical barriers such as hard pans, which can often inhibit the growth of plant roots.

6.2 Soil types

Soils in the higher rainfall areas of the region are generally acidic and can exhibit low to moderate soil fertility with natural deficiencies in phosphorus, sulphur and molybdenum. Soils in low rainfall areas of the region such as the Adelaide Plains and the Northern Hills are generally neutral to alkaline. In highly alkaline soils manganese and copper deficiencies are likely to occur.

Highly leached sandy soils can create problems for pasture growth, since nutrients are readily washed through the soil profile (leaching). Pale or whitish soil horizons are often features of these soils. Maintaining sufficient nutrient levels to optimise plant growth is a more challenging task when managing these soils compared with the more fertile red brown earths.

There are many different soil types within the region such as the black cracking clays at Yankalilla through to peat soils at Willunga, so landholders should be aware of their soil type(s) and understand the level of fertility and barriers to plant growth.

Similar soil types in the region have been put into 'soil groups' and mapped. (Figure 13).

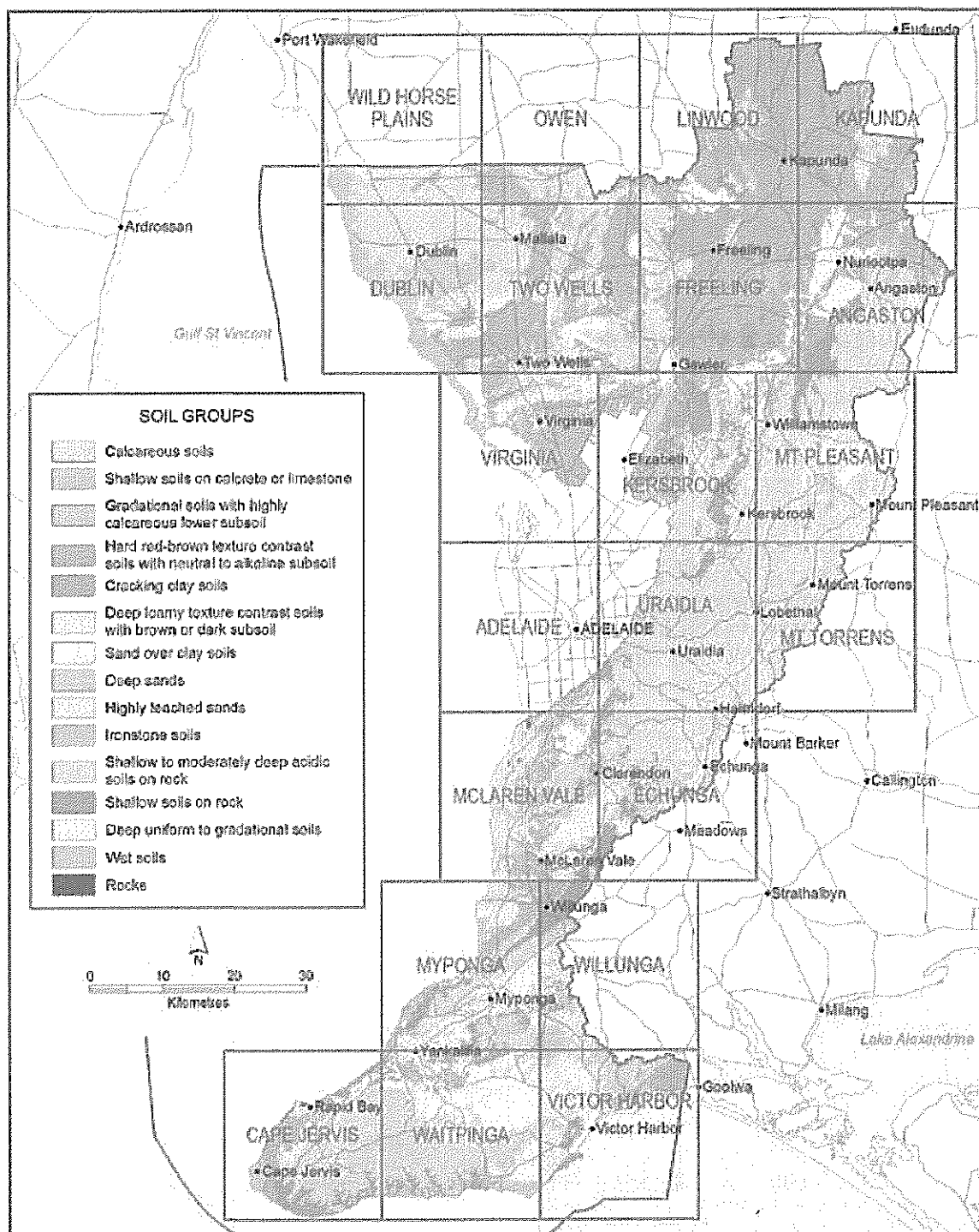


Figure 13. Soil groups of the Adelaide and Mount Lofty Ranges NRM region

Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

The map depicts the distribution of 15 generalised soil groups, and is based on an interpretation of soil landscape mapping units, which invariably comprise several soils. The most commonly occurring soil group in each landscape unit is delineated on this map.

The groups are categorised as follows:

- Group 1 Calcareous soils
- Group 2 Shallow soils on calcrete or limestone
- Group 3 Gradational soils with highly calcareous lower subsoil
- Group 4 Hard red-brown texture contrast soils with neutral to alkaline soils
- Group 5 Cracking clay soils
- Group 6 Deep loamy texture contrast soils with brown or dark subsoil
- Group 7 Sand over clay soils
- Group 8 Deep sands
- Group 9 Highly leached sands
- Group 10 Ironstone soils
- Group 11 Shallow to moderately deep acidic soils on rock
- Group 12 Shallow soils on rock
- Group 13 Deep uniform to gradational soils
- Group 14 Wet soils
- Group 15 Rocks

It should be pointed out however, that these maps are broad representations based on soil landscape mapping units, with the group name being determined by the dominant soil type. Other soil types will also be present. A soil landscape mapping unit is an area of land (typically 0.5 to 50 square kms in area) with recognisable topographic features and a limited range of soil types.

So while maps can be a useful guide to determine the likelihood of a particular soil type being present on the property, the only certain way to know what soils exist, is to examine the soil on site. Often cuttings can expose soil profiles, or landholders can use an inexpensive hand held auger to raise the various soil horizons. If necessary professional assistance can be sought to characterise the properties of the soil and gain a better understanding of what restrictions there may be to plant growth, and how best to manage that soil.

The following soil types, and their properties, are examples of soils from within the regional soil groups listed above, and which appear on soil maps throughout this document. It should be stated however, that the variability of soil types within soil groups means that landholders may not necessarily have soil profiles which are precisely the same.

Photographs and soil properties were obtained courtesy of the Soil and Land Program (2007).

Soil group 1: calcareous soils

Soil profile: Calcareous loam over clay loam over clay.

Location: Mallala, Easting: 268400, Northing: 6186450.

General description: Calcareous loam becoming more calcareous with depth, overlying substrate clay within 120 cm.

Drainage: Well drained. The soil rarely remains wet for more than a day or so following heavy or prolonged rainfall.

Fertility: Inherent fertility is moderate. Nutrient retention capacity is favourable, but high surface carbonate content reduces availability of phosphorus, copper, zinc, manganese and iron.

pH: Alkaline at the surface, strongly alkaline with depth.

Rooting depth: 68 cm at the pit site, with few roots below 15 cm.

Barriers to root growth: High pH, high boron concentrations and probable high sodicity restrict root growth.

Erosion potential: Water – low. Wind – moderately low.

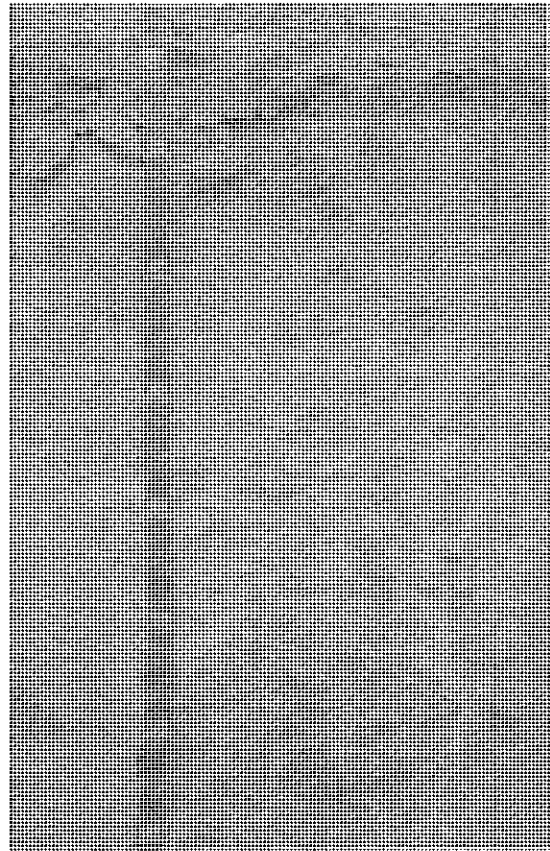


Figure 14. Calcareous soil

Soil group 2: Shallow soils on calcrete or limestone

Soil profile: Red gradational loam over limestone.

Location: Cape Jervis, Easting: 246000, Northing: 6060850.

General description: Well-structured dark red loam grading to a red friable clay moderately shallow over calcareous rock.

Drainage: Well drained. The soil is unlikely to remain saturated for more than a day following rain.

Fertility: Natural fertility is moderate. At the pit site, phosphorus levels are low, copper and zinc appear to be low. Organic carbon levels are high.

pH: Acidic throughout. Dolomite is required.

Rooting depth: 60 cm at the pit site.

Barriers to root growth: Moderately shallow depth to rock is the main limitation. This will be highly variable across the paddock.

Erosion potential: Water – high, due to the slope of the land. The soil itself is relatively erosion resistant. Wind – low.

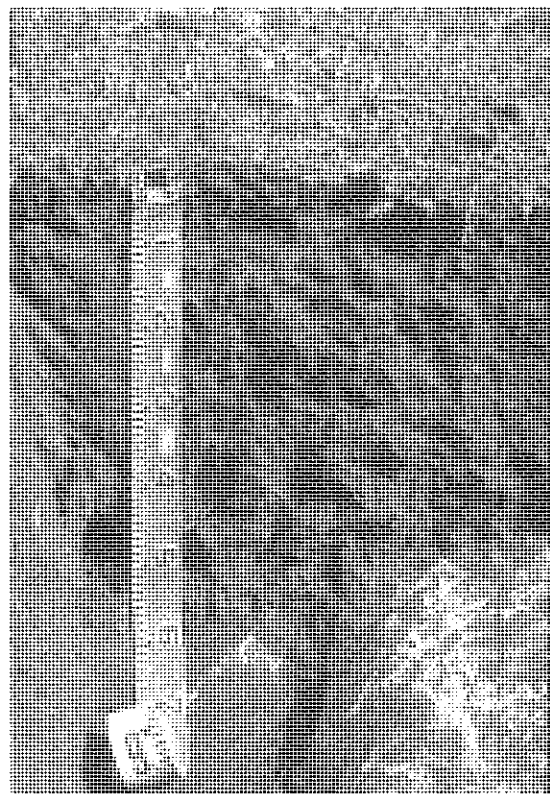


Figure 15. Shallow soil over limestone

Soil group 3: Gradational soils with highly calcareous lower subsoil

Soil profile: Gradational red clay loam.

Location: Willunga, Easting: 273500, Northing: 6094450.

General description: Well-structured clay loam overlying a finely polyhedral red clay with soft carbonate accumulations at depth, grading to sandy or sandy clay sediments.

Drainage: The soil is well drained and is never likely to be saturated. The calcareous subsoil is moderately sodic and indicates that excessive irrigation will cause a water table to develop within a metre of the soil surface.

Fertility: Natural fertility is high. Neutral pH helps to maintain nutrient availability.

pH: Neutral at the surface, alkaline with depth.

Rooting depth: 170 cm at the pit site, with few roots below 90 cm.

Barriers to root growth: The strong carbonate layer restricts root growth.

Erosion potential: Water – low. Wind – low.



Figure 16. Gradational soil with calcareous subsoil

Soil group 4: Hard red-brown texture contrast soils with neutral to alkaline subsoil

Soil profile: Loam over poorly structured red clay.

Location: Kapunda, Easting: 311350, Northing: 6201000.

General description: Hard loam to clay loam abruptly overlying a coarsely structured dispersive red clay, calcareous with depth, continuing below 100 cm.

Drainage: Moderately well drained. Water perches on the clayey subsoil for a week or so following heavy rainfall.

Fertility: Inherent fertility is moderately high. Nutrient availability is favoured by neutral pH. Trace element concentrations in the surface are satisfactory.

pH: Neutral at the surface, strongly alkaline with depth.

Rooting depth: 56 cm at the pit site.

Barriers to root growth: The hard dispersive clayey subsoil restricts root growth and density but does not prevent root growth.

Erosion potential: Water – moderately low. Wind – low.

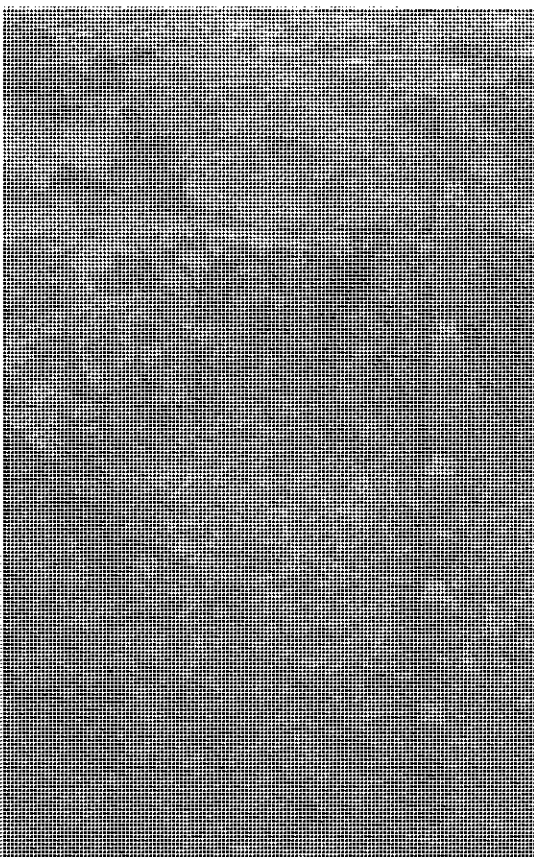


Figure 17. Red brown texture contrast soil with alkaline subsoil

Soil group 5: Cracking clay soils

Soil profile: Grey cracking clay.

Location: Freeling, Easting: 300200,
Northing: 6189850.

General description: Strongly structured dark cracking clay grading to a coarsely structured dark grey heavy clay with variable soft carbonate, over heavy clay

Drainage: Moderately well drained. The cracking soil accepts water readily when dry, but after the cracks close, water moves slowly through the soil.

Fertility: Natural fertility is very high. Nutrient retention capacity is very high. Zinc may be deficient, as is often the case on dark cracking clays.

pH: Alkaline at the surface, strongly alkaline in the subsoil.

Rooting depth: About 100 cm in the pit.

Barriers to root growth: The lenticular structure of the underlying light brown clay is very hostile to roots. High pH, high boron and high sodicity from 100 cm prevent any further root growth.

Erosion potential: Water – low. Wind – low.

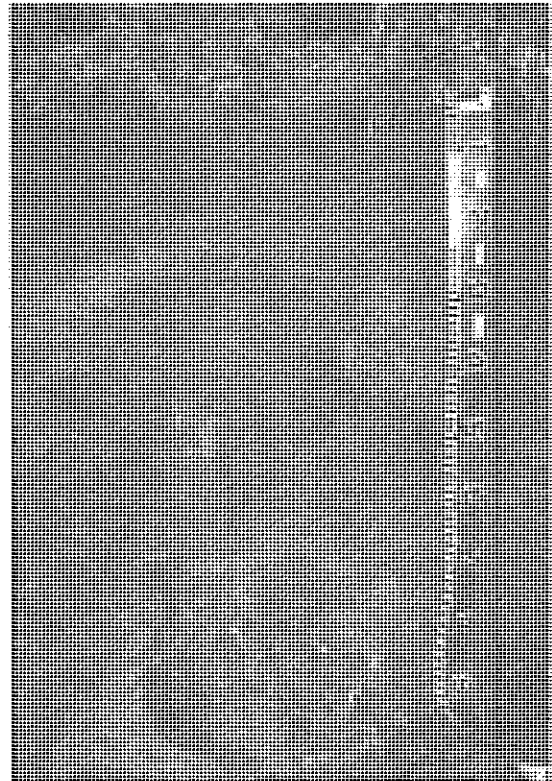


Figure 18. Dark cracking clay soil

Soil group 6: Deep loamy texture contrast soils with brown or dark subsoil

Soil profile: Sandy clay loam over dark clay.

Location: Yankalilla, Easting: 272400,
Northing: 6095850.

General description: Black medium to fine textured well-structured surface soil, overlying a dark, mottled clayey subsoil, calcareous with depth and formed on heavy clay.

Drainage: The soil is imperfectly drained. A perched water table can form with prolonged irrigation.

Fertility: The inherent fertility of the soil is very high. Phosphorus, potassium, calcium, magnesium and trace elements are all high by agricultural standards.

pH: Alkaline at the surface becoming strongly alkaline with depth.

Rooting depth: 200 cm in the pit, with few below 140 cm.

Barriers to root growth: The tight clay below 90 cm affects root proliferation to some extent. Salinity is high in the tree line and is almost certainly reducing yields. High alkalinity at depth will limit root growth.

Erosion potential: Water – low. Wind – low



Figure 19. Deep loam over dark clay

Soil group 7: Sand over clay soils

Soil profile: Sand over acidic clay.

Location: Back Valley, Easting: 273300,
Northing: 6063100.

General description: Thick sandy surface soil, bleached with ortstein (coffee rock) nodules at base, overlying a yellow, brown and red clay subsoil grading to soft red, yellow and grey sandstone.

Drainage: Well drained. Soil is unlikely to remain wet for more than about a week.

Fertility: Natural fertility is low. This is due to the low clay content of the surface and the mineralogy of the clay in the subsoil.

pH: Acidic in surface, strongly acidic in subsoil, causing marginal aluminium toxicity, molybdenum deficiency and poor legume nodulation. Dolomitic lime is required.

Rooting depth: 120 cm at the pit site, but roots below 65 cm are confined to sand filled cracks.

Barriers to root growth: Low pH (with possible aluminium toxicity) and low nutrient status.

Erosion potential: Water – moderately low due to thick, highly permeable surface soil.
Wind – moderate, due to loose sandy surface.

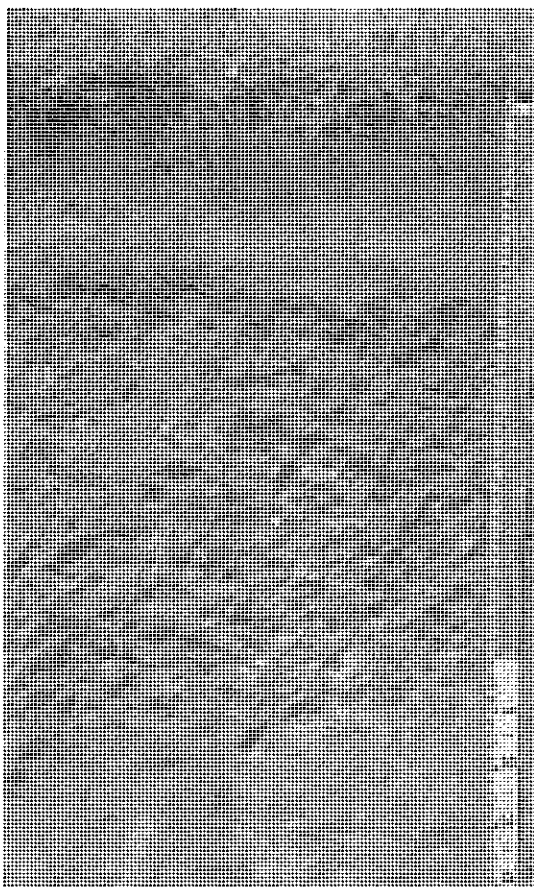


Figure 20. Sand over clay soil

Soil group 8: Deep sands

Soil profile: Deep bleached sand.

Location: Noarlunga, Easting: 283405,
Northing: 6106750.

General description: Loose grey sand with a strongly bleached subsurface layer, becoming yellow with depth, over Tertiary sediments or a buried sand over clay profile.

Drainage: Rapidly drained. The soil rarely remains wet for more than a few hours at a time.

Fertility: Inherent fertility is low. Regular frequent monitoring and fertiliser applications are needed on these soils.

pH: Neutral to the surface, slightly acidic with depth.

Rooting depth: Roots continuing below 145 cm in the sampling pit.

Barriers to root growth: The only chemical barrier is low nutrient status and retention capacity.

Erosion potential: Water – moderately low.
Wind – moderate due to low fertility, loose sandy surface.



Figure 21. Deep sand

Soil group 9: Highly leached sand

Soil profile: Imperfectly drained highly leached sand.

Location: Willunga, Easting: 279150,
Northing: 6087300.

General description: Moderately deep loose sand overlying coffee rock (sand cemented by iron oxides and organic matter), grading to a yellow and brown sandy clay forming in soft red, yellow and grey sandstone

Drainage: Imperfectly to moderately well drained. Soil may remain wet for a week to several weeks.

Fertility: Natural fertility is low, due to the low clay content of the topsoil. Nutrients are easily leached from the topsoil.

pH: Acidic in the surface, strongly acidic at depth. Correction requires dolomitic lime.

Rooting depth: 115 cm at the pit site, but density is moderate to low throughout.

Barriers to root growth: Very few roots grow in the coffee rock and must grow through cracks to reach the underlying clay. The coffee rock is usually not continuous. Low fertility and low pH are major limitations to satisfactory root development.

Erosion potential: Water – low to moderately low. Wind – moderate, due to loose surface sand.

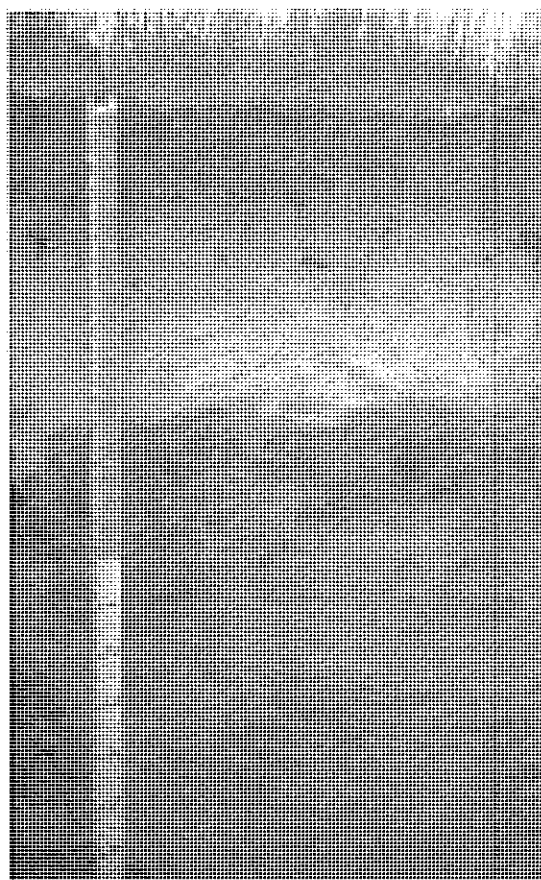


Figure 22. Highly leached sand

Soil group 10: Ironstone soils

Soil profile: Ironstone soil.

Location: Noarlunga, Easting: 288000,
Northing: 6101650.

General description: Ironstone gravelly sandy loam overlying a yellow brown clay with red mottles at depth, grading to kaolinitic weathering rock.

Drainage: Moderate. A “perched” water table will form on top of the clay layer after prolonged rain, saturating the upper part of the soil for a week or more at a time.

Fertility: The natural fertility of the soil is moderate. Leaching associated with acidification is reducing the soil's fertility.

pH: Strongly acidic at the surface; acidic at depth. The acidification process must be controlled to prevent further nutrient leaching and release of toxic aluminium.

Rooting depth: 130 cm in the pit, but few roots below 40 cm.

Barriers to root growth: The clayey subsoil presents a minor constraint to root development. Low pH and possible aluminium toxicity. Moderate fertility.

Erosion potential: Water – moderate. Wind – low.



Figure 23. Ironstone soil

Soil group 11: Shallow to moderately deep acidic soils on rock

Soil profile: Acidic sandy loam over brown clay on soft rock.

Location: Kersbrook, Easting: 304150, Northing: 6151300.

General description: Medium thickness grey brown sandy loam over a friable orange clay grading to weathering schist.

Drainage: Moderately well to imperfectly drained. Water will "perch" in the bleached layer above the subsoil clay for periods of one to several weeks after prolonged rain.

Fertility: Natural fertility is low. Magnesium probably deficient.

pH: Acidic at the surface, strongly acidic at depth. Dolomite or high magnesium lime is needed for correction.

Rooting depth: 70 cm in the pit.

Barriers to root growth: Low pH (possible aluminium toxicity) from 45 cm.

Erosion potential: Water – moderately high. Wind – moderately low.

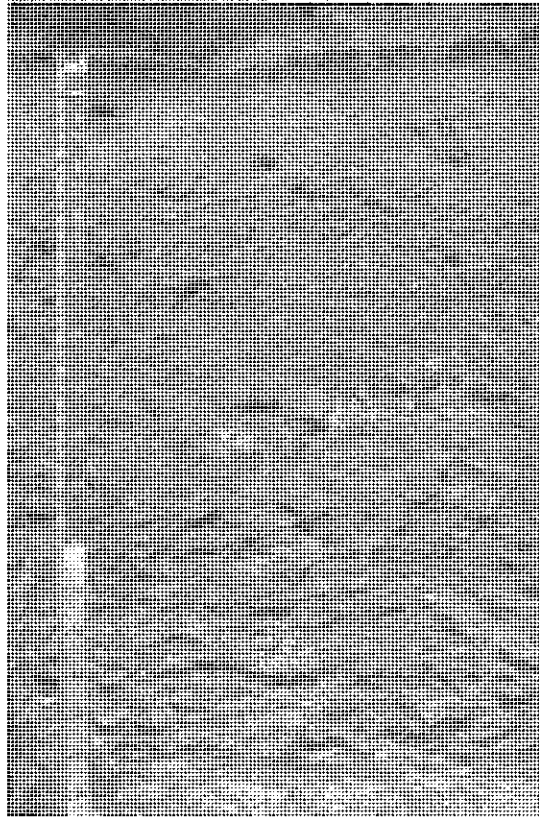


Figure 24. Shallow acidic sandy loam over brown clay

Soil group 12: Shallow soils on rock

Soil profile: Shallow sandy loam on rock.

Location: Echunga, Easting: 316775, Northing: 6114110.

General description: Medium to thick sandy loam with variable gravel, overlying weathering basement rock shallower than 50 cm.

Drainage: Rapidly drained. The soil rarely remains wet for more than a few hours following heavy or prolonged rainfall.

Fertility: Inherent fertility is moderate. These soils have about 15% clay, which is the minimum required to retain adequate levels of nutrient.

pH: Neutral.

Rooting depth: 70 cm in exposure, but roots only in cleavage planes of rock below 35 cm.

Barriers to root growth: The strength and depth of the underlying rock is the only limitation.

Erosion potential: Water – very high due to the slope. Wind – low.



Figure 25. Shallow soil over rock

Soil group 13: Deep uniform to gradational soils

Soil profile: Deep gradational clay loam.

Location: Forest Range, Easting: 299550, Northing: 6131050.

General description: Black well-structured silty loam to clay loam, overlying a black or dark grey blocky clay becoming yellow and grey mottled with depth.

Drainage: The soil is imperfectly drained due to its position in the landscape and its high clay content. The soil may remain wet for several weeks to some months.

Fertility: This soil is normally very fertile, but at this site the very low pH has weakened the nutrient retention capacity of the soil.

pH: Acidic at the surface and strongly acidic from 10 cm. This has caused severe leaching. Lime is needed for pH correction.

Rooting depth: More than 130 cm in the pit.

Barriers to root growth: Waterlogging due in part to tight clay layers at depth is the main physical constraint to root growth. High acidity and low nutrient retention capacity in the subsoil are the main chemical limitations (abnormal for this soil).

Erosion potential: Water – moderately low, provided that run on water is controlled. Stream bank erosion in creeks associated with these soils is more significant. Wind – low.



Figure 26. Deep uniform to gradational soil

7. Pasture types

7.1 Pasture elements

If livestock production is one of the primary objectives for your property, grazing paddocks will be much more productive if they contain pasture plants and few weeds. Pastures with a significant proportion of desirable pasture species will provide higher levels of livestock production and lower levels of animal health and land management issues.

The composition of an ideal pasture can vary according to seasons, soil type and the purpose for which it is being used.

However pastures should always:

- be productive and meet the nutritional needs of stock
- withstand grazing and persist
- resist disease and weed invasion
- provide good ground cover throughout the year
- not cause livestock health problems.

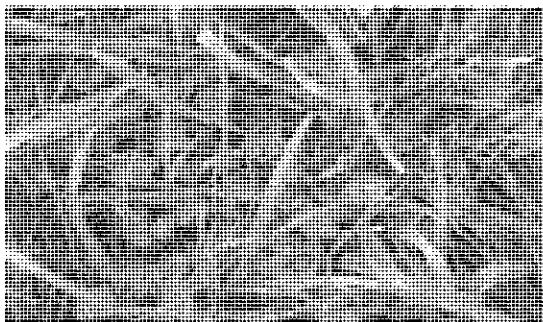
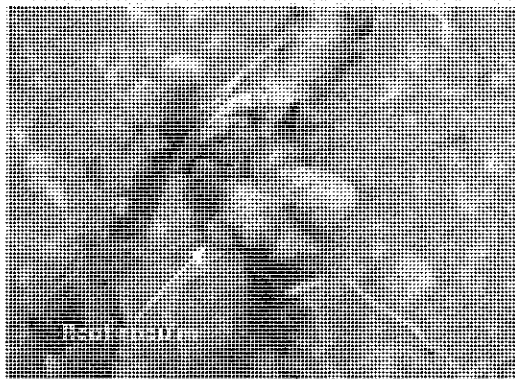


Figure 27. Well balanced pastures contain a mix of legumes and grasses

Legumes and grasses

Nitrogen fixation

Low soil nitrogen is one of the most widespread nutrient problems in South Australia because it is easily leached from the soil. Legumes add nitrogen to soil naturally through a process known as 'nitrogen fixation' which occurs when Rhizobia bacteria in root nodules convert atmospheric nitrogen into soluble nitrogen to assist plant growth. On average, irrigated lucerne can add up to 225 kg/Ha of nitrogen to the soil each year, whilst clover can add approximately 60 to 100 kg/Ha. To see these nodules, carefully dig up any legume plant such as a clover, bean or pea. Gently wash off the soil to reveal small swellings on the roots. When they are pink in colour, the plant is fixing nitrogen.



Most pastures are made up of grasses and legumes (e.g. clovers). Grasses produce the bulk of pasture growth during the year, while legumes are important for producing high levels of digestible protein and greater amounts of calcium than grasses. All legumes are pod bearing plants which add nitrogen to the soil which is then utilised by grasses.

Ruminant (cattle and sheep) pastures should contain approximately 70% grass and 30% legume. Where the legume content is lower than 30%, the nutritional value of the pasture declines and dry matter production can decrease. However, when a mixed grass and legume pasture is dominant in legumes, the production level declines and animal health issues can arise.

The most common legume grown in the high rainfall areas of the region is subterranean clover (*Trifolium subterraneum*) (Figure 28).

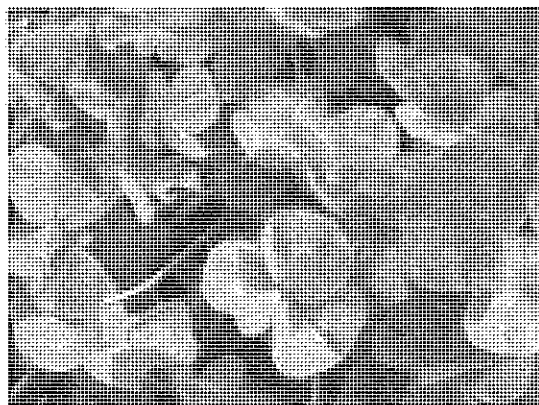


Figure 28. Subterranean clover (*Trifolium subterraneum*)

Annuals and perennials

Pasture plants can be described as either 'annual' or 'perennial'. Annual plants survive for only one year and reproduce by setting seed in spring which germinates the following autumn e.g. subterranean clover (*Trifolium subterranean*).

Perennial plants have deeper root systems, live from year to year, and have the capacity to grow all year if water is available. Perennial ryegrass (*Lolium perenne*), phalaris (*Phalaris aquatica*) and cocksfoot (*Dactylis glomerata*) are common introduced perennial pasture grasses. One of the most productive introduced perennial legume is lucerne (*Medicago sativa*) which can be grown in a dryland situation, but is more commonly grown under irrigation.

Where annual legumes are germinating amongst perennial grasses, they can find themselves competing for water, light and nutrients with well-established grasses. This normally occurs at the break of the season in autumn. At this time it is important to ensure that grasses are grazed down to 5 cm avoid shading out the emerging legume seedlings.

Rainfall and soil type will play an important part in determining whether perennial or annual pastures are sown (or in some cases a mixture of both).

7.2 Pasture plants

Variability in rainfall, soil type, topography, salinity, acidity, rocks, erosion potential and limitations due to waterlogging will directly influence the nature of pastures found on small properties. In addition, the long term goals of individual landholders will play an important part in how pastures are maintained.

When deciding on how pastures are to be grown and managed, landholders should always consider the protection of natural resources. Ideally these decisions should be part of a whole of property planning approach which recognises different land classes and addresses long term sustainability issues.

Implementing any property plan should also be compatible with the broad aims of the Adelaide and Mount Lofty Ranges Natural Resources Management Board which promotes the importance of sustainable land management.

A range of different pasture types are found on small properties.

- Degraded pastures which have a high proportion of weed species, including broad leaf weeds (e.g. capeweed) and annual grasses (e.g. barley grass and brome grass). In general fertiliser inputs are low and pastures are set stocked.
- Summer growing native plants such as kangaroo grass (*Themeda triandra*) and brushwire grass (*Aristida behriana*) with no fertiliser or legume and are mainly found in lower rainfall areas.
- Native perennial species which normally grow through autumn to early summer such as wallaby grass (*Rytidosperma* spp. previously *Austrodanthonia* spp.) and weeping rice grass (*Microlaena stipoides*), along with introduced annual introduced legumes, some weeds and limited fertiliser applications.
- Older introduced improved pastures that have some perennial grass and legume but also have a weed burden. These pastures have had a fertiliser and weed control history but are currently not managed for high production.
- Highly productive introduced pastures with perennial grasses such as perennial ryegrass (*Lolium perenne*), phalaris (*Phalaris aquatica*), cocksfoot (*Dactylis glomerata*) in association with annual legumes. Weed content is low but fertiliser, weed control and grazing management inputs are high.

The following section highlights some of the characteristics of different pasture species and explains where they might suitably be grown.

Introduced pasture species

Perennial ryegrass (*Lolium perenne*)

A perennial grass which is native to Europe, Asia and North Africa, it was brought to Australia on the First Fleet and remains one of the most important grasses in high rainfall and irrigation areas. It is easy to establish, has good nutritional value and is highly digestible. Older cultivars contain an endophyte fungus which can affect the nervous systems of animals causing 'grass staggers'. Newly developed cultivars, which are labelled as AR1, do not affect grazing livestock.

Available cultivars differ greatly in maturity, growth habit, and resistance to disease and moisture requirements. Minimum rainfall is approximately 600 mm p.a. for dryland pasture cultivars. However as this plant does not have an extensive root system, its persistence under 750 mm p.a. rainfall is questionable especially when spring rainfall is poor. In a seeding mix, it is not compatible with other perennial grasses as it outcompetes the other grass seedlings. Perennial ryegrass is also ideal under irrigation where it can be sown with white clover. Sowing rates range from 8 to 30 kg/Ha depending on seed size, rainfall and irrigation.

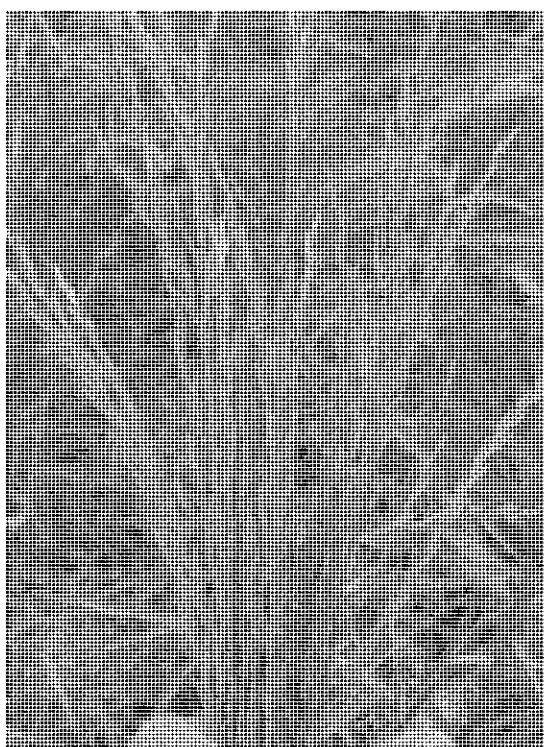


Figure 29. Perennial ryegrass (*Lolium perenne*)

Phalaris (*Phalaris aquatica*)

Phalaris is a deep-rooted perennial grass native to the Mediterranean region, which requires at least 450 mm rainfall p.a. It is relatively drought tolerant and should persist, provided pastures are not overgrazed during spring. There are two types of phalaris; prostrate semi winter dormant types such as Australian and more upright winter active types such as Holdfast. Phalaris has a lower seedling vigour than perennial rye grass, so care should be taken at establishment. It will persist on a wide range of soil types including heavy waterlogged soils, but it is the most sensitive of the temperate grasses to acid soils, where aluminium toxicity can severely reduce growth. New varieties such as Holdfast GT and Advance AT have been bred to tolerate lower acidity and higher aluminium. In general it performs best on neutral soils. Although the risk is small, livestock may experience staggers when grazing phalaris dominant pastures that contain older varieties such as Australian. In some cases sudden death may occur during autumn and early winter. Animals should be moved to a non-toxic pasture and veterinarian advice sought. Newer varieties do not cause staggers as they have much lower levels of the alkaloid that causes this condition. Sowing rates are generally 2 to 4 kg/Ha when mixed with other cultivars, or 4 to 6 kg/Ha when sown as a sole grass.



Figure 30. Phalaris (*Phalaris aquatica*)

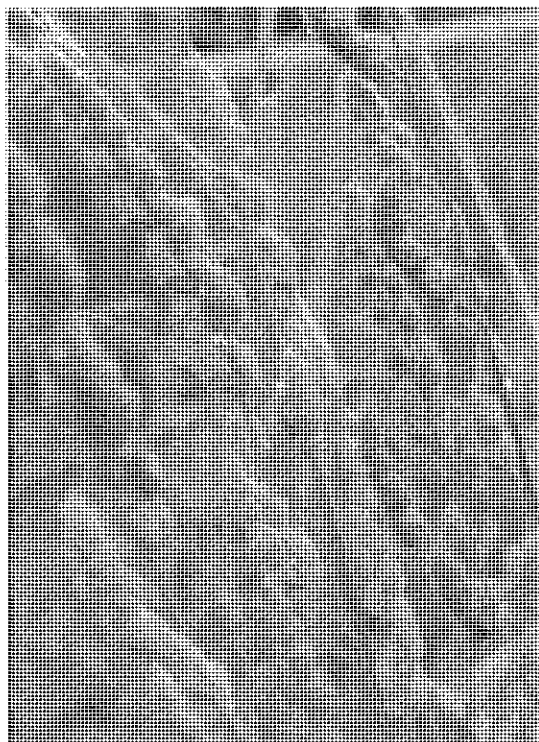


Figure 31. Cocksfoot (*Dactylis glomerata*)

Cocksfoot (*Dactylis glomerata*)

Cocksfoot is a deep-rooted perennial grass of high to moderate drought tolerance (depending on the cultivar). Native to Northern Europe and the Mediterranean region, it requires a minimum of 450 mm rainfall. Cocksfoot varieties vary in their summer dormancy and the appropriate variety should be chosen depending on rainfall zone. High summer dormancy is suited to lower rainfall rains.

Cocksfoot will not tolerate waterlogged soils, but does grow well on more acidic soils. The quality, or perceived lack of quality, of cocksfoot has for some time been an issue, however, new cultivars are of a higher quality. Persistence and quality can be further improved by attention to grazing management. Cocksfoot does not contain animal toxins and is often recommended as a suitable pasture for alpacas and horses due to its lower sugar content.



Figure 32. Italian Ryegrass (*Lolium multiflorum*)

Photo: Will Hannaford

Italian ryegrass (*Lolium multiflorum*)

Similar in appearance to perennial ryegrass, this pasture is suited to lower rainfall areas where perennial ryegrass will not survive. It is native to Europe and comprises both biennial and annual cultivars. Italian ryegrasses are generally used in short-term pastures for the production of quality hay or silage, but are sometimes used as a minor component of a perennial pasture. They are quick to establish and are of high nutritional value. Minimum rainfall requirement is 450 mm, unless irrigated cultivars are being used. Sowing rate is generally 15 to 30 kg/Ha depending on seed size, rainfall or irrigation.

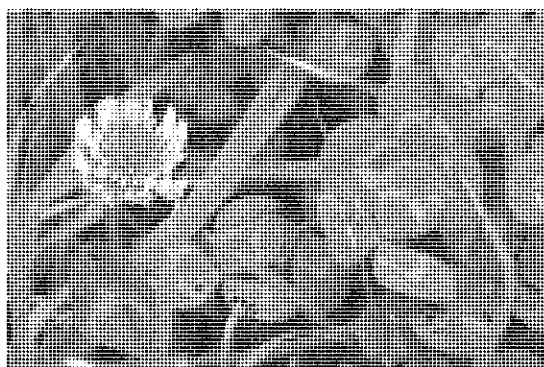


Figure 33. White clover (*Trifolium repens*)

White clover (*Trifolium repens*)

White clover is a perennial clover native to Europe which is suited to regions which have at least 750 mm of rainfall p.a. or where irrigation is available. It is easy to establish and produces surface runners which form roots at the nodes. It will grow on a wide range of soil types, but is most highly productive on fertile soils. One method of differentiating white clovers is by its large leaf size, another by stolon density. Persistence in pasture is usually in those cultivars whose stolon density is highest, although some persistence can be attributed to seed set. When sowing irrigated pastures white clover is often mixed with perennial ryegrass or tall fescue. Sowing rates vary from 1 to 2 kg/Ha dryland, and 3 to 5 kg/Ha in high rainfall areas or where irrigation is available.



Figure 34. Subterranean clover (*Trifolium subterraneum*)

Subterranean clover (*Trifolium subterraneum*)

Native to the Mediterranean region, subterranean clovers grow on a wide range of soil types. Rainfall requirements vary from 250 mm p.a. to in excess of 750 mm p.a. depending on the variety. Subterranean clover is a self-regenerating annual which buries its seed in the ground. Some of the seed produced is 'hard seed' which is desirable where persistence is needed in drier parts of the subterranean clover zone. They add considerable quantities of nitrogen to the soil which benefit the growth of pasture grasses. Recently new varieties have been bred that are more resistant to red-legged earth mites. Together with a Time-Right spray strategy in spring that times the spray to reduce subsequent populations, reliance on broad spectrum insecticides in managing red-legged earth mite can be reduced. Sowing rates are generally 4 to 12 kg/Ha when mixed with perennial grasses. If irrigated, rates may be as high as 15 to 25 kg/Ha.

Table 7. Characteristics of some subterranean clover varieties

Variety	Colour	Flowering	Seed set	Resistance
Subterranean	Reddish	mid to late	low	moderately resistant to red leg, resistant to clover mite
Subterranean	Cashmere	mid to late	moderate	moderately resistant to red leg, resistant to clover mite
Subterranean	Seedling Free	mid to late	moderate	moderately resistant to red leg, resistant to clover mite
Subterranean	Green	late	moderate	moderately resistant to red leg, resistant to clover mite
Subterranean	Fluorid	late	moderate	moderately resistant to red leg, resistant to clover mite
Subterranean	Tri-Blue	mid to late	moderate	moderately resistant to red leg, resistant to clover mite
Subterranean	Blue	mid to late	low	moderately resistant to red leg, resistant to clover mite
Subterranean	Blue	mid to late	moderate	moderately resistant to red leg, resistant to clover mite

Lucerne (*Medicago sativa*)

Lucerne is a deep tap rooted perennial legume. It is one of the oldest cultivated plants in the world and is prized for its drought tolerance and high quality as an animal feed. With proper establishment and management lucerne has the ability to survive for over 20 years. It requires well-drained fertile soils with a pH ranging from neutral to alkaline. All lucernes are summer active, but are rated on a scale of 1–10 by their amount of winter activity (1 is winter dormant, 10 is highly winter active). The choice of cultivar should, as a general rule, depend on its intended use and the area where it will be sown. Lucerne is most productive under irrigation where it can be rotationally grazed or cut for hay. It can also be sown into a dryland pasture mix where a 5–6 winter activity level is most suitable. Lucerne requires at least 250 mm of rain during the growing season. Sowing rates vary from 6 to 10 kg/Ha for Dryland production, and 8 to 15 kg/Ha under irrigation.

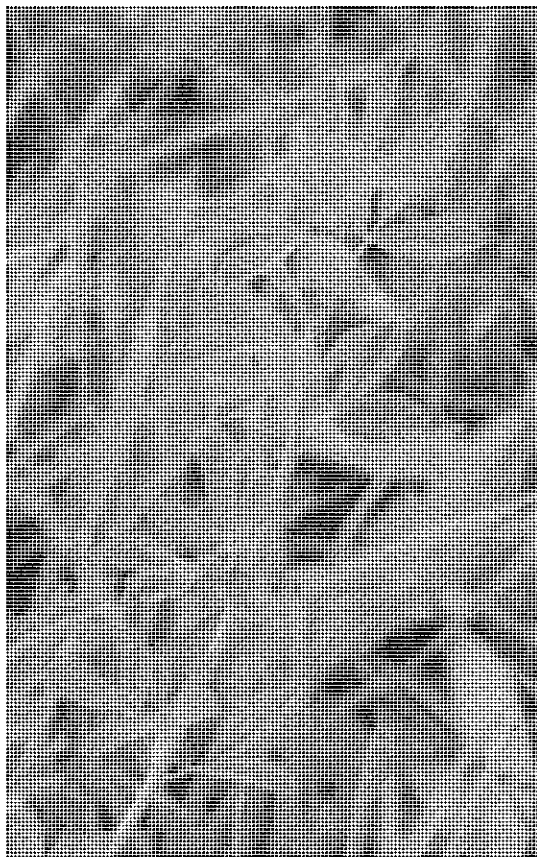


Figure 35. Lucerne (*Medicago sativa*)

Tall fescue (*Festuca arundinacea*)

Tall fescue is a deep-rooted perennial grass native to Europe, the Mediterranean region, and Asia. Tall fescue is suited to soils of medium to high fertility and will tolerate some waterlogging and moderately saline conditions. There are now two distinctively different types, summer active and summer dormant. Summer active tall fescues have the ability to out produce perennial ryegrass during summer and require periodic summer rainfall or irrigation. Summer dormant types have the ability to persist in areas of very low rainfall. Older varieties such as Demeter are not that palatable but new varieties have been substantially improved. Tall fescue is most productive under irrigation, but can be included in dryland pasture mixes where rainfall is at least 450 mm p.a. The sowing rate is generally 10–20 kg/Ha.

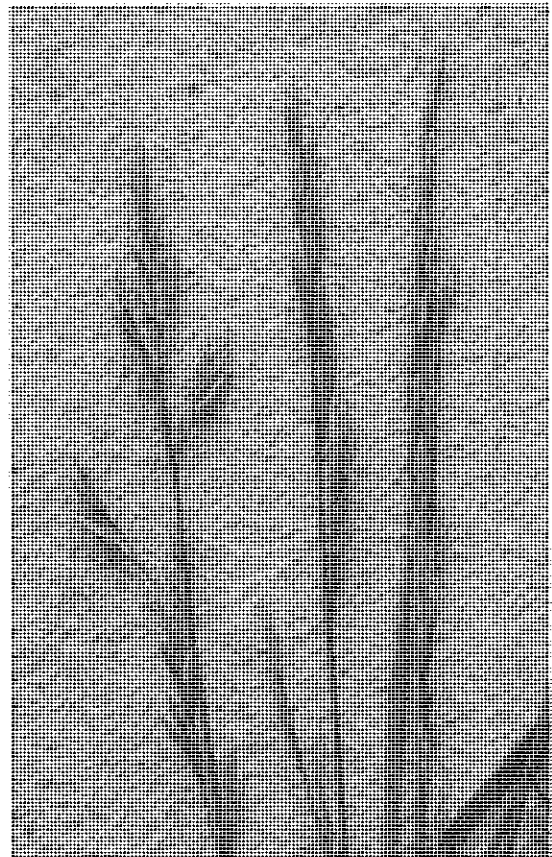


Figure 36. Tall fescue (*Festuca arundinacea*)

Annual medics (*Medicago* spp.)

The term 'Medics' describes a particular group of annual legumes. They are predominantly suited to alkaline soils in medium to low rainfall areas. Medic species originated in Europe and are generally yellow flowered, and named according to pod appearance (i.e. snail, barrel, burr). The pods of most medics generally hold between 4 and 10 seeds per pod. Persistence and resistance to pests and diseases make them ideally suited to many areas. Generally sown in autumn, the seed should be sown to a depth of no more than 10 mm. The sowing rate, when blended with selected grass species, is usually between 5 and 10 kg/Ha depending on the variety.

Salt tolerant pastures

A soil test may reveal high salinity levels which preclude the sowing of many pasture species. In this case, the use of salt tolerant plant species is advised. Puccinellia (*Puccinellia ciliata*) and tall wheat grass (*Thinopyrum ponticum*) are suitable perennial grasses, while strawberry clover (*Trifolium fragiferum*) and balansa clover (*Trifolium michelianum*) are both tolerant of moderately saline soils.



Figure 37. Annual medic (*Medicago* spp.)

Native pasture species

In much of the Mount Lofty Ranges where rainfall is above 600 mm, native pastures are no longer present as they have been removed over the last 100 years through native vegetation clearance and the establishment of introduced pastures. If native grass pasture is present on your property, it is very important to preserve it as it provides valuable habitat for our native wildlife. Before considering any management changes to these pastures, contact Natural Resources Adelaide and Mount Lofty Ranges for advice.

Wallaby grass (*Rytidosperma* spp. previously *Austrodanthonia*)

There are over 30 different wallaby grass species with 14 of them found in South Australia. The main flowering time is spring with some flowering in autumn. They are drought tolerant, palatable and provide valuable year round green feed for livestock. Wallaby grass has a low sugar level and is suitable for horses. Pastures should be rotationally grazed to avoid dry leaf material which will lower feed utilisation.

They will tolerate frosts and a wide range of soil types provided they are not waterlogged.



Figure 38. Wallaby grass (*Rytidosperma* spp.)

Weeping rice grass (*Microlaena stipoides*)

A tufted low growing perennial with short rhizomes that can remain green all year. *Microlaena* is a competitive species and will respond to rotational grazing. It tolerates acid soils and is productive when rainfall exceeds 650 mm. It has a characteristic fine arching or weeping seed-head. Flowering time is summer to autumn.

Kangaroo grass (*Themeda triandra*)

Widespread across Australia, this tall (up to 90 cm) tufted summer active perennial grass does not tolerate continuous grazing, soil acidity, or increasing soil fertility. It is rare to find these grasses on properties which have a medium to high stocking rate.

It has a deep root system and is drought tolerant. Normal flowering time is early summer to mid autumn.

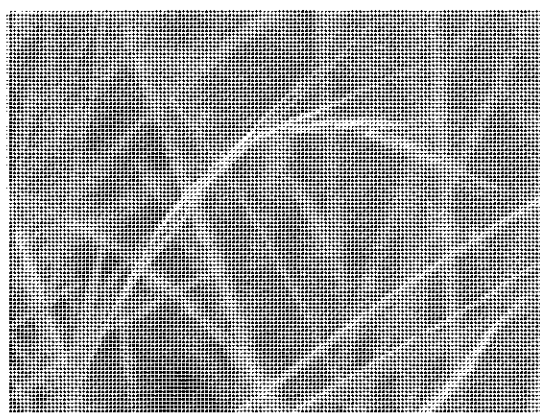


Figure 39. Weeping rice grass (*Microlaena stipoides*)

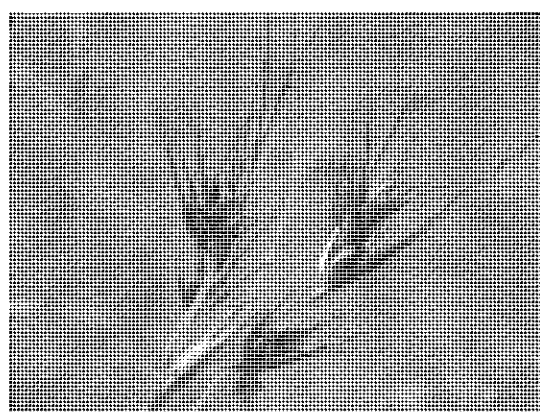


Figure 40. Kangaroo grass (*Themeda triandra*)

Spear grass (*Austrostipa* spp.)

Austrostipa species are common throughout the region with 39 species being located in South Australia. Most species grow actively in spring and early summer, while others make active growth in late autumn/winter. Nutritional value for stock is only medium and palatability can be a problem. The sharp seeds enter fleeces to downgrade wool quality.

Applications of fertiliser will cause spear grass to decline in numbers.

Windmill grass (*Chloris truncata*)

This tussocky plant is relatively short lived (2 to 3 years). The most rapid growth is made in spring and early summer. It has a low tolerance to frost and is only moderately drought tolerant. It regenerates from seed but is not generally noted as a productive pasture grass.



Figure 41. Spear grass (*Austrostipa* spp.)

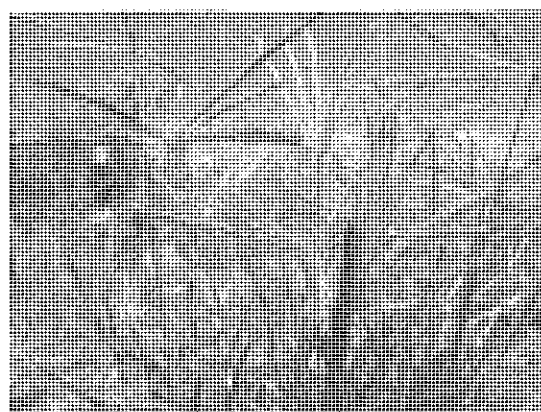


Figure 42. Windmill grass (*Chloris truncata*)

Photo: SARDI Entomology

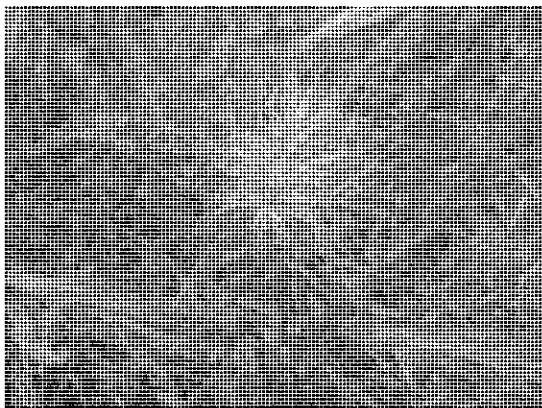


Figure 43. Brush wire-grass seed head (*Aristida behriana*)

Brush wire-grass (*Aristida behriana*)

Brush wire-grass is a very common species of grass in low rainfall areas. A summer growing grass, it forms a low, compact tussock and has many flowering heads. Seeds can contaminate wool, although they do not have the strength to drive into skins. Brush wire-grass is very palatable and can form an important component of pastures in lower rainfall areas.

7.3 Pasture mixes

Before purchasing any pasture seed it is imperative to consider the four Evergraze principles to ensure successful pasture establishment and persistence; "Right plant (and variety) in the right place for the right purpose with the right sustainable grazing management". Rainfall, drainage, soil depth and soil acidity are an important part of this "right place" philosophy.

For example, lucerne requires deep, well drained soils which are neutral to alkaline with low aluminium levels, while subterranean clover prefers neutral to acidic soils. Phalaris will tolerate waterlogged soils but not highly acidic soils where aluminium toxicity can be a problem. Cocksfoot on the other hand, will grow well in acidic soils but not in waterlogged soils where fescue or perennial ryegrass is preferred. Sowing with a diverse mixture of different grasses used to be the preferred option but using the Evergraze principle of "right plant/variety in the right place" is now best practice in achieving maximum pasture production and sustainability.

Thinking about the "purpose" is also very important. How will the extra feed be utilised on a small property? Is the extra time and resources needed to establish new pastures worth it? Is it a lot easier to keep stocking rates low to just "keep the grass down"? In many cases, new owners of small properties jump into pasture improvement thinking it is necessary and will allow them to run many more livestock. However, more thought is needed prior to making this important decision as in many cases, the economics of pasture establishment on small properties do not stack up.

However, if pasture improvement is needed, the following examples represent a range of suitable mixes which could be used in particular circumstances. Professional advice should always be sought before choosing seed mixes, since improvements to pasture varieties are continuously being made. For further information go to www.evergraze.com.au.

Permanent introduced pastures

Options for dryland (non-irrigated) situations

Example 1. Rainfall >800 mm p.a.

Perennial ryegrass 20 kg/Ha

Subterranean clover 10 kg/Ha

Example 2. Rainfall >650 mm p.a.

Cocksfoot (summer active) 2 kg/Ha

Phalaris (winter active) 4 kg/Ha

Subterranean clover 6 kg/Ha

Where pH and fertility are at good levels chicory and Lucerne can be added to this mix

Example 3. Rainfall 500 – 650 mm p.a.

Cocksfoot 2 kg/Ha

Phalaris 4 kg/Ha

Subterranean clover 6 kg/Ha

Example 4. Rainfall 425 – 500 mm p.a.

Cocksfoot 2 kg/Ha

Phalaris 3 kg/Ha

Subterranean clover 6 kg/Ha

Note: In alkaline soils subterranean clover can be replaced with medics.

Option for dryland (non-irrigated) situation with poorly drained waterlogged soils

Example 5. Rainfall 550 – 700 mm p.a.

Phalaris 5 kg/Ha

Tall fescue 10 kg/Ha

Balansa clover 2 kg/Ha

Strawberry clover 3 kg/Ha

Options for dryland (non-irrigated) situations with saline soils

Example 6. Rainfall > 450 mm p.a.

Tall wheat grass 10 – 15 kg/Ha (slightly saline areas)

Balansa clover 1 kg/Ha

Strawberry clover 1 kg/Ha

Note: Tall wheat grass can spread and become invasive. It can also become very clumpy, so careful management is required for environmental protection, and to maintain feed quality.

Example 7. Rainfall > 350 mm p.a.

Puccinellia 6 – 10 kg/Ha (highly saline areas)

Balansa clover 1 kg/Ha

Strawberry clover 1 kg/Ha

For more information on suitable pasture for saline areas go to www.saltlandgenie.org.au.

Options for irrigated pastures

Landholders on small properties may have a licence to irrigate, however, using this precious resource is questionable when a well-managed dryland pasture will usually enable all of their lifestyle goals to be achieved.

In most cases, lifestyle landholders who wish to increase their livestock carrying capacity, could invest in a dryland pasture improvement program rather than irrigate, especially when many of these pastures have not been sown as recognised irrigation mixes.

However, for those who wish to maximise their production, a mixture of perennial ryegrass and white clover is commonly used to produce high quality feed under irrigation. The following pasture is ideal for grazing, hay and silage production.

Example 8.

Perennial ryegrass 25 kg/Ha

White clover 6 kg/ha

Annual pastures

Some areas with low rainfall do not support permanent pastures, unless irrigation is available. This can create problems for small landholders who do not possess the machinery to undertake sowing of short term annual pastures each year. Contractors or local farmers can provide support in these circumstances, however the key objective should always be to ensure enough ground cover is maintained to avoid any soil erosion.

Sowing annual ryegrasses for hay, silage or grazing is common in low rainfall areas. However, these pastures, known as short term Italian ryegrasses, will only last one or two years. They are often sown with annual medics (or clovers) to lift the protein value in hay.

Where an annual pasture is required which will eliminate the need to sow each year it is best to choose a species which is self regenerating from the seed it produces each spring. 'Safeguard' annual ryegrass is recommended as a self regenerating vigorous variety which is resistant to annual ryegrass toxicity (ARGT).

Safeguard ryegrass will crossbreed with the local ryegrass species such as Wimmera, to produce ARGT resistant seeds which germinate the following year.

This has been developed for the drier regions of South Australia and has excellent winter pasture production and is resistant to the root disease Take-all. This is an option for small horse properties where grazing in spring can be controlled to allow adequate seed set for germination the following autumn.

It is necessary to sow only certified seed of Safeguard to ensure the pasture remains free of ARGT.

Options for dryland (non-irrigated) situations with low rainfall e.g. Adelaide Plains

Example 1. Self regenerating annual ryegrass (no ARGT) Rainfall 350 – 500 mm p.a.

Annual ryegrass 10 to 15 kg/Ha (Safeguard)

Medics 5 kg/Ha

Lucerne 2 kg/Ha

Example 2. Grazing, silage or hay mix.
Rainfall 350 – 500 mm p.a.

Oats 40 kg/Ha

Annual Italian ryegrass 17 kg/Ha

Medics 5 kg/Ha

Example 3. Grazing, silage or hay mix.
Rainfall 350 – 500 mm p.a.

Annual Italian ryegrass 17 kg/Ha

Balansa clover 3 kg/Ha

Example 4. Grazing, silage or hay mix.
Rainfall 350 – 500 mm p.a.

Annual Italian ryegrass 15 kg/Ha

Shaftal persian clover 10 kg/Ha

Example 5. Grazing, silage or hay mix.
Rainfall 350 – 500 mm p.a.

Annual Italian ryegrass 10 – 15 kg/Ha

Medics 5 kg/Ha

Lucerne 2 kg/Ha

Other pastures

Lucerne

For the better drained soils with neutral to alkaline pH, lucerne has generally performed well.

Sowing rate in 400 to 800 mm rainfall areas is 4 to 8 kg/Ha. If irrigated, the rate is 15 to 20 kg/Ha. If a grass is required for a mixed dryland pasture add 1 to 3 kg/Ha of cocksfoot and phalaris. Overseeding grasses the following autumn after lucerne is established works well, however, lucerne can be successfully established if sown in late April with cocksfoot, phalaris and clover or in mid September in a La Nina year.

Kikuyu

Kikuyu is a perennial prostrate grass which spreads by runners, rhizomes and seed. Late spring, summer and early autumn are the main growing season. It is generally managed as a dryland pasture if rainfall is >500 mm per annum.

On medium input horse properties, where paddocks are generally small and grazing is restricted to a few hours each day, kikuyu is an option provided it is managed well. If no legumes are present in the pasture, consideration will need to be given to applications of nitrogen and in low rainfall areas (<500 mm p.a.) limited irrigation during summer will encourage production and help to maintain good ground cover.

It will tolerate a range of soil types (both alkaline and acid), and is best established by seed sown in spring. A suitable sowing rate is 2 kg/Ha. If a legume is required use Balansa clover.

However kikuyu is invasive and does not provide any growth in winter. Careful consideration should be used before deciding on using kikuyu.

8. Pasture establishment

8.1 Permanent pasture in medium to high rainfall areas (>450 mm p.a.)

8.1.1 Deciding to re-seed

In many cases pastures that are weedy and unproductive may not have to be re-seeded if enough desirable pasture species are present. Re-seeding is expensive and careful attention to soil fertility, weed control and appropriate grazing can restore paddock health and productivity without the need to spray out the old pasture and start again. Some paddocks that look unproductive may have native grasses and other native broadleaf species present. These paddocks may provide valuable habitat for our native wildlife. Advice should be sought from Natural Resources Adelaide and Mount Lofty Ranges prior to any management changes in these types of paddocks.

Degraded introduced pastures which contain very few good pasture species and are dominated by weeds, may need to be re-sown. In these circumstances it is important that clear benefits will be observed, because the process can be expensive and is not without risks. The presence of weeds alone is not necessarily a good reason to start again with a new pasture. Before making the decision to re-sow, thought needs to go into the four principles of Evergraze; "Right plant (and variety) in the right place for the right purpose with the right sustainable grazing management".

Some pastures may only require additional seed and could be 'over-sown' to improve the density. If unsure, landholders should seek professional advice before embarking on the process of 'pasture renovation' (i.e. sowing a new pasture).

The first step when deciding if a pasture needs to be re-seeded is to undertake an assessment of good pasture species. As a guide, a minimum of 20 perennial grass plants and 60 clover plants per square metre should be present to avoid re-seeding the pasture. This figure may be higher for intensively grazed properties. A professional and experienced consultant can provide help if necessary.



Figure 44. Fence off difficult sites for conservation purposes

Landholders should also be aware that no grazing will be possible during the first 3 months of a newly sown pasture, and only limited grazing will be available for another 9 months, so the feed requirements of all livestock on the property will need to be considered for that year.

Unless paddocks need to be levelled (i.e. the surface smoothed), the recommended technique for re-seeding is 'direct drilling'. This involves the use of non-selective herbicides to control weed growth during autumn, after which the pasture seed is drilled into the soil with minimum soil disturbance.

Cultivation of highly erodible soils on steep slopes poses a high erosion risk, particularly when carried out over summer and autumn during the high intensity rainfall period. In these circumstances landholders should seek professional advice to avoid the risk of environmental damage.

Paddocks with severe limitations for sowing pasture seed, such as rocks, steep slopes and erodible soils, may be better fenced off for conservation purposes. These areas can be revegetated with native trees and shrubs which will create shelter for livestock.

Landholders should also be aware that native grass pastures on steep land which is difficult to manage, can provide good grazing. Attempts to re-seed these areas is not wise and can result in degraded sites at risk of erosion.

If a pasture is to be re-seeded, landholders require a detailed seasonal action plan covering two years. Inexperienced landholders should consider engaging a professional land management consultant, or agronomist, who will be able to consider local conditions when developing the plan.

8.1.2 Developing a two year plan

It is important to ensure that good weed control is carried out in the year prior to seeding. Many failures can be attributed to pasture seedlings not being able to compete with stronger more vigorous weed seedlings during autumn.

The plan should consider:

- control of pests
- appropriate pasture varieties
- sowing rate
- requirements for inoculation of legume seed
- soil preparation
- time of seeding
- soil testing and fertiliser applications
- correcting soil acidity
- grazing management.

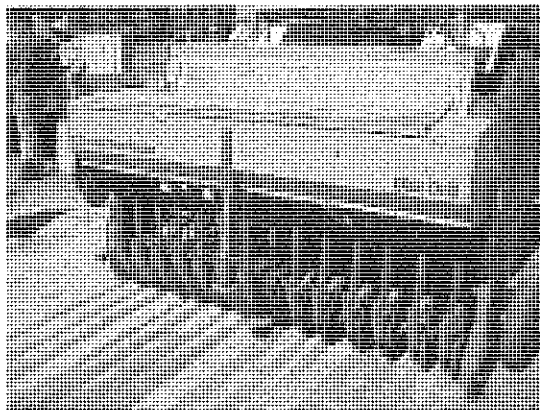


Figure 45. Direct drill pastures in high rainfall areas

Checklist

It is important for landholders not to rush into re-seeding. Follow a two year plan to establish a new pasture and do not omit any steps in the process. The following checklist is suitable for establishing pastures in high rainfall areas of the Mount Lofty Ranges.

1. Assess, select and plan early

- Assess existing pasture, weeds and soil fertility.
- Seek independent professional advice if unsure whether to re-sow.
- Check on the availability of equipment and/or contractors.

2. Control weeds/pests the year before sowing

- Spray or spray-graze to control broadleaf weeds.
- Spray metsulfuron-methyl to control Guilford Grass or Dock (late July).
- Spraytop, slash or graze to control annual pasture weeds.

3. Check soil fertility

- Soil test over summer to check fertility levels.
- Apply lime (if required) anytime up to sowing.
- Seek advice on a suitable fertiliser program.

4. Graze prior to sowing

- Graze well over summer to remove residues.

5. Control weeds and pests in autumn

- Allow a full weed germination after the autumn break (normally 3 weeks after opening rains).
- Spray appropriate herbicides/insecticides to control weeds and pests (e.g. redlegged earth mite).
- Harrow paddock only if surface has to be made even. Cultivate to achieve a firm, fine weed-free seedbed.

6. Ensure adequate soil moisture

- Don't sow on the first autumn rains.
- Sow into moist soil after weeds have been controlled.
- Sowing can commence if significant rain (> 12 mm) is likely soon afterwards.

7. Place seeds accurately when sowing

- Direct seed to achieve 5 to 10 mm soil cover over seed.
- As a guide, around 5% of the seed should be visible after sowing.

8. Monitor weeds and pests

- Check weekly for any pasture pests and weeds.
- Treat problems promptly.

9. Strategically graze new pastures

- First graze when plants are 10 cm tall and well anchored.
- Graze heavily but quickly down to around 3 cm.
- Re-graze when plants again reach 10 cm tall.
- Reduce grazing pressure in the first spring (allow cocksfoot and phalaris to set seed).
- Do not graze with horses in the first year of a new pasture.
- Do not cut hay in the first year of a new pasture.

8.1.3 Sowing techniques

The risk of soil erosion is significant in parts of the Adelaide and Mount Lofty Ranges region. Steep slopes and light textured soils are most likely to be at risk during high intensity rainfall events. Consequently choosing an appropriate sowing method should be determined after considering:

- soil erodibility
- the slope of the paddock
- the nature of vegetation cover
- availability of appropriate machinery.

There are several techniques that can be used.

Direct drilling

This is the most appropriate technique for sowing pastures in this region and involves sowing seed directly into undisturbed soil after paddock weeds have been treated with a non-selective herbicide (Figure 46).

The use of narrow points on sowing machinery contributes to successful sowing and helps with the correct depth of seed placement.

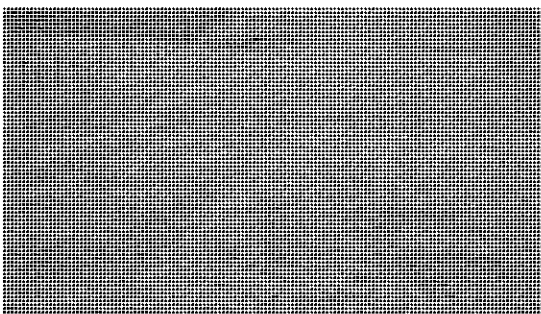


Figure 46. Apply glyphosate herbicide prior to direct drilling a new pasture

Minimum tillage (harrowing and sowing)

This technique involves limited cultivation, often with a harrow, and usually in combination with one or more herbicide applications (Figure 47). It is generally not recommended in high rainfall areas on steep slopes due to the risk of soil erosion. However there may be cases where heavier textures soils with gentle slopes can be treated this way to clean up the surface and smooth areas which have become pugged due to livestock trampling.

Landholders should note that any disturbance of the soil can lift weed seeds to the surface which will compete with sown pasture seeds. Excessive harrowing can also destroy the structure of soils and lead to surface crusting.

Broadcast sowing

Broadcasting can be carried out using a fertiliser spreader and combining the seed with the fertiliser. The success of this technique depends upon how clean the paddock surface is, so landholders are advised to use livestock to graze down pastures during summer before sowing in autumn.

Hand broadcasting is another alternative for landholders who have small paddocks, limited machinery and cannot engage contractors. To improve establishment of seedlings, the sowing rate should be higher than normal recommendations.

Aerial sowing

This is only recommended where ground sowing is not possible. The technique involves using aircraft to apply herbicides followed later by pasture seed and fertiliser. It is costly and nowhere near as successful as other ground based techniques.

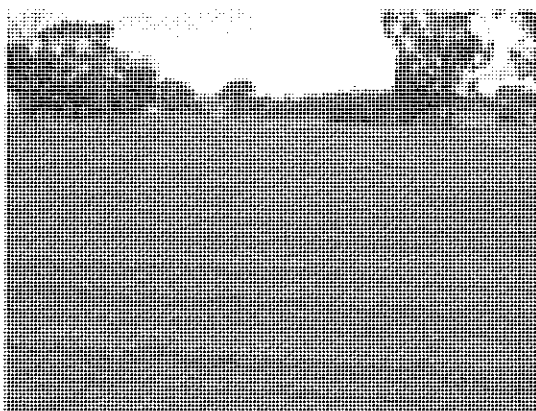


Figure 47. Paddocks may have to be lightly harrowed before sowing

8.1.4 Pasture management calendar

The following calendar is a guide only, since management will vary according to average rainfall, seasonal conditions, soil types, slopes, aspects, pasture species and the type of stock grazing. On small lifestyle properties, hay cutting will depend upon the availability of machinery

and or contractors. If it is not possible to cut hay, overgrown paddocks may need to be slashed, or grazed by additional livestock brought into the property. If left untouched during late spring and summer, overgrown pastures may become rank and unpalatable to livestock, and also create a fire hazard.

Table 8. High rainfall permanent pasture management calendar (e.g. perennial ryegrass and subterranean clover)

Month	Management
January to March	<p>Check down dry paddocks to 1 cm. If not overgrazed, subterranean clover should be supplementary feed for stock.</p> <p>Soil test paddocks to determine fertilizer and lime requirements.</p> <p>Leave paddocks in March, if necessary.</p>
April	<p>Fertilize according to soil test reports.</p> <p>If fertilizing close to watercourses, split applications are recommended (first in autumn and the remainder in early spring).</p> <p>Control subterranean clover, red clover, lucerne and pasture cockspur if present.</p>
May	<p>Inspect for insects, spray early for annual broadleaf weeds, if necessary.</p> <p>Control rank paddocks, if necessary.</p> <p>Leave paddocks in rotation.</p>
June and July	<p>Inspect for insects, spray for perennial broadleaf weeds, if necessary and follow instructions for safe applications and livestock withholding periods.</p> <p>Spray for Cambridge Grass in late July if larvae are identified present. If spraying for Cambridge grass in late July with methidathion-methyl, paddocks must not be re-grazed for 14 days (see 7.1.2).</p> <p>Apply 10 to 20 kg/ha of nitrogen to pastures in rotation.</p>
August	<p>Apply NPK fertilizer in late August to dry paddocks.</p> <p>Close these paddocks off at least until 1st October.</p>
September and October	<p>Watch for insect pests (e.g. lucerne fly) and subterranean clover root rot and record if they are a problem. Help to finance control www.livestock.com.au.</p> <p>Spray for annual grasses in sandy paddocks with pre-emergent herbicide.</p> <p>Hard grass paddocks cut out for hay, especially if windy.</p>
October and November	<p>Cut paddocks for hay or silage. This is important not to cut hay off the same paddock year after year since this will encourage the build up of annual weeds and reduce the quality of pasture. Hay paddocks should be rotated over a 3 to 4 year cycle.</p> <p>Control lucerne and red clover.</p> <p>Put in June 10 cm of pasture cover by the end of November.</p>
December	<p>Control lucerne and red clover. Always keep a reserve of 10% cover.</p>

8.2 Pasture in low rainfall areas (250 to 450 mm p.a.)

Maintaining perennial grass pastures in low rainfall areas is difficult. In sandy soils perennial veldt grass may have established, or landholders may be fortunate enough to have native grasses. However, relying on annual pastures each year is common. These may need to be re-seeded each year depending on the cultivars used. A range of cultivars for low rainfall areas is outlined in Chapter 7.

8.2.1 Sowing annual pastures

- Conduct a soil test to determine fertiliser requirements.
- Graze down dry residues to 3 cm in autumn prior to sowing the seed.
- Allow weeds to germinate following the opening rains (usually late April) and spray out with Glyphosate.
- Sowing can be undertaken during May or early June provided it is not too cold.
- Seed is best sown by direct drilling, however on small paddocks broadcasting seed may be appropriate. It is important to run a light chain or a piece of weldmesh over the paddock if broadcasting seed.
- Ensure fertiliser is applied when the seed is sown.
- Watch for weeds and pests after the pasture has germinated and apply appropriate chemical sprays if necessary.
- Allow the plants to establish before grazing. This usually when the roots are firmly held in the ground and plants cannot be pulled out by livestock.
- Once the pasture is approximately 12 cm in height graze down to 5 cm and rest the pasture. Graze again when 12 cm and rest when plants reach 5 cm. This rotational grazing approach is important to best utilise the pasture.
- It is important not to graze annual pastures too heavily in spring, since it is a time when you should be encouraging seed production which will germinate again next autumn.
- These pastures can also be sown to produce good hay to feed out during summer and autumn when paddock feed is low.

9. Soil testing, fertilisers and liming

Soils are dynamic ecosystems containing vast numbers of living organisms, mineral particles and organic matter which provide water, nutrients and air for plant growth.

Appropriate management of soils is critical to avoid degrading them to the point where plant growth suffers. The continued removal of plant products without the addition of fertilisers will result in a loss of crucial soil nutrients. The physical condition of a soil, together with its chemical and biological status is used to measure soil health. Nutrient levels, soil acidity and erosion can all impact on the health of a soil.

Correcting soil nutrient levels is important, however overuse of fertiliser can be a source of water pollution. This is an important issue to consider throughout the high rainfall areas of the Mount Lofty Ranges. Where fertiliser applications are being made near a watercourse it can be beneficial to split the applications so that half is applied in autumn and the other half in spring.

If soil nutrient levels are low it is important to apply fertiliser to counter poor plant growth which can often lead to a lack of ground cover, increased weed growth and erosion.



Figure 48. Shallow soils over rock are common in some parts of the region

9.1 Soil testing

Laboratory tests on soil samples will measure the nutrient status of soils and indicate the level of soil acidity (pH). From this information the type and amount of fertiliser for each paddock can be determined, and if lime is required, to correct soil acidity, an accurate application rate can be calculated.

Spring and summer is the best time to test soils, once they are dry, since this is when the nutrient levels are the most stable and the test results most reliable.

Leaf tissue tests are sometimes required to accurately measure trace element deficiencies e.g. copper, zinc and manganese. Foliar sprays can be used to rectify these deficiencies. Test kits should provide details of sampling procedures.

A soil test is essential prior to liming, or when re-seeding pastures, or when sowing a new crop. It is also important to test soils on a regular basis (every three to four years) to monitor the effect of management on soil fertility and pH.

Different soil types should be sampled separately. Aim to take a representative sample of a relatively uniform area, avoiding stock camps, tracks, headlands, etc. where conditions may not be representative. If testing pasture or cropping paddocks, approximately 30 cores to a depth of 10 cm (if possible 15 cm) should be collected and mixed thoroughly for laboratory testing. Soil samplers can be borrowed from most natural resource centres.



Figure 49. Collecting a soil sample for testing

Soil test results will identify nutrient deficiencies, but if assistance is required, when calculating the level of fertiliser or lime to apply, always seek independent professional advice.

An important principle to keep in mind when applying fertilisers is that production is linked to the most deficient nutrient. For example, an application of phosphorus can be wasted if another element is limiting plant growth, so ensure that all nutrients levels are adequate and represent the correct balance of plant nutrients.

9.2 Soil acidity

Acid soils predominate in the higher rainfall areas of the region which includes the Mount Lofty Ranges and the Fleurieu Peninsula, while alkaline soils are generally found on the Adelaide Plains.

Pasture production from soils which are highly acidic, or highly alkaline, can decline resulting in economic losses for landholders. Soils are often characterised as being acidic, or alkaline, and measured using the term pH. The pH scale covers a range from zero to 14.0 with 7.0 being neutral (Figure 50). If soils are measured at less than pH 7.0 (in water) they are considered to be acidic. If they are less than pH 5.0 (in water) they are considered to be strongly acidic. The ideal pH range for most plants is from 6.5 to 8.5 (in water).

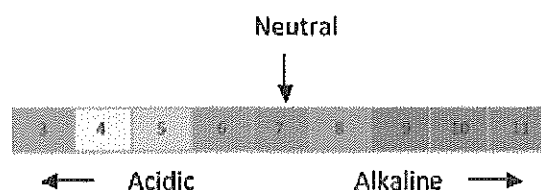


Figure 50. Soil pH scale

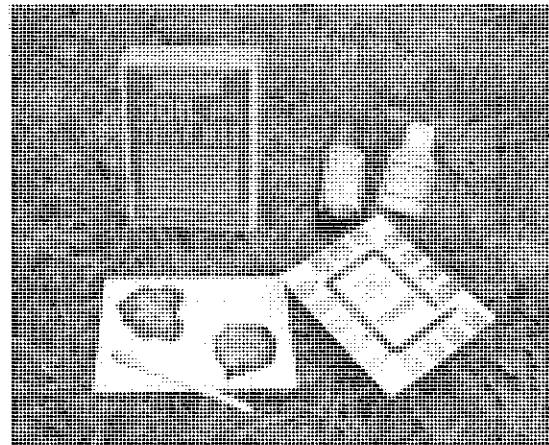


Figure 52. Field pH testing kit

A field kit, consisting of barium sulphate, universal indicator and a colour chart, can give an indication of soil pH (Figure 52).

Small hand held meters are also available to measure soil pH.

However, a laboratory soil test should be undertaken to measure the precise pH reading. Most laboratories measure pH by two methods (pH_{water} and pH_{CaCl₂}). Typically pH_{CaCl₂}, (i.e. pH calcium chloride) is about 0.8 units lower than pH_{water}, but gives a more accurate measurement in acidic soils.

Causes

Acidification is caused by:

- organic matter decomposing and producing organic acids
- nitrogen compounds being added to soils e.g. fertilisers and legumes such as clovers, lucerne and lupins
- removal of alkaline elements in crops and hay.

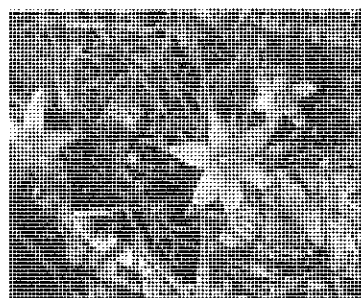
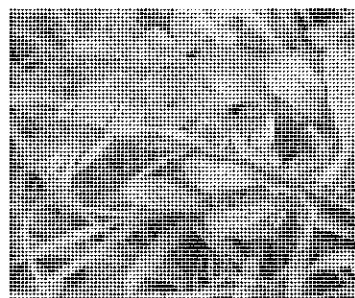
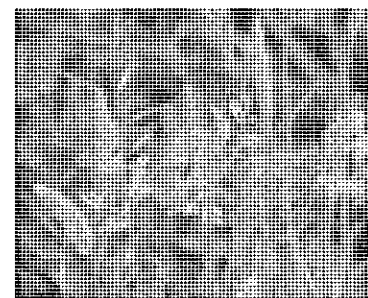


Figure 51. Plants indicating soil acidity

51a: Guildford grass (*Romulea rosea*)



51b: Sorrel (*Rumex acetosella*)



51c: Fog grass (*Holcus lanatus*)

In high rainfall areas, such as the Mount Lofty Ranges, nitrogen compounds are naturally leached from the soil profile, leaving acid conditions behind. However, land management practices, such as pasture production and removal of nutrients in farm products (e.g. hay and silage) can accelerate this process.

The addition of urea, ammonium sulphate and ammonium nitrate fertilisers have a major acidifying effect.

Some soils can be naturally alkaline, such as parts of the Adelaide Plains, with some being caused by the presence of calcium carbonate.

Consequences of soil acidity

Most of the detrimental effects of soil acidity are due to plant nutrients becoming less available (Figure 53). For example, phosphorus which is needed by all plants for good root development, can become tied up with other nutrients at low pH and become insoluble and therefore less available to plants. In addition, nutrients such as iron, aluminium and manganese can become toxic to plants.

When this occurs, plant growth slows and dry matter production declines which can result in poor vegetative cover and exposed soil.

Phalaris and lucerne, are especially susceptible to aluminium toxicity at low pH, and overall production can be severely reduced.

Significant economic losses can also occur in agricultural production systems if soil acidity is not recognised and treated.

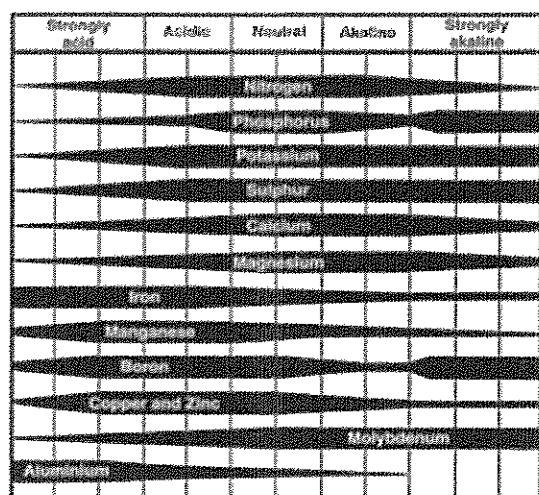


Figure 53. Nutrient availability

Correcting soil acidity

Acidity is a form of soil degradation which can be corrected by the addition of lime (calcium carbonate). The lime neutralises the acid and raises the pH.

There are a number of different lime materials such as:

- calcium carbonate
- hydrated lime
- burnt lime.

These, and various other liming materials, vary in their neutralising capacity. Good lime should have a neutralising value of at least 80 (i.e. 80% as effective as pure calcium carbonate) but should not be so fine that it blows away when spread, or too coarse that it reacts extremely slowly in the soil (Figure 54).

Dolomite lime (calcium magnesium carbonate) should be used where soil test indicates a deficiency in magnesium.

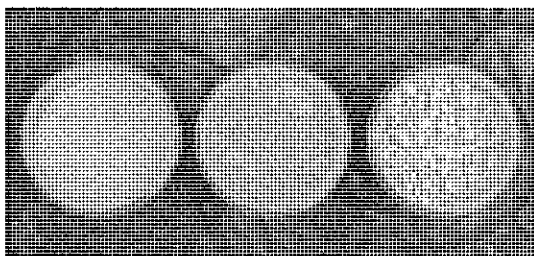


Figure 54. Particle size varies with different lime products

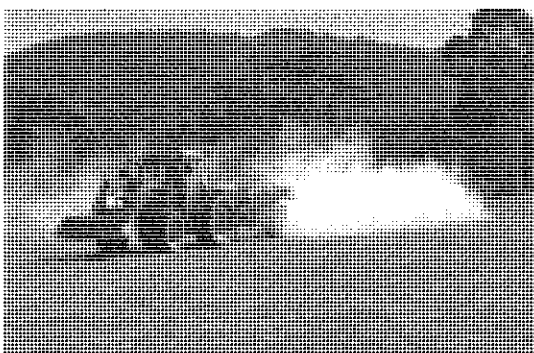


Figure 55. Lime spreading on pasture
Photo: PIRSA Rural Solutions SA

Lime requirements

The amount of lime required to reduce acidity will depend upon:

- soil texture
- initial pH
- target pH.

In all situations lime should be added to prevent the pH from falling below 5.0 (CaCl_2). The target range for extensive grazing on small properties will depend to some extent on the stocking rate, but an acceptable range is pH 5.0 to pH 5.5. In intensive grazing situations aim for the ideal pH of 5.5.

Table 9. Lime requirements to raise soil pH by approximately 1 unit (e.g. raise pH (CaCl_2) from 5.0 to 6.0)

Soil texture	Approximate lime requirement (t/ha)
Sand, heavy sand	3.0
Sandy loam	3.5
Loam, sandy clay loam	4.5
Heavy clay	5.0

There is a range of soil acidity information and decision tools available:

Ag Excellence Alliance: Soil acidity – <http://agex.org.au/project/soil-acidity>

Natural Resources Adelaide Mount Lofty Ranges: Small Talk Autumn 2017 – www.naturalresources.sa.gov.au/adelaidentloftyranges

Agriculture Victoria: Soil acidity monitoring tools – <http://agriculture.vic.gov.au/>

Soil quality: Soil acidity – www.soilquality.org.au/factsheets/soil-acidity

PIRSA: Action on acid soils – <http://pir.sa.gov.au>

The following map (Figure 56) illustrates the distribution of acidic topsoil in the AMLR NRM region. Those shown as neutral to alkaline have pH (in water) of 7.0 to 14.0. Where soils are acidic with moderate to high buffering capacity (i.e. soils which contain clay particles that resist changes to soil acidity), high amounts of lime are often required to correct soil acidity. The pH (water) range of these soils can be 6.5 to 6.9. Acidic soils with low buffering capacity can have a pH (water) range of 5.5 to 6.4, while strongly acidic soils with low buffering capacity are often less than 5.4.

Table 10. Preferred ranges of pH (water) for some agricultural crops

Crop	Preferred pH range
Barley	6.0 to 6.5
Grass	4.5 to 6.0
Wheat	5.5 to 6.5
Triticale	4.5 to 6.5
Lupine	5.0 to 7.0
Groundnuts	6.0 to 7.5
Apple	6.0 to 7.5
Grape	5.5 to 7.5
Brassica napus	6.5 to 7.5
Citrus	5.5 to 7.0
Corn/maize	5.0 to 7.5
Peanut	5.5 to 7.0
Ucuna	6.0 to 6.5
Mustard	6.0 to 6.5

Correcting alkaline soils

Alkalinity can be reduced by adding sulphur, however few soils show an economic response due to excessive amounts of free limestone which counters the impact of sulphur. Growing legume based crops, such as field peas, lucerne and annual medics, may help to reduce pH to some extent, but to avoid poor plant growth it is important to grow crops which tolerate a high pH.

In alkaline soils (high pH) phosphorus can become tied up and less available to plants, and molybdenum can become toxic in some soils. Boron may also be toxic in soils with high pH, but be deficient in acid soils (low pH). Soils which are higher than pH 8.5 can also have significant levels of the element sodium. These soils are known as 'sodic' soils and can limit plant growth.

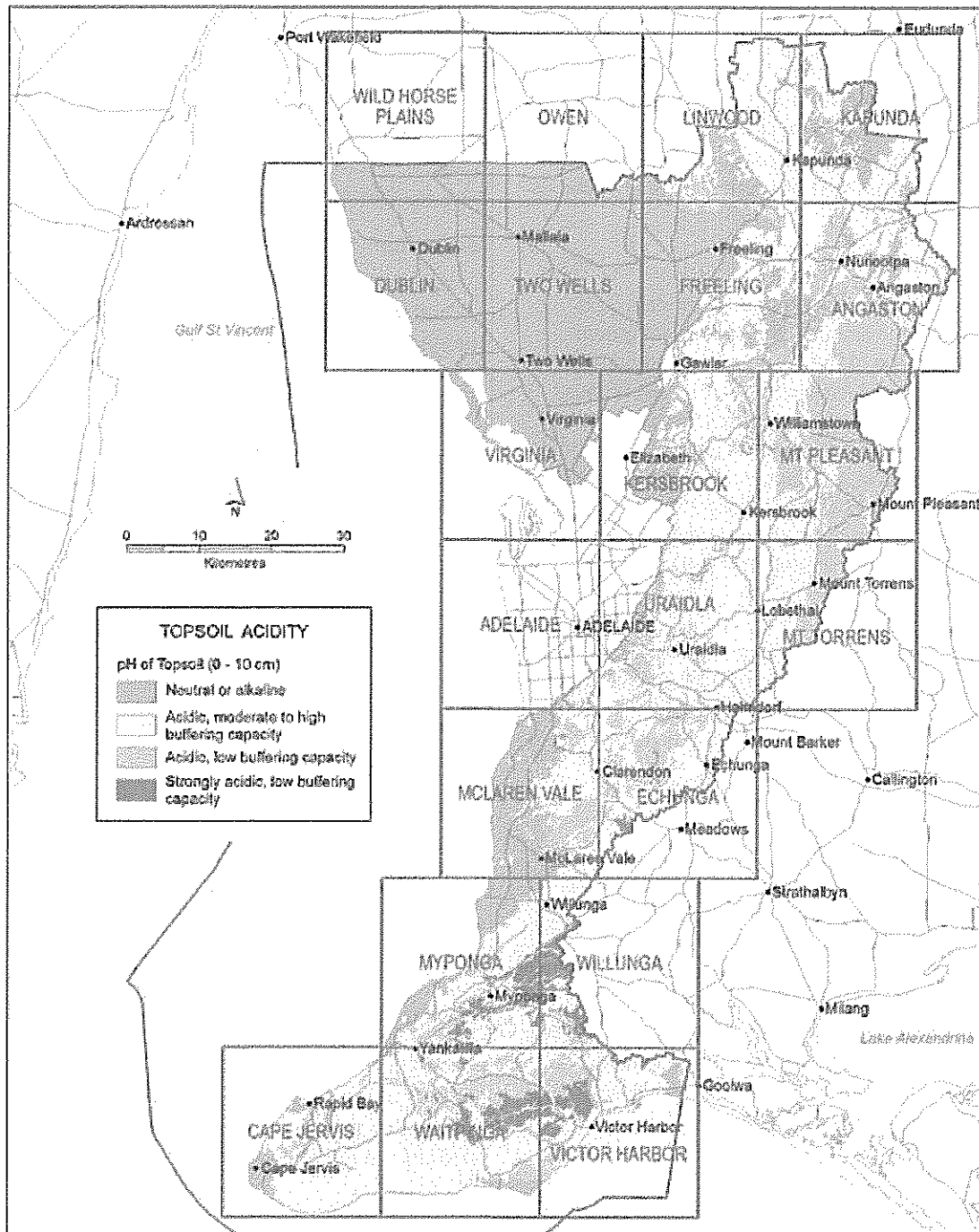


Figure 56. Topsoil acidity in the Adelaide and Mount Lofty Ranges NRM region

Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

9.3 Nutrient requirements

Plants require a range of nutrients to grow successfully and if levels of these are not adequate in soil, production will decline and animal health may be affected. The most common nutrients applied to soils in South Australia are phosphorus and nitrogen.

Nitrogen (N)

Plants require nitrogen to make protein, and require large amounts for normal leaf growth. It can be one of the most widespread nutrient deficiency problems in South Australia because it is easily leached from the soil. Fortunately, legumes add nitrogen to soil naturally through a process known as 'nitrogen fixation'. On average, lucerne can add approximately 225 kg/Ha of nitrogen to the soil each year, whilst clover can add up to approximately 100 kg/Ha.

Phosphorus (P)

Most Australian soils, in their natural state, suffer from phosphorus deficiency. Available phosphorus in soil encourages good root growth. Plants suffering from stunted growth may be lacking phosphorus.

Potassium (K)

Potassium deficiencies are generally rare in South Australian soils, however, continual cutting of hay will remove large quantities of this nutrient. Potassium is required by flowers and seeds.

Sulphur (S)

Sulphur deficiencies are generally not widespread in soils containing sulphate compounds and reasonable levels of organic matter. Common high analysis fertilisers were often low in sulphur, but this nutrient is now being added to improve soil nutrient levels. Gypsum is a good source of sulphur.

Calcium (Ca)

Most Australian soils have sufficient calcium in the form of limestone, calcrete, and 'soft' lime. However, some soils can be low in calcium which leads to plant disorders, especially in horticulture.

Magnesium (Mg)

Sandy soils in high rainfall areas can be heavily leached resulting in a deficiency of magnesium. These soils can also be quite acidic, in which case dolomite lime may need to be spread. This type of lime will not only correct the level of the acidity, but it will also add magnesium to help correct deficiencies.

Trace elements

Trace elements are required by plants in only small quantities, but they still have the capacity to severely impede the growth of plants.

Examples include:

- copper (Cu)
- manganese (Mn)
- zinc (Zn)
- molybdenum (Mo)
- iron (Fe)
- boron (B)
- cobalt (Co)
- selenium (Se).

Any product removal from paddocks, be it hay, milk, meat, wool, depletes the nutrient "bank" in the soil (Table 11). These nutrients need to be replaced, and this is best determined from the results of a soil test. From this analysis suitable fertilisers can be applied to lift nutrient levels.

Table 11. Nutrient loss from a paddock

Nutrient loss	Average nutrient loss (kg/ha)		
	Phosphorus	Potassium	Nitrogen
May 14.3 t/ha reaction test	13	85	0
May 14.3 t/ha reaction test	14	27	0
May 17.5 t/ha reaction test	2	7	2
Grass Crop Barley 2.5 t/ha	3	10	4
Legume Crop peas 2.5 t/ha	11	15	0
Grass 2.5 t/ha	0.2	0.4	1.4

Table 12. Nutrient content of particular fertilisers

Fertiliser	Nitrogen
Superphosphate – fine analysis	0.0340.11
Triple superphosphate	0.0310.11
Urea	0.4510.20
Sulphate of ammonia	0.190.10
Muriatic	
Superpotash #1	0.1710.10
Hydroxide	0.175.085
Muriatic with trace elements	
Superphos (Ca 1.0%, Zn 1.0%)	1.10.0.10
Organic	
Phosphate bone	0.04.0.0
Patric's Organic	0.04.1.1
Grass 10 t/ha	1.710.0.10.24
Grass 10 t/ha	
Reactive rice phosphate (acid soluble)	0.12.5.0.1.4

Choosing fertilisers can be confusing, so in order to determine how much of a particular product to add, the 'nutrient analysis' for each fertiliser should be known (see Table 12). This is usually expressed as a ratio e.g. DAP (di-ammonium phosphate) has a ratio of 18:20:0:1.6 where the nutrients are N:P:K:S.

Hence DAP contains 18% nitrogen, 20% phosphorus, 0% potassium and 1.6% sulphur.

10. Stocking rates, grazing pressure and dry sheep equivalents

For lifestyle landholders, the type and numbers of livestock they run on their individual property will often vary widely depending on why they chose to purchase land in the first place.

The region is home to numerous recreational horse properties, often with no agricultural pursuits at all. On the other hand, sheep, cattle and alpacas are the chosen livestock for many other property owners. In nearly all cases there is a reliance on pasture production to manage a particular number of animals, so getting the numbers right is paramount for animal welfare and to manage our natural resources.

Under-grazed properties can pose a risk of fire and promote weed infestations, while over-grazed properties can lead to serious environmental damage and land degradation.

Soil type and rainfall are two important environmental factors which influence stocking rate determinations. For example, pasture production from a highly leached sandy soil with a rainfall of 450 mm p.a. will be considerably less than the pasture production from a deep uniform red brown earth in a 800 mm p.a. rainfall zone. As a consequence the number of stock that can be carried on these two properties will vary significantly.

Management is also a critical part of the equation. Good managers can generally carry more livestock and still protect, and in many cases improve, the condition of natural resources by:

- improving pasture
- controlling weeds

- improving grazing strategies
- increasing soil fertility
- combating soil acidity
- matching livestock numbers to pasture productivity.

How much stock can be carried on a single property can vary throughout the year since the level of pasture feed will vary from season to season. Hence, calculating the initial overall 'stocking rate' will only give landholders a 'ball park' figure which should be used as a guideline when stocking a grazing property. Management practices, variability in rainfall and soil fertility all play an important part in how much feed is ultimately available and therefore how much stock can be run at any one time.

The term 'carrying capacity' is sometimes used when discussing stocking rates. This refers to the number of animals which can be run on the property at times of low feed production. This is likely to be in winter.

It is important to distinguish between the overall stocking rate for the property and 'grazing pressure' (i.e. stocking density). Grazing pressure refers to the number of animals grazing a particular area of pasture for a limited time. For example, a small property may be able run a maximum of 20 head of cattle. If the area to be grazed is 20 hectares, the grazing pressure will be 1 animal per hectare. However, if the property is divided into two paddocks of equal size and all animals graze in one paddock, the grazing pressure in this paddock is now two animals per hectare (Figure 57).

1 paddock (20 ha)	2 paddocks (10 ha each)		4 paddocks (5 ha each)	
20 hectares 20 cattle Grazing Pressure 1hd per ha	10 hectares 20 cattle Grazing Pressure 2hd per ha	10 hectares not grazed (rested)	5 hectares (rested)	5 hectares (rested)
			20 cattle Grazing Pressure 4hd per ha	5 hectares (rested)

Figure 57. Relationship between livestock numbers, paddock area and grazing pressure on a 20 hectare property

Adopting effective grazing pressures, and rotating animals through a series of paddocks, can increase pasture production, give better weed control and increase livestock production. Consequently dividing a small grazing property into four to six paddocks is recommended.

The challenge for landholders is to determine a suitable stocking rate for the property and apply grazing pressures which have a positive impact and do not degrade the land.

If the overall stocking rate is too high or grazing pressure is excessive:

- pasture production is reduced
- pasture quality declines
- the proportion of weeds can increase
- soil erosion can occur, particularly during a drought
- livestock can be stressed or suffer health problems.

10.1 Dry sheep equivalents (DSE)

When discussing stocking rates the term dry sheep equivalents (DSE) is generally used. This is a standard unit frequently used to assess the carrying capacity of a given area of farmland. The standard DSE unit is the amount of feed required by a two year old, 50 kg sheep (wether or non-lactating, non-pregnant ewe) to maintain its weight. Using this as the standard allows comparisons to be made between different classes of livestock (Table 13). For example, an adult dry cow or steer has a DSE value of 7.0 to 8.0 and would therefore require the same amount of feed as 8.0 or 10.0 dry sheep. If 10 hectares of good pasture were available in a region with a stocking rate of approximately 10 DSE, either 8.0 or 10 cattle could be carried, or 80 to 100 dry sheep.

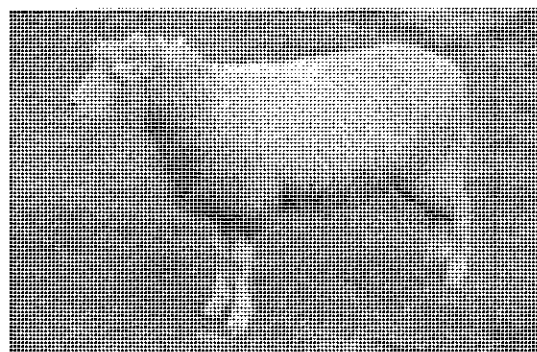


Figure 58. One standard dry sheep is used as a benchmark to compare feed requirements of stock

Table 13. Dry sheep equivalents (DSE) values for different classes of sheep and beef cattle based on daily energy requirements

Source: Agriculture Victoria, formerly Victorian Department of Primary Industries 2007

Animal Class	Weight (kg)	DSE
Sheep (Wethers)		
Adult (2 years)	50 kg	1.0
– growing (100 kg)	100 kg	1.3
– growing (200 kg)	200 kg	1.6
Adult (dry)	50 kg	1.0
– growing (100 kg)	100 kg	1.3
– growing (200 kg)	200 kg	1.6
Pregnant ewes (last 6 weeks range bands)	50 kg	1.4
Pregnant ewes (last 6 weeks (low range bands)	50 kg	1.3
Ewes with range bands at foot	50 kg	1.4
Ewes with low range bands at foot	50 kg	1.3

Table 13. continued

Class of livestock	DSE at specified liveweights	
Beef cattle (British breeds)		
Weaned calves	200 kg	250 kg
– gaining 0.25 kg/day	5.5	6.5
– gaining 0.75 kg/day	8.0	9.0
Yearling	300 kg	350 kg
– gaining 0.25 kg/day	7.0	8.0
– gaining 0.75 kg/day	10.0	11.0
Mature cattle	400 kg	500 kg
Dry cows, steers (store)	7.0	8.0
– gaining 0.25 kg/day	8.0	9.0
Bullocks (store)	8.0	9.0
– gaining 0.75 kg/day	12.0	14.0
Pregnant cows last 3 months	9.0	11.0
Cows with 0 to 3 month calf	14.0	18.0
Cows with 4 to 6 month calf	18.0	22.0
Cows with 7 to 10 month calf	22.0	25.0

When using DSE values it is important to remember that they are only approximations and are based on the energy requirements of livestock. They do not account for differences in protein and mineral requirements of different animals, or requirements due to genetic variations. Livestock feed requirements vary according to liveweight, level of production, physiological state and climatic conditions.

Landholders should also be aware that the carrying capacity of land is greatly reduced when animals are infected by large numbers of parasites.

Table 14. Dry sheep equivalents (DSE) values for horses, deer and goats

Class of livestock	DSE value
Horses	
Light horse	10.0
Draught horse	14.0
Pony	6.0
Horse – light work	13.5
Horse – heavy work	18.7
Deer	
Fallow dry female or castrate	1.5
Fallow breeding female with fawn	2.2
Red dry female or castrate	2.2
Red breeding female with young	3.0
Red buck	3.1
Weaner doe	1.4
Weaner buck	1.9
Goats	
Dry angora	1.0
Breeding angora	1.6
Dry milk or meat goat	1.5
Milk or meat goat lactating	3.0

Table 15. Dry sheep equivalents (DSE) for alpacas

Category	25 kg	45 kg	65 kg
Alpacas			
Dry adult (non-lambing, non-pregnant)	0.6	0.8	0.9
Hefters	0.8	1.1	1.3
Wethers	0.7	0.9	1.1
Caracul 50 g/km ² /ha	1.1	1.5	1.7
Caracul 100 g/km ² /ha	1.2	1.7	2.0
Caracul 150 g/km ² /ha	1.4	2.0	2.3

10.2 Using DSE values to initially stock a property

In order to estimate how much stock your property can run, without reducing pasture quality or degrading land, a DSE rating (i.e. indicative baseline stocking rate/ha) for the location of your property will need to be known. These are often regarded as 'regional stocking rates'. This is the subject of the next chapter which will take into account key factors including: soil type, average annual rainfall, slope of the land and pasture quality. For the example below it is assumed that the regional DSE/ha is 10.

Estimating a total stocking rate for a small property

Example: Firstly, determine how much land is available for grazing. Eliminate non grazing areas such as house, sheds etc. Take account of restricted seasonal grazing due to waterlogging.

Available grazing land:

Area 1: (grazing all year) = 6 ha
 Area 2: (restricted for 3 months in winter) = 2 ha
 Area 3: (only available for 6 months) = 4 ha

Assume the regional stocking rate for the region is 10DSE/ha and the pasture is good.

Maximum stocking rate for the property:

Area 1: $6 \text{ ha} \times 12/12 \times 10\text{DSE} = 60 \text{ DSE}$

Area 2: $2 \text{ ha} \times 9/12 \times 10\text{DSE} = 15 \text{ DSE}$

Area 3: $4 \text{ ha} \times 6/12 \times 10\text{DSE} = 20 \text{ DSE}$

Total for the property = 95 DSE

(i.e. 95 dry sheep can be run on this property without degrading the land)

If running steers; divide 95 by the DSE for steers (9) i.e. $95/9 = 10.5$ steers.

If running lambing ewes; divide 95 by the DSE for this class i.e. $95/1.5 = 63$ ewes.

Note: All calculations of this nature are approximate. Land managers will need to monitor pasture and livestock condition regularly to avoid any land degradation or loss of livestock condition.

10.3 Are you overstocked?

Thankfully most landholders in the Region are responsible and endeavour to look after their properties. Even so, for inexperienced landholders it can be difficult to judge appropriate stock numbers in the early days of managing a property for the first time.

If your property stands out from others in the district because paddock feed always seems low, or you have enormous feed bills, or your animals are not in good condition, or summer and autumn bring bare paddocks, you are most likely overstocked.

Following the above method to estimate your stocking rate will provide you with an overall 'ball park' figure given in DSEs. The following example will enable you to determine if your current stock numbers are comparable.

Example: Assume that the overall stocking rate for this property was calculated to be 120 DSE. The current actual stocking rate can be calculated using the following table.

In this case the property is clearly overstocked at 262 DSE. Buying extra feed will not protect paddocks from being overgrazed. Bare soil and degraded pastures are a likely consequence.

Table 16. Calculating current stocking rate

Stocking rate	Stocking rate	Stocking rate	Stocking rate
2	Holstein Friesian	10	20
25	Young cattle (3-4 years)	11	210
6	Agona (dry) (3-4 years)	12	40
12	Free range Lamb of 300 kg	13	200
Total DSE			262

10.4 Excess grazing pressure can create bare soil

One of the most common causes of bare soil is excess grazing pressure, even though in many cases landholders have determined a realistic stocking rate for the property.

For example, consider a small property which has an overall stocking rate of 40 DSE, which may well just be 5 yearling steers. If these animals are given free run of the property there should be no major problems with overgrazing. However, if the property is divided into four paddock of equal size and all animals graze together in a single paddock at any one time, they have only one quarter of the total feed available. So it is important to move these animals on to the next paddock when pasture feed is low. Leaving animals in individual paddocks for too long leads to overgrazing, and once again, bare soil and degraded pastures are a likely consequence.

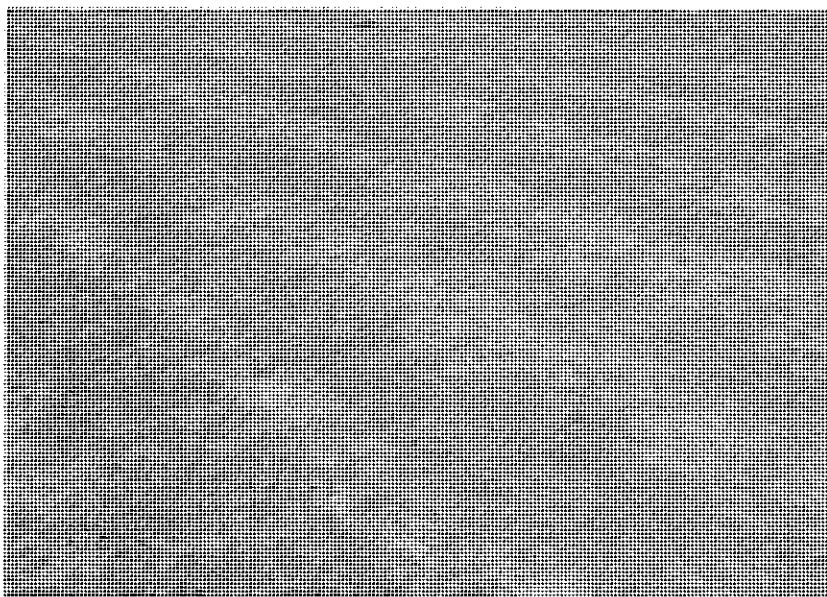


Figure 59. Excess grazing pressure can expose surface soil

11. Regional stocking rates

Most landholders make use of regional stocking rate estimates to help them determine how much stock they can run on their property, and for the most part they can be a necessary and useful guide. However, the variability in stock numbers per hectare, between farms in the same location, can be significant despite similar annual rainfall.

While rainfall has the biggest influence on pasture production, other factors play an important part, such as soil type, soil fertility, length of growing season, pasture quality and grazing management.

11.1 Dryland pasture (non-irrigated)

Many field trials have been conducted over recent years which have enabled agronomists to produce a range of formulae to help calculate how much stock a landholder can run on a property. The key principle which allows a formula to be used, is the amount of dry matter a pasture produces during the growing season. What underpins this approach is the understanding that 1 kg/day of dry matter is required to maintain one DSE (dry sheep equivalents). So the amount of dry matter per mm of rainfall often becomes the starting point to calculate an overall stocking rate. This value can vary markedly depending on dryland pasture quality, with 20 kgDM/Ha/mm regarded as high compared with 6 kg DM/Ha/mm which is regarded as poor.

1 kg/day of dry matter is required to maintain one dry sheep (50 kg dry ewe or wether)

A good average farmer will probably be around the 1.5 to 2.0 DSE/Ha/100 mm rainfall. However, it is important that landholders regard regional stocking rate values as 'indicative baseline stocking rates' only. They may be improved upon in some situations by better management, or on the other hand, landholders may find themselves reducing stock numbers to better match feed production and protect the environment.

Table 18 contains values for 'indicative baseline stocking rates' for a range of pasture and soil qualities and are intended as a guide to help landholders match stock numbers with pasture production.

Basic assumptions were made to calculate these figures. They are:

- 10% of rainfall is lost as runoff
- evaporation is 70 mm during the growing season
- poor pasture produced approximately 6 kgDM/Ha/mm rainfall
- high quality pasture produced approximately 20 kgDM/Ha/mm rainfall
- only 50% of the dry matter produced is utilisable
- 400 kg of pasture dry matter production is lost due to trampling and the impact of dung.

Since pasture quality varies so much from property to property, estimating regional stocking rates is difficult unless this variability is taken into account. The following four pasture descriptors (Table 17) represent poor, moderate, good and high quality pastures and are differentiated on the basis of pasture type, soil fertility, management and limitations due to slope and rocks. These qualities were used to help determine regional stocking rate values. Average annual rainfall was then considered to arrive at the final baseline stocking rate estimates (Table 18).

Table 17. Categories describing pasture quality and soil limitations

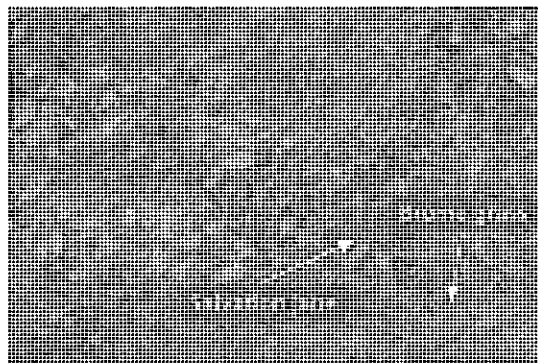
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Figure 60. Poor quality pasture, salvation Jane and annual brome grass only



Figure 61. Moderate quality pasture, <15% perennial grass, capeweed and barley grass dominate

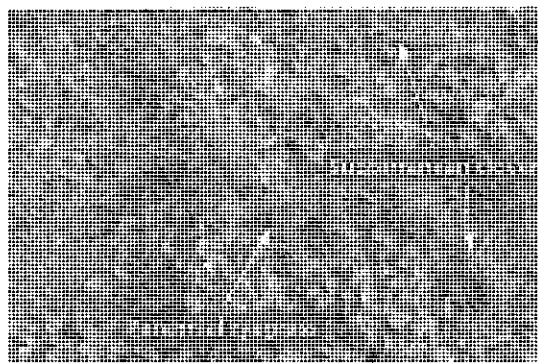
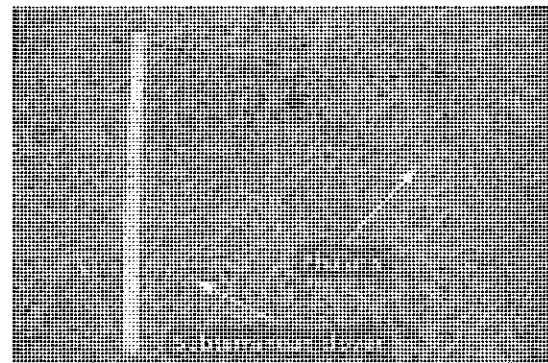


Figure 62. Good quality pasture, 50% perennial grass and clover



40% subterranean clover

Table 18. Indicative baseline stocking rates (DSE/ha) for varying rainfall, pasture and soil qualities in the AMLR NRM region (refer to Table 17 for descriptors)

Stocking rate (DSE/ha)	Very good pasture and soil quality (1000mm rainfall)	Good pasture and soil quality (800mm rainfall)	Fair pasture and soil quality (600mm rainfall)	Poor pasture and soil quality (400mm rainfall)
1000	6	10	15	21
900	6	9	14	21
800	6	9	14	20
700	5	8	13	19
600	5	7	12	17
500	4	7	11	16
400	4	6	10	15
300	3	5	9	14
200	3	5	8	12
150	3	5	8	11
100	3	4	7	10
50	2	4	6	9
25	2	3	5	7
10	1	2	4	5

Table 19 provides indicative baseline stocking rates for specific locations. One column of figures are given for pasture quality which is 'good', and where soil fertility, rocks and slope are not limiting for production. The other set of figures 'poor' assume that pastures are unimproved, of poor quality, and soil fertility, rocks and slope are limiting for production. Average annual rainfall values have been taken from the past 30 years, since these values are likely to better represent potential annual rainfall in a drying climate.

Table 19. Indicative baseline stocking rates for locations in AMLR NRM region

Location	Average annual rainfall (mm)	Stocking rate (DSE/ha) for good pasture quality	Stocking rate (DSE/ha) for poor pasture quality
Lancelotti Pasture in Currie	1007	15	6
Longwood	959	13	6
Clarence Commemorative Park	946	15	6
Parade	923	13/12/15	6
Sandstone Valley Farm	906	14	6
Cherry Gardens	855	14	6
Lockhart	810	13/12/14	6
Carleton Creek	813	12/12/13	5
Bulbin (State River Primary)	814	13/12/13	5
Heathcote	780	11/12/12	5
Chambers	734	11/12/12	4/12/5
Edinboro	768	11/12/12	4/12/5
Carrennawa	703	11/12/12	4/12/5
Hardwicke	737	10/12/11	4
Yarradilla	733	10/12/11	4

Table 19. continued

Property	Property Number	Estimated carrying capacity (DSE/ha)	
		Estimated carrying capacity (DSE/ha)	Estimated carrying capacity (DSE/ha)
Arcoona	710	12.00.11	8
Blackpool	707	10	4
Berkeley	694	10	4
Blythorn	681	9.10.10	4
Challenger	675	9.10.10	4
Upper Hemmings	673	9	4
Edward Macdonald	616	8.10.9	4 and 4
Challenger	614	8	3
Sacred Valley	602	8	3
Argenton	599	8	3
Carroll	592	7.10.8	3
Lyndon	589	7.10.8	3
Verde Estate	588	7.10.8	3
Barmanville	517	7.10.8	3
Greenock	511	7.10.8	3
Irwin	505	7	3
Kepperton	496	7	3
Magnum	484	6.10.7	2.00.3
Port Elliot	483	6.10.7	2.00.3
Frederic	483	6.10.7	2.00.3
Frederic	480	6.10.7	2.00.3
Lake	464	6.10.7	2.00.3
Harvey Bridge	450	6	2
Pennington	431	5.10.6	2
Gower	424	5.10.6	2
Boddy	403	5	2
Owen	404	5	2
Port Gifford	391	5	2
Malinta	383	4.10.5	1.00.2
Lower Light	382	4.10.5	1.00.2

11.2 Irrigated pasture

Available water is the greatest factor influencing the overall stocking rate on small grazing properties, and since most of these properties do not irrigate, seasonal rainfall alone will determine how much pasture is produced each year.

However, where irrigation is practised a greater level of dry matter can be produced and more

stock can be carried. Up to 46 DSE/ha is possible where regular irrigation and fertilising of improved pasture occurs.

This figure may will drop if landholders are only watering occasionally and/or the pasture does not contain appropriate species for irrigation (refer to Chapter 7).

12. Principles of grazing management

Developing a suitable grazing strategy for a small property, so that the needs of the animals and pastures are met, is not difficult as long as a few basic principles are followed. Rotational grazing, set stocking, resting pastures for seed production, and supplementary feeding, all need to be considered when deciding on the best tactical approach for grazing.

The benefits of implementing an effective grazing strategy are considerable and include:

- improved pasture quality
- increased livestock production
- better control of weeds
- less environmental damage.

12.1 Set stocking

Set stocking involves grazing livestock for a set period of time in a particular paddock without any resting phase. This is quite common on small properties where landholders have low stock numbers and production is not a major objective.

Where a property consists only of one main grazing area, and has not been subdivided into smaller paddocks, the landholder often has no choice but to apply set stocking. In this case the overall stocking rate is generally calculated so that area of land will carry a set number of livestock for the year.

Rotational grazing is also not possible on small properties where all paddocks are occupied by different groups of animals. These landholders operate a set stocking regime.



Figure 64. Set stocking can occur when a property has only a single paddock

A common problem with this approach is the build-up of weeds and a decline in pasture quality. Livestock tend to consume palatable pasture species and leave the unpalatable species, which in many cases are weeds. This is known as 'selective feeding'. In this situation, the seed set of weeds increases and the balance of the pasture changes as weeds begin to dominate the pasture.

Feed shortages can be managed by supplementary feeding with hay, silage or grain.

12.2 Rotational grazing

Rotational grazing is a practice where livestock are grouped together and rotated through a number of paddocks in order to rest pastures. Resting pastures is a vital practice if landholders wish to improve pasture quality, reduce weeds, and increase productivity. This process relies on the rest period being long enough to allow sufficient pasture growth so that grazing can begin again.

Rotational grazing can increase stocking rates by up to 20% compared with set stocking.

Under these circumstances grazing pressure is higher than under set stocking and relies on more intensive grazing of the vegetative pasture phase. Livestock graze less selectively when grazing pressure is high which helps to keep weeds under control.



Figure 65. Paddock division is important for rotational grazing

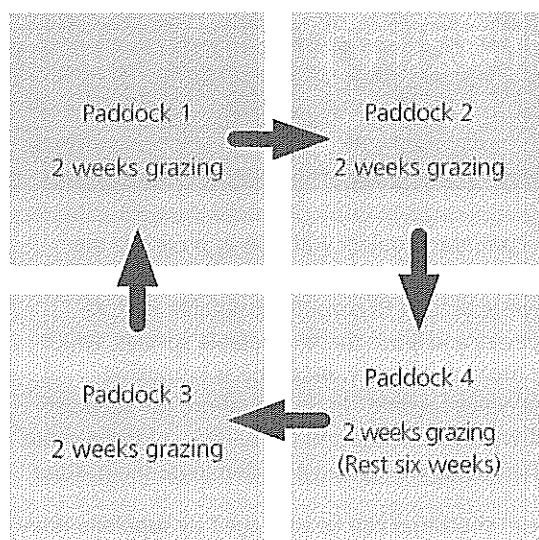


Figure 66. Paddock rotation during moderate growth – six week rest

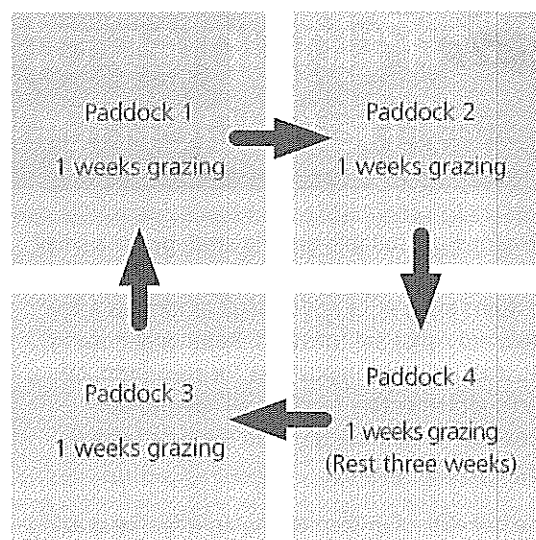


Figure 67. Paddock rotation during rapid growth in spring – three weeks rest

Small properties should be divided into at least four paddocks (ideally four to six paddocks). This enables a simple four paddock rotation for a single group of animals to be quite easily managed. Temporary electric tape can be used for horses and cattle if landholders do not want permanent fences. However, five or six wire internal electric fences are very effective for these classes of animals.

To operate a simple four-paddock rotation during moderate pasture growth, combine animals together and run as one herd or flock on the property. Rotate these animals around the four paddocks following a program of approximately two weeks grazing and six weeks rest.

During **rapid** pasture growth in spring graze for approximately one week and then rest for approximately three weeks. This will help to keep the pasture in the vegetative (or growth phase).

Rotational grazing helps to reduce 'patch' grazing and livestock camps, minimises broadleaf weeds and annual grasses. It also provides a more even distribution of manure and urine to the pasture. If managed appropriately ground cover over summer will be improved.

It is essential that paddocks are not grazed for too long since this will result in plants not recovering as quickly as they should. The height at which pastures are grazed is a critical part of the success of this grazing strategy. Pasture utilisation is best when plant are growing between 5 cm and 12 cm. The use of a pasture ruler is helpful when estimating pasture height (Figure 68).

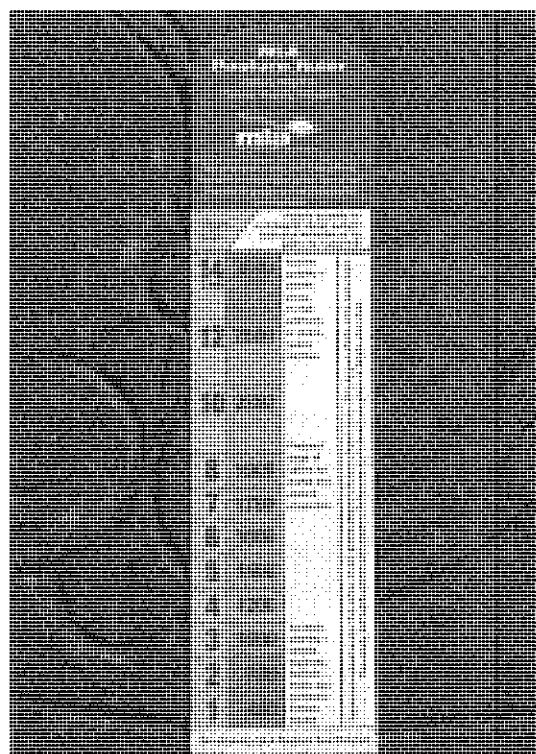


Figure 68. Pastures should be grazed in the green zone

Paddocks should be rested when pastures have been eaten down to 5 cm during pasture growth phases, and animals re-introduced when pastures have grown to 12 cm

When livestock are moved out of a paddock it is advisable to monitor pasture height to estimate the degree of under, or overgrazing. Overgrazed pastures will take longer to recover, result in less pasture production over the year, and often create bare patches which become invaded by weeds.

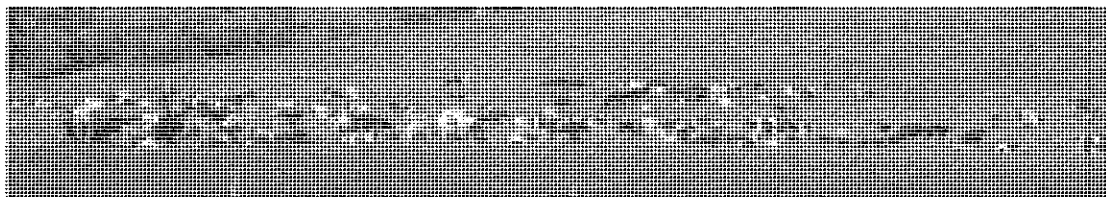


Figure 70. Strip grazing on a dairy farm – Fleurieu Peninsula

12.3 Intensive rotational grazing

This grazing system involves stock being rotated frequently (every 1–3 days) through a large number of paddocks (up to 20 or 30). Intensive rotational grazing systems are also referred to as:

- high density grazing
- short duration grazing
- block grazing
- strip grazing
- cell grazing.

Intensive grazing is a very efficient method of utilizing pasture and relies on rotations being planned around the most desirable plant species in the pasture which grow actively in different seasons.

Stocking densities are very high and so grazing periods are short. They can be as low as one day depending on pasture growth rates and stock numbers. Stocking densities of 100DSE per hectare and higher are manageable provided paddock numbers and resting periods are carefully determined.

Dairy farmers have used strip grazing as an efficient grazing strategy for decades. The use of electric tape is effective and animals quickly adapt to the system.

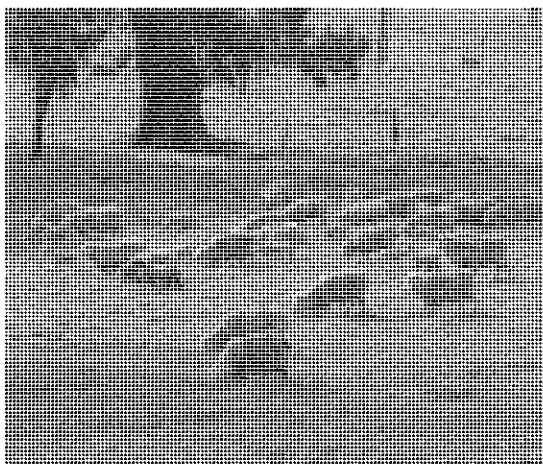


Figure 69. High stocking densities are required for intensive rotational grazing

Speeding up the rotation when growth is rapid is important to ensure pasture can be maintained in the vegetative state with plenty of leafy grasses and a high legume content.

During spring some paddocks will need to be dropped out of the rotation and used for silage or hay production if they cannot be kept to below 14 cm in height. Avoid grazing pastures lower than 4 cm if using this system, and monitor pastures to avoid overgrazing.

12.4 Supplementary feeding

The usual spring flush results in extra pasture growth which can be conserved as fodder in the form of hay or silage.

Silage is made from green pasture or fodder crops and is cut earlier than normal hay. The plant material is preserved by a process of bacterial fermentation where sugars are converted to lactic acid. This usually takes about two weeks.

Traditionally silage was placed in large heaps on the ground and rolled by a tractor to push out all the air, then covered by a plastic sheet held down by recycled tyres. However, storing silage as individual bales has become more popular (see Figure 71). In this case pastures are cut when plant dry matter is around 60 to 70%. The bales are wrapped tightly in plastic wrappers to exclude oxygen, and the material then goes through a limited fermentation.

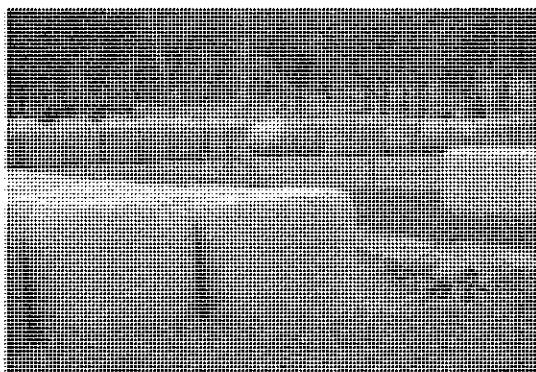


Figure 71. Silage conserved as summer feed

Feeding out hay or silage to livestock when paddock feed is low will help to support all grazing strategies and help match feed requirements with feed supply.

If fodder has to be purchased the benefits will need to be weighed against the costs.

Matching livestock numbers with available paddock feed and fodder cut from the property, will help to avoid baring out paddocks in summer and autumn. However, in particularly dry seasons, or in times of drought, confinement paddocks may need to be considered to avoid damage to pastures and possible erosion.

12.5 Confinement paddocks

Confining livestock to a single paddock, sometimes referred to as a 'sacrifice paddock', is a drought feeding strategy where animals

receive supplementary feed while ground cover and land condition is preserved across the majority of the property.

This paddock should be well fenced and provide animals with adequate room, water, feed, and shelter from wind and sun. In addition, manure management will need to be considered in line with Environmental Protection Agency requirements. The site chosen for a sacrificial paddock should have a low erosion risk, be at least 50 metres from any watercourse (wet or dry) and have a slope of no more than 8%. A sacrificial paddock should not be used more than two years in five. Monitoring the condition of all stock is important when hand feeding.

Feed ration tables are available for all classes of livestock to assist landholders maintain stock in appropriate condition. Visit: www.dpi.nsw.gov.au/animals-and-livestock for more detail.

Daily water requirements should be based upon peak consumption at all times (Table 20).

Table 20. Livestock daily water requirements

Source: Agriculture Victoria, formerly Victorian Department of Primary Industries 2007

Animal Class	Minimum water requirement (litres per day)	Maximum water requirement (litres per day)
Sheep		
Lactating ewes on dry feed	9	13.5
Medium ewes on dry pastures	7	10.5
Medium ewes on green pastures	3.5	4.5
Wethers/lambs on dry pasture	2.2	3
Wethers/lambs on green pasture	1.1	1.1
Cattle		
Dairy cows in milk	70	200
Dairy cows - dry	45	140
Adult beef cattle	45	140
Calves	25	110
Horses		
Working	55	110
Greening	35	45
Pigs		
Breeding sows	32	40
Finishing sows	18	18

Table 20. continued

Stocking rate (cows/ha)	Estimated carrying capacity (cows/ha)	Estimated carrying capacity (cows/ha)
Alpacas		
Medium adult	6.5	7.0
Large adult	10.0	12.0
Poultry	(1000/1000000)	(1000/1000000)
Laying hens	12	14
Brooding hens	18	22
Turkeys	15	18

12.6 Grazing to manage pasture species

Most perennial grass based pastures should not have to be re-sown unless they become degraded for some reason, which can sometimes be the result of poor management. Landholders should be especially careful during flowering and seed set, and during establishment because pastures are particularly vulnerable to overgrazing at these stages.

Grazing undesirable species to prevent seed set, or resting desirable species to encourage seed production are two key strategies to maintain pasture quality.

Perennial ryegrass is a common pasture grass used in high rainfall areas of this region. Its persistence depends on how it is grazed during spring. Allowing ryegrass to flower and set seed during spring and summer will increase the density of a stand of perennial ryegrass. Significantly more new tillers are produced from plants which have flowered than those kept in a vegetative state by grazing. In addition further seed will germinate in autumn to help thicken up the pasture. So resting these pastures occasionally will have noticeable benefits.

For newly established phalaris and cocksfoot pastures it is important to allow seed set before grazing.

Inexperienced landholders should seek independent professional advice to ensure their grazing strategy is appropriate for the pasture species mix on the property.

12.7 Grazing native pastures

Some of the common native grasses found in the Adelaide and Mount Lofty Ranges region include:

- weeping grass (*Microlaena stipoides*)
- wallaby grass (*Rytidosperma* spp.)
- kangaroo grass (*Themeda triandra*)
- windmill grass (*Chloris truncata*)
- spear grass (*Austrostipa* spp.)
- brush wire-grass (*Aristida* spp.)
- black-head grass (*Enneapogon nigricans*)
- tussock grasses (*Poa* spp.).

Wallaby grass and weeping rice grass in particular are regarded as significant pasture species and should be carefully grazed to ensure long term production. (Refer to Chapter 7 for identification).

Native grass pastures should be rotationally grazed or stocked at low rates to maintain productivity.



Figure 72. Productive wallaby grass pasture, Meadows

After the autumn break defer grazing for 6 to 8 weeks to allow the native plants to grow and become competitive. In spring grazing pressure can be increased which will encourage shorter species such as wallaby grass, and help to reduce competition from annual grasses. Once seed heads emerge reduce the grazing pressure or defer grazing to encourage seed production.

While low levels of phosphorus will be beneficial for some native pastures, for example, wallaby grass and weeping rice grass, others such as kangaroo grass will not respond as well. Applying 0.5 kg P/DSE/ha to a responsive native grass pasture should promote significant pasture growth.

Legumes, in particular clover, can be an important component of native grass pastures provided that they do not exceed more than 20%. Values higher than this can lead to excess nitrogen resulting in more weeds and less native grass.

13. Soil conservation

13.1 Soil erosion

Soil erosion events can be significant. A loss of 1 mm of topsoil represents 10 to 12 tonnes per hectare, with the loss of approximately 10 kg/Ha of nitrogen and 2 kg/Ha of phosphorus.

Large tracks of primary production land can be lost due to gully erosion (Figure 73), while silt in watercourses and dams can damage aquatic habitats and interfere with the respiration of fish and other biota.

Furthermore the functioning dynamics of a watercourse can be dramatically changed to the point where specific plants become a problem. Bulrushes (*Typha* spp.) thrive and spread rapidly in shallow water caused by siltation.

Silt in water supplies can also damage infrastructure, slow flow rates and reduce water quality.

(a) Cereal cropping areas (rainfall <450 mm p.a.)

Light sandy soils in particular are very susceptible to both wind and water erosion once the surface is loose, whether by cultivation or grazing animals.

The keys to minimising the risk of erosion are:

- maintain adequate surface cover of native vegetation, pasture or stubble (Table 21)
- minimise the time that cultivated land is exposed and without cover
- use conservation farming practices (i.e. no-till and stubble retention)
- fence off sand dunes and permanently stabilise by planting perennial vegetation
- establish windbreaks to reduce surface velocity and reduce the erosive forces of the wind
- construct contour banks in cereal paddocks with 4% to 12% slope to reduce the risk of water erosion.



Figure 73. Severe gully erosion on prime agricultural land



Figure 74. Grain legume stubble

Grain legume stubble is far less effective than cereal stubble in holding soil together and is easily blown away. Careful management is required.

Maintaining surface cover is particularly important in cereal growing areas of the region. In the past it was common practice, once the grain was harvested, for livestock to graze the remaining stubble. In some cases insufficient cover was left resulting in disturbed soil being blown, or washed away. A better understanding of soil conservation practices, coupled with a move to continuous cropping, has now resulted in stubble being retained to reduce the risk of erosion.

Light soils on steeper slopes pose the highest risk, while heavier soils on flat land have a much lower erosion risk.

Table 21. Surface cover needed to protect soil from wind and water erosion in cropping land

Source: Fact sheet 89, DWLBC 2008

Erosion	Minimum vegetative surface cover		Desirable vegetative surface cover	
	%	tonnes/ha	%	tonnes/ha
Wind				
Loam	15	0.5	35	1.0
Sandy loam	20	0.6	50	1.5
Sand	50	1.5	70	2.5
Water				
Level land	60	2.0	75	3.0
Sloping land	75	3.0	85	4.0



Figure 75. Light textured sandy soils are vulnerable to erosion if cover is insufficient

(b) High rainfall areas (>450 mm p.a.)

High rainfall areas of the Adelaide and Mount Lofty Ranges are at risk of water erosion if land management practices are not appropriate.

To reduce the likelihood of erosion:

- aim for 100% cover, but do not let this fall below 70% at all times
- do not overstock
- adopt appropriate grazing management strategies
- avoid cultivation of steep land
- direct drill new pastures
- stabilise watercourses by planting appropriate native vegetation.



Figure 76. Erosion due to overstocking

13.2 Pasture ground cover

Maintaining adequate ground cover is an important consideration when managing a grazing property. Soil erosion is often the result of insufficient ground cover. (Figure 77).

Variations in seasonal rainfall, stock numbers and pasture type will impact on how much cover there is at any one time, however, landholders have a responsibility to ensure that paddocks are not overgrazed to the point where soil erosion occurs.

Apart from any environmental considerations, it is important to avoid bare soil because in most cases this will result in weed infested pastures and low feed production (Figure 80).

The best form of ground cover is dense pasture, however, living or dead plants also provide ground cover along with any parts that fall ground, such as leaves, stalks, seed pods (Figure 78). Pebbles and rocks, mosses, lichens and fungi also protect soil.

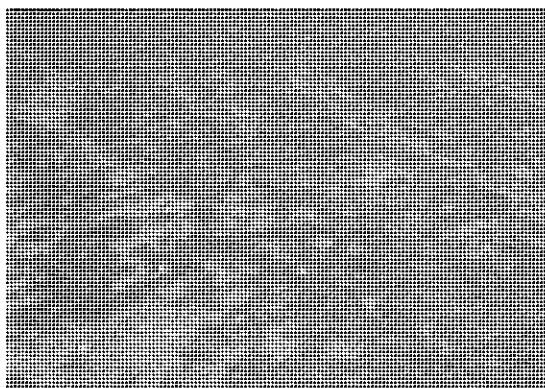


Figure 77. Erosion caused by insufficient ground cover



Figure 78. Ground cover includes leaf litter which protects soil

In cereal growing areas cover is provided by crops and the stubble that remains after harvest.

Maintaining adequate ground cover on pasture paddocks will:

- help to prevent water erosion
- reduce the risk of wind erosion
- moderate the temperature on the soil surface and help to reduce evaporation
- provide food for livestock
- aid recycling of nutrients as plant products decompose and return nutrients to the soil.

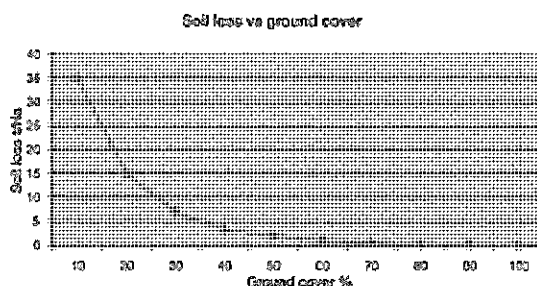


Figure 79. Relationship between ground cover % and average annual soil loss (t/ha)

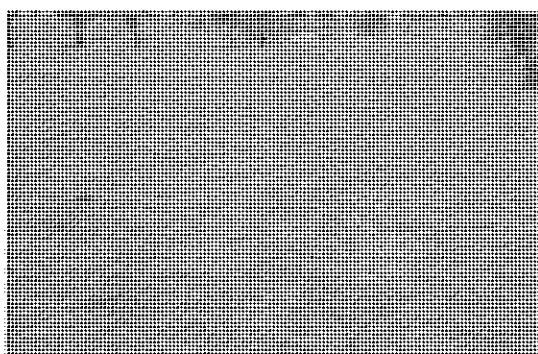


Figure 80. Severe overgrazing promotes weeds and soil loss

13.3 How much ground cover is sufficient?

In farming situations in particular, the amount of ground cover can vary considerably throughout a year and is dependent on a range of factors including:

Plant type – plants have different growth habits and can be annuals or perennials. Perennial pasture grasses (introduced or native) are ideal to hold soil together, while the stubble of annual cereal crops can provide soil protection for up to 12 months. On the other hand, grain legume stubble will rapidly break down and expose soil to wind and rain thereby increasing the risk of erosion.

Growth rates – soil moisture, fertility levels and seasonal conditions all affect plant growth.

Land management – grazing, cropping and fire management practices have a major impact on ground cover levels. In vulnerable cereal growing areas of the region, no-till farming practices, along with stubble retention, is now an established conservation practice.

Soil type, slope and intensity of rainfall play an important part in determining the potential for erosion to occur. To reduce the risk of this form of land degradation, adequate ground cover levels should be maintained. 100% ground cover, of at least 3 cm in height, is ideal. However, this is not always possible, especially during a long hot dry summer, consequently a figure of 70% ground cover throughout the driest seasons is often used to provide an absolute minimum benchmark. During winter and spring landholders should aim for total cover.

Benchmarks for pasture:

Extremely poor levels of ground cover

In all cases the cause was overgrazing due to poor management. The risk of erosion is high to very high for an average rainfall event.

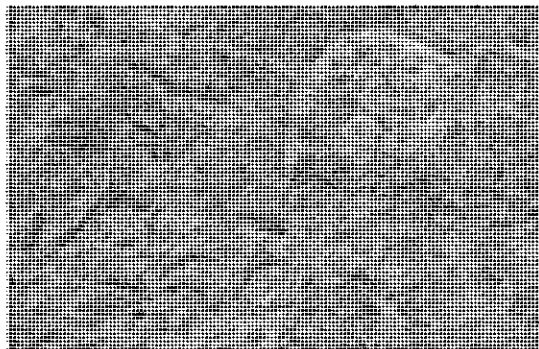


Figure 81. Ground cover 5% in winter

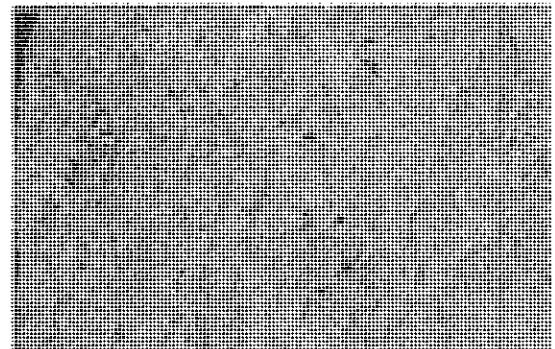


Figure 82. Ground cover 20% in summer

Insufficient ground cover

In all cases the cause was overgrazing due to poor management. There is a high risk of erosion for an average rainfall event.

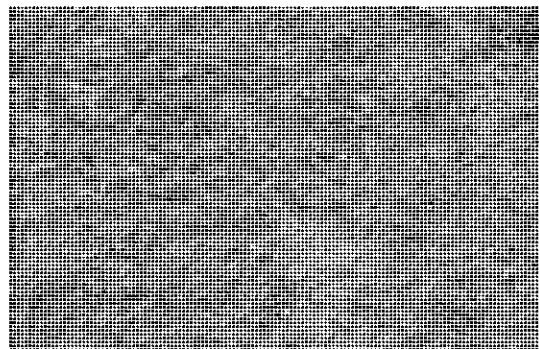


Figure 83. Ground cover 50% in winter

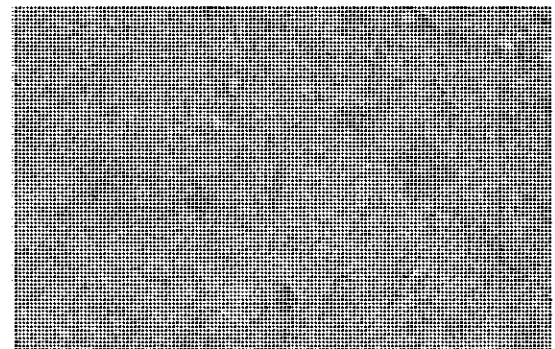


Figure 84. Ground cover 50% in summer

Marginal ground cover

The following photographs are examples of a minimum 70% ground cover. There is still a risk of erosion with an average rainfall event.

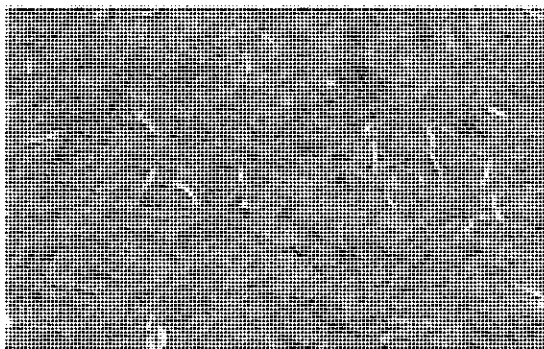


Figure 85. Ground cover 70% in autumn

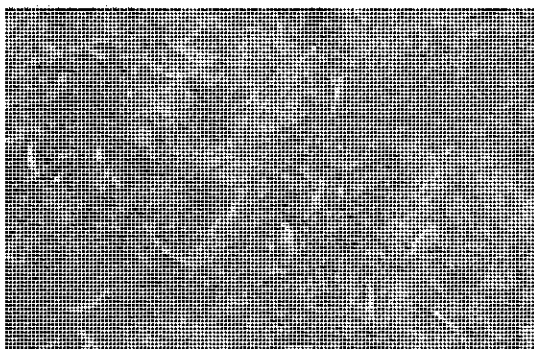


Figure 86. Ground cover 70% in summer

Sufficient ground cover

The risk of erosion is low.

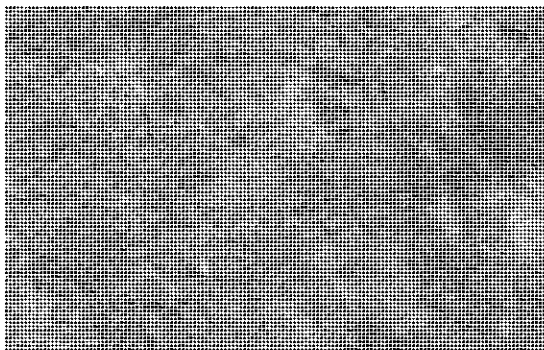


Figure 87. Ground cover 80% in autumn

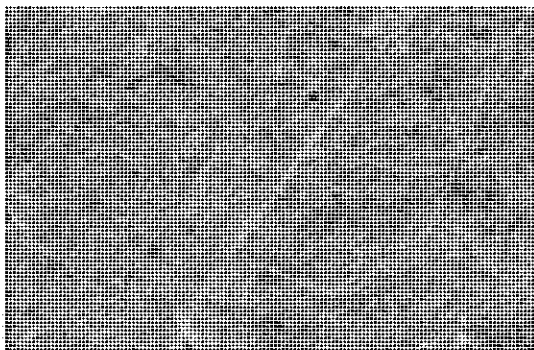


Figure 88. Ground cover 80% in summer

Optimum ground cover

Erosion is unlikely.

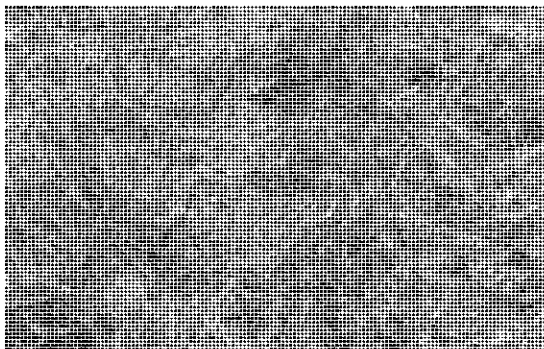


Figure 89. Ground cover 100% in summer

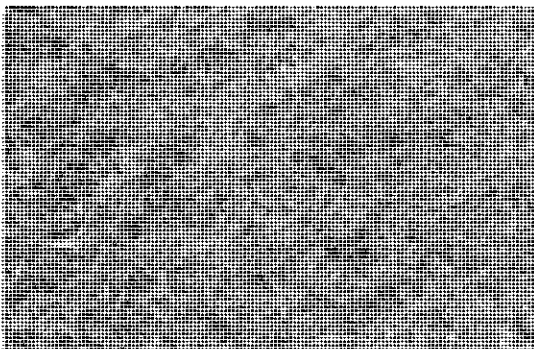


Figure 90. Ground cover 100% in spring

When assessing the percentage ground cover for the situations above, all surface cover was considered, provided it contributed to protecting the soil from an intense rainfall event. This included dead annual plants, plant stalks, leaves, twigs, pebbles and dung. Consequently some percentage values may appear to be overestimated on initial viewing.

13.4 Improving soil structure

Structure refers to the way that soil particles (sand, silt and clay) clump together into aggregates. A well-structured soil relies on the formation of small soil aggregates which remain stable when wet and contain pore spaces which allow water and air to penetrate (Figure 5 in section 4.3).

Soil structure is generally a product of inherent soil characteristics. However, land management practices, such as continuous cultivation, can contribute to the destruction of good soil aggregates.

Most soils will benefit from the addition of organic matter, which not only encourages good aggregation, but also releases nutrients to assist plant growth, and improves water holding capacity. The structure of some heavy clay soils may also be improved by the addition of gypsum (calcium sulphate) which helps soil particles to aggregate.

14. Property management planning

Property management planning is a process supporting sustainable land management which considers the personal goals of landholders, environmental issues and economic returns. Good management can lift productivity and at the same time improve the condition of natural resources.

Developing a property management plan will assist landholders to:

- identify clear goals
- solve problems
- budget
- allocate time.

Most properties contain a range of soil types, topographical features, each with individual productive potential and management needs, so landholders will need to apply some form of classification when conducting an initial assessment of the characteristics of the property. This classification system is known as land capability.



Figure 91. Slope plays an important part in how land is managed within its capability

14.1 Land capability

Land capability describes the ability of the land to accept a type and intensity of use with minimal risk of damage to the soil. Understanding land capability is at the core of responsible land management and land use. Land use decisions should only be made on the basis of adequate information about the land itself.

Land capability is based on the physical attributes of the land which is called land quality. A range of limitations (potential for land degradation) exist for different land qualities, which will influence land use. These include:

- water erosion – steep slopes create a high potential for degradation if soil cover is not adequate
- wind erosion – deep sandy soils in low rainfall cropping areas have the potential to erode, particularly with intense rainfall events
- soil acidity – highly acidic soils have the potential to reduce productivity



Figure 92. Steep land cleared of native vegetation has resulted in severe gully erosion

- water absorption – some low lying areas may become waterlogged in the wetter months and will reduce the amount of land available to stock; others are highly water repellent and can affect the quality of pasture, crop and horticultural production
- rockiness – the degree of stoniness will affect the purpose to which the land can be used, particularly where machinery is involved

- inherent fertility – some soils are poorer in nutrients than others. While nutrients can be added to soil, it is important to decide whether the cost of fertiliser outweighs the value of the enterprise as a whole.

An assessment of all the attributes of the land will decide its limitations. These limitations can then be used to assign the land to particular 'land classes' (Table 22).

Table 22. Generalised land class definitions

Land class	Land description
1	Land with little risk of degradation and able to support a wide range of uses. Suitable for all types of agricultural production on a permanent basis.
2	Land with some risk of degradation but suitable to support a wide range of uses. Some conservation practices required if used for cropping, e.g. broad rotation and/or some special cultivation practices.
3	Land with moderate risk of degradation. Special conservation practices required if used for cropping.
4	Land with moderately severe risk of degradation. Regular cropping would contribute an unacceptable risk.
5	Land with little risk of degradation but unsuitable for cropping because of soil, topography, climate or safety. Suitable for cultivation associated with pasture development.
6	Land with severe risk of degradation. Suitable for grazing but good management needed to prevent degradation. Specialised management is necessary for establishment of improved pasture.
7	Land with very severe risk of degradation. Suitable for controlled grazing. Good vegetation cover essential for protection of the land.
8	Land incapable of sustaining any form of agricultural production.

Individual properties can have a range of land classes which will place limitations on how the land is managed.

Steep slopes have the potential to create severe water erosion if sufficient ground cover is not maintained. Cropping land is particularly vulnerable. In high rainfall areas, extreme slopes which prohibit the use of machinery and are dangerous to livestock, should be reserved for native vegetation.

Rockiness reduces the ability to use machinery and can indicate a shallow soil depth rendering the land unsuitable for improved pasture or perennial horticulture (Figure 93). Rocky areas which have little agricultural value can be fenced off and revegetated.



Figure 93. Rocks severely limit land capability

Watercourses are fragile ecosystems which can be severely degraded by livestock. Water quality and biodiversity assets decline under these circumstances, so all watercourses (including dams) should be fenced off from livestock. Rehabilitation of degraded watercourses is an important process which contributes to the improvement of our natural resources.

Deep sand dunes are at risk of eroding if used for agricultural purposes. This land should be fenced off from stock and stabilised with appropriate native vegetation, or cereals such as cereal rye or triticale. Perennial veldt grass has the capacity to stabilise these dunes, however it can become invasive if not controlled.

Land class system for grazing

Using a simplified land capability approach for particular enterprises can be used as an alternative to the more complex eight-class system. For example, grazing can use a three class system (Table 23).

Table 23. Simplified land class system for grazing on small properties

Land class	Description
All year grazing areas	Grass to moderate slopes, well drained, fertile to clayey soils. All year season can be grazed. Suitable for any type of stock. Vegetation is well established and is not overstocked or overgrazed.
Prohibited areas	Grass to moderate slopes, well drained, clayey soils, heavy, shallow and/or poorly drained soils. Stock is restricted during the year when certain areas are overgrazed or waterlogged. Vegetation is not in good condition.
Prohibited areas	Extreme slopes, areas affected by erosion, flooding, salinity, waterlogging, or other vegetation cover is too sparse.

The 'prohibited areas' classification needs to be considered when assessing stocking rates and the type of management required. Identifying whether your property has any limitations (such as waterlogging, extreme slopes or rockiness) will enable the property owner to achieve a more realistic assessment of the amount of grazing land available. Allowing stock to graze waterlogged land will damage soil and pasture.

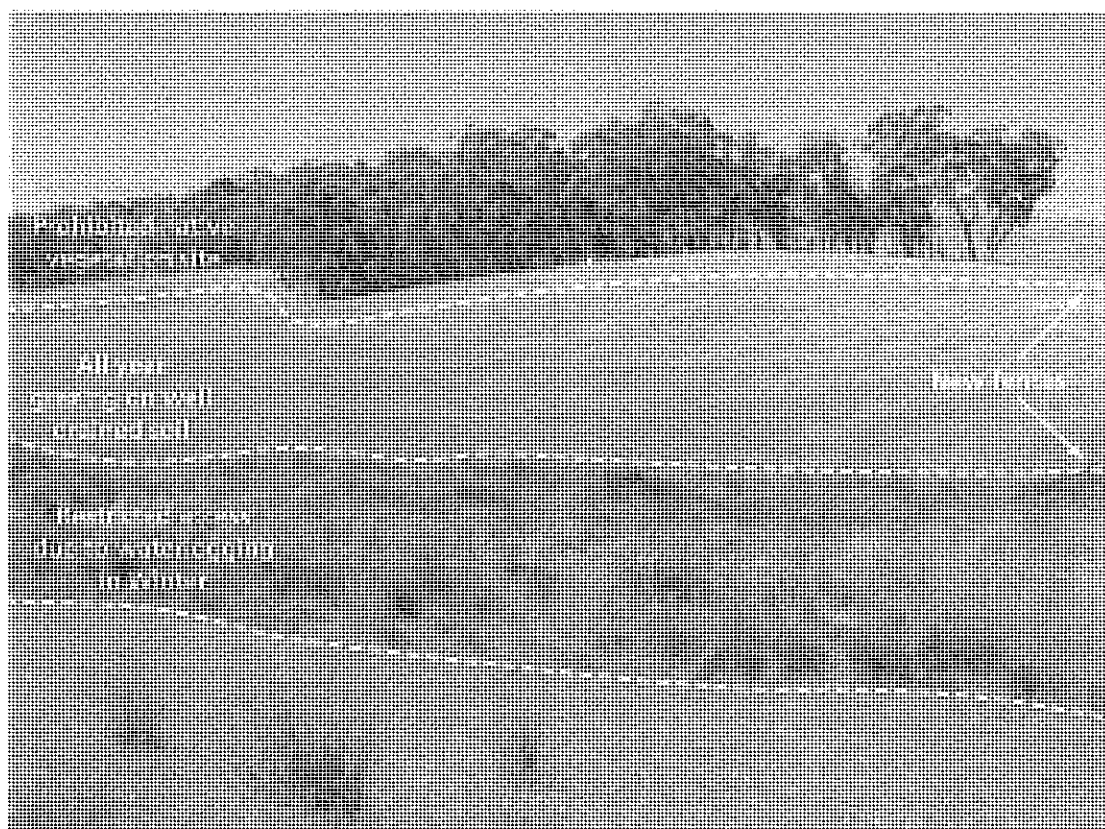


Figure 94. Grazing areas should be fenced off from different land classes such as native vegetation and waterlogged areas

14.2 Mapping land classes

Why map land classes?

1. Show where you can or cannot graze.
2. Allows fencing to land class which separates productive areas from non-productive areas.
3. Separating areas enables a more accurate assessment of carrying capacity.
4. Determines the area available for grazing.
5. Shows limitations for other enterprises e.g.
 - Vines: need well drained soils and avoid frosts.
 - Farm forestry: maximum slope of 35%.
 - Cropping: avoid land over 12% slope.
 - Grazing: avoid waterlogged soils.
 - Strawberries: avoid saline soils.
 - Phalaris: highly acidic soils can cause aluminium toxicity.

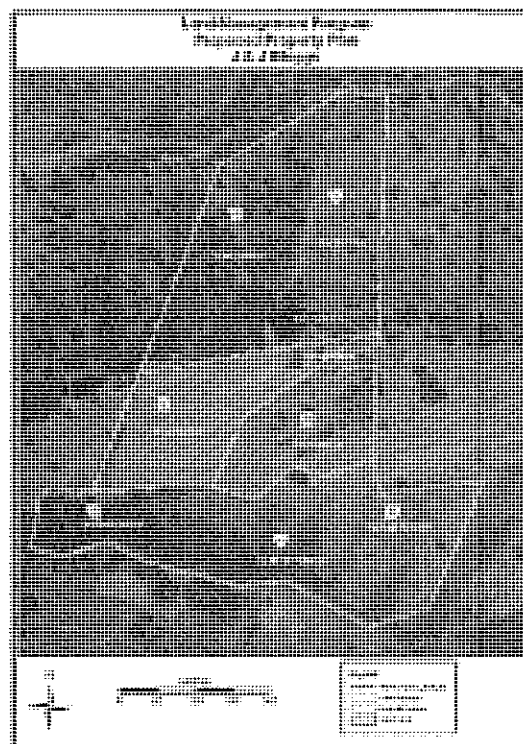


Figure 95. Land class mapping

14.3 Four steps to develop a successful property plan

Step 1 – Identify your goals and visions

Having a clear vision for your property is important if you are to achieve your hopes and aspirations. You will need to consider goals for:

- the property and its resources
- the business
- your family
- your lifestyle.

For most small property owners' lifestyle counts for a lot, however, particular enterprises can be a source of income if managed effectively. Whatever your priorities, appropriate management is critical to maximise your land's potential, or minimise any negative impacts on your resources.

Step 2 – Assess the natural resources of your property

To write a property plan effectively, you will need to gather information about the property.

This includes:

- natural resources – soil type, rainfall, native vegetation, water quality, water quantity
- physical geography – slope, rocky outcrops, drainage lines
- limitations of the property – waterlogging, weeds, erosion, salinity
- financial and human resources – what are the requirements of the enterprises to be run? Do these match the attributes of the property?

It is important to understand that the property assessment cannot be done in a short period of time. Landholders need to observe how the property reacts to weather events and seasons (dry, wet, prevailing winds, frost etc.).

Obtaining an aerial photograph of the property (Figure 96) will help by providing an overview of the existing layout, topography, native vegetation and watercourses. Land classes and existing infrastructure can be drawn on a clear overlay.



Figure 96. An aerial photograph will provide an overview of your property

Landholders can obtain an aerial photograph from a range of sources including:

- the internet
 - Google Earth: <http://maps.google.com.au/>
 - Nearmap: www.nearmap.com.au
- private businesses
- Mapland: www.environment.sa.gov.au/Science/mapland.

Step 3 – Develop the plan

Using a series of clear overlays will enable a realistic plan to be drawn up (Figure 97).

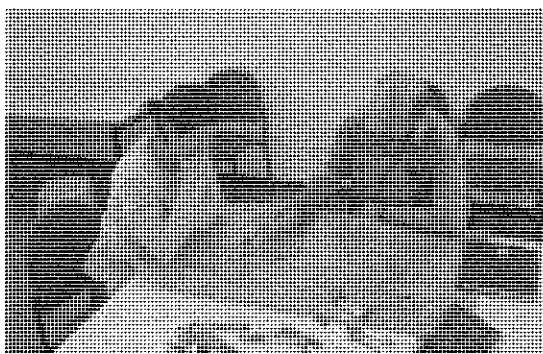


Figure 97. Overlays are used to draw up a realistic plan

Overlay 1 includes all the physical and permanent features of the property which will impact on its management (i.e. saline sites, rocky areas, steep slopes, native vegetation and watercourses etc.).

Overlay 2 includes the existing layout of the property (including fences, stock troughs, raceways, etc.).

Overlay 3 is the realistic plan based upon best practice land management principles and includes future plans such as new fence lines, revegetation areas or permanent structures.

The following should be considered when drawing up your realistic farm plan:

- location of the house
- location of sheds and yards
- location and types of fences
- water resources including stock watering points
- trees and vegetation
- surface water management
- names or numbers of paddocks
- raceways
- number and types of enterprises
- new fences
- livestock movement plan.

Step 4 – Write a detailed action plan

The success of any property management plan will depend upon the amount of resources needed to implement the changes. Most landholders will be limited by time, money and technical knowledge, so a feasible action plan should be drawn up which includes appropriate management strategies to accomplish specific tasks.

The action plan will need to address the following:

- prioritising issues
- location or area
- desired outcomes
- management strategies
- costs
- practical actions
- start and completion dates
- monitoring and evaluation.

14.4 Other planning considerations

Property management planning should lead to improvements in farm design which may result in a number of changes to infrastructure.

Fences

Horse properties

A permanent conventional fence of ringlock and three plain wires would be appropriate as a boundary fence to keep horses in and other animals out. Height should be approximately 1.4 metres. The top wire can be a sighter wire. To reduce the impact of horses damaging their hooves in the netting, a single electric offset wire is often used (Figure 98). Alternative horse fencing such as 'post and rail' is another possibility although for some people the cost is prohibitive.

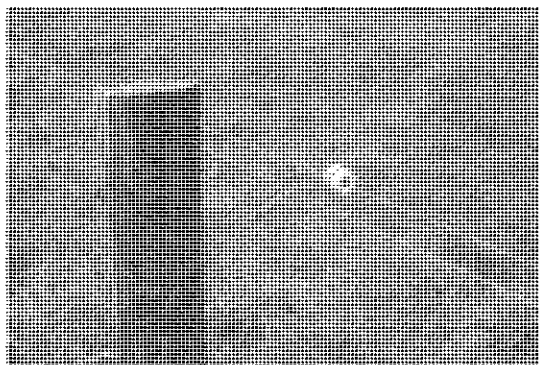


Figure 98. A single offset electric wire can be used to keep horses well away from ringlock fencing

Painting them can also create time consuming maintenance issues. Barbed wire is likely to injure horses or damage horse rugs, and so should not be used.

Internal electric fences are less expensive than permanent conventional fences, but are very effective. Four or five wire electric with a top sighter wire is usually appropriate.

For temporary fences the use of electro-braid or tape is equally effective and can be correctly located in the paddock by using simple tread-ins.

There is a huge range of fences for horses so good research is recommended to decide on the most suitable fence for your property.

Cattle

Mature cattle are large animals which require adequate fences and yards to be managed appropriately. If the property will only ever run cattle, five or six strands of barbed wire will be adequate to keep cattle in (Figure 99). However, dogs will often penetrate these and can be a nuisance to young calves. If at any time sheep are introduced to the property these fences will be inadequate, especially for young lambs.

Where both sheep and cattle are being managed on the same property, a conventional fence of ringlock and three barbed wires would be appropriate (Figure 100). As a rule electric fences are generally not used for boundary fences, but are ideal as an internal cattle fence (Figure 101).



Figure 99. Six barbed wire boundary or internal fence

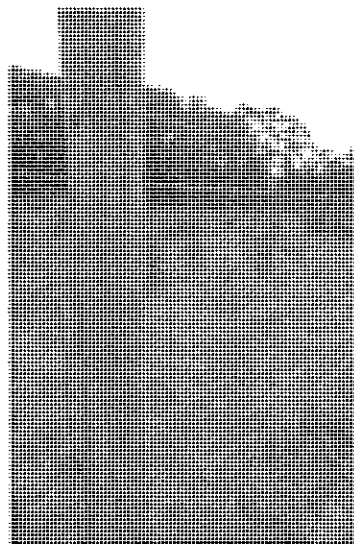


Figure 100. Conventional ringlock and barbed wire boundary or internal fence

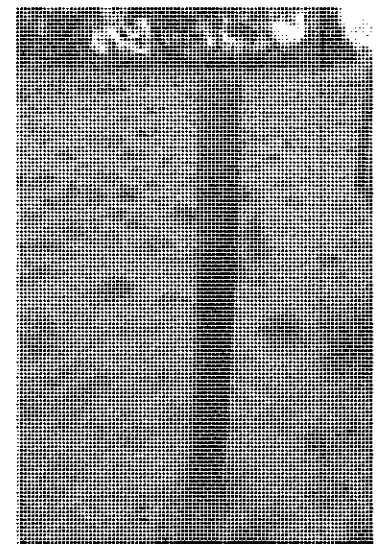


Figure 101. Internal electric fence

Sheep

A boundary fence of ringlock and three plain wires (or barbed) is generally required. It is possible to use internal electric fencing but sheep are well insulated against electric shocks, and so should be introduced to this type of fencing after they are shorn. More strands of wire, usually six to eight are required to effectively hold sheep and lambs compared with cattle. Internal fences of ringlock and three plain wires are more commonly used as internal fences.

Alpacas

Provided adequate paddock feed is available, alpacas will respect fences, and prefer to remain with the herd rather than jump fences. Fencing which is suitable for sheep will also be appropriate for alpacas. Ringlock with three plain wire strands, or five to seven plain wire strands is generally adequate. Electric fencing can work, but is not always recommended since the animals fleece will often insulate them against the shock. Barbed wire is not recommended since it can cause serious injuries.

Yards

Placement of yards is an important consideration when re-designing a property. Yards need to be situated where large trucks can manoeuvre on solid ground (Figure 102). A flat, well drained area will avoid a quagmire during the wetter months of winter. If constructing a new yard it is well worth a few hours research to ensure that the facility meets your requirements and does not represent a danger to people or livestock.

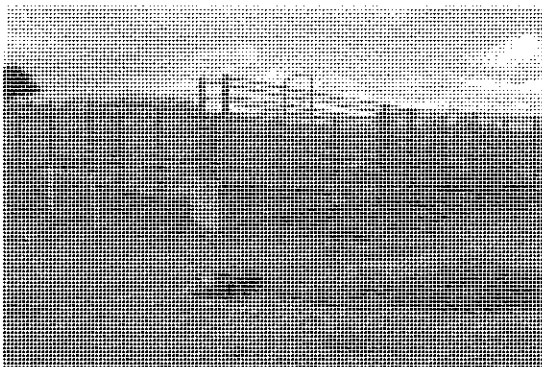


Figure 102. Well-constructed cattle yards with road access

Stock water

Ideally dams and watercourses should be fenced off from livestock which will no longer be able to access water directly from these sources.

A reticulated watering system (Figure 103) is generally accepted as the most efficient way to provide stock water. This system relies on water from dams (or bores) being pumped to a header tank which then allows water to flow through underground polypipe, by the force of gravity, into stock troughs strategically placed in each paddock. A series of pressure valves and ball floats will ensure that water troughs are always full. However, these should be checked regularly to avoid any problems. Water trough should be placed on higher well drained ground away from fences and 'at risk' areas of the paddock.

And where possible these troughs should be placed adjacent to shade trees. They should not be placed through a fence, which tends to encourage bare areas susceptible to erosion.

There are many types and sizes of water troughs. Whether landholders use troughs which are all polyethylene construction, or made of concrete, will depend largely on circumstances and personal preference. Concrete troughs are solid and will resist damage from large animals, especially if the ball float is protected, but they can crack in time and are generally heavy and difficult to move around.

Polyethylene troughs are light and animals are less likely to injure themselves. They can also be shifted easily to provide a short term water supply when creating temporary paddocks.

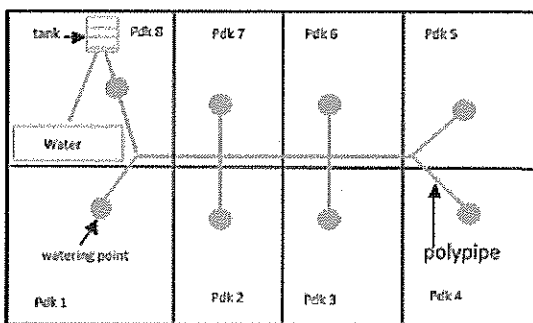


Figure 103. Example of a reticulated watering system

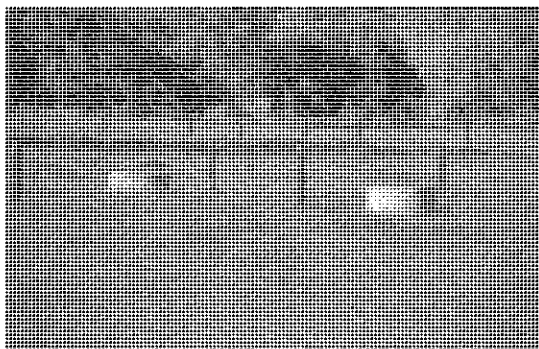


Figure 104. Round concrete troughs are popular on small horse properties

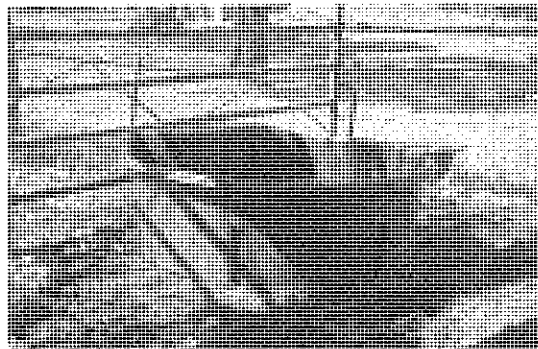


Figure 105. Round polyethylene troughs are light and easily moved

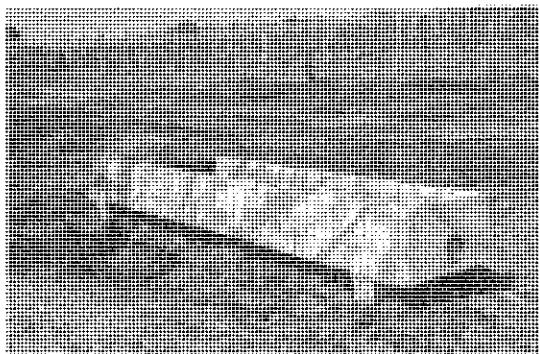


Figure 106. A basic trough suitable for a small flock of up to 300 sheep

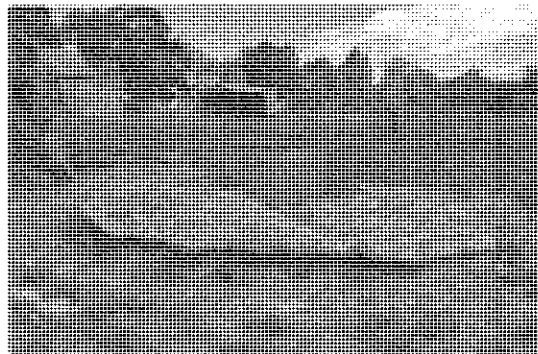


Figure 107. Poorly designed troughs can lead to erosion
Photo: Will Hannaford

In either case, troughs should be deep and large enough to supply the needs of all the animals in the paddock. Round troughs are quite popular for small horse properties since they allow good access by a number of horses at any one time.

Raceways

Raceways can be an efficient way of accessing paddocks. Planning and careful positioning of raceways contribute to safe and easy livestock movement, and moving machinery around the property is less time consuming since fewer gates need to be opened. In the event of fire, livestock can be moved quickly to safer areas, and fire authorities will have better access to deal with any threats caused by bushfires.

Shelterbelts

Livestock require shelter from intense summer sun and severe winter winds. New paddocks may not have adequate shelter, so it may be necessary to erect an artificial shelter from plastic netting or wooden slatting, while newly planted shelterbelts are becoming established. Shelterbelts are a potential fire hazard, so when planning their location, landholders need to assess the risk to property, livestock and family. Species selection can be important in managing this risk.



Figure 108. Shelterbelts provide good protection for livestock

Fire

In planning for fire protection, consider the total property as well as buildings, and consider the situation in relation to known hazards. For example, the proximity of native vegetation. Assess the fire hazard when locating new buildings, hay sheds, water supply points, access tracks, yards, fence lines and livestock. Remember ambient heat from an intense bushfire can kill livestock held in yards. And always prepare a bushfire survival plan.

15. Livestock feed requirements

Using regional stocking rate figures (Chapter 11) is a helpful guide to matching livestock numbers with anticipated annual pasture production each year. However, a much more accurate approach is possible if the dry matter (DM) produced by a pasture can be estimated (or measured) at different times of the year. Seasonal conditions will have a significant influence on dry matter production. For example, an average dryland pasture in the Mount Lofty Ranges may produce 20 kg DM/ha/day during June, but in October this can jump to 50 kg DM/ha/day. Therefore, knowing how much feed is in a paddock will enable landholders to be more precise when determining how many animals can graze a particular paddock, and for how long.

This is referred to as feed budgeting, which allows livestock productivity to be maximised, and helps to ensure enough cover is maintained in paddocks to prevent erosion. How much feed is available for livestock over a particular time period is referred to as 'food on offer' or 'herbage mass'.

15.1 Pasture productivity

Annual rainfall will impact strongly on pasture growth along with the quality of pastures. However, it is important for landholders to recognise that not all pasture growth is consumed by livestock,

therefore pasture utilisation is a better measure of actual productivity from a pasture (Table 24). For intensive strip, or cell grazing, where stocking rates are high, pasture utilisation is likely to be around 60 to 70%. Where stocking rates are average, and a four paddock rotational grazing system operates, this figure is more likely to be 45 to 55%. Utilisation can drop to 25% where set stocking is the only grazing strategy and stocking rates are below the district average.

Table 24. Pasture utilisation (tonnes DM/ha/year) on dairy farms in the Mount Lofty Ranges

	2006-07	2007-08
Poor	1.8 (1.1)	2.8 (1.1)
Average	3.0 (1.4)	3.0 (1.2)
Good	4.5 (1.8)	4.2 (1.5)

Pasture growth will vary according to the seasons of the year with most growth of dryland pastures occurring during spring, while for irrigated pastures this period of high production extends through to summer and early autumn.

Typical Dryland Pasture Growth in the Mt Lofty Ranges

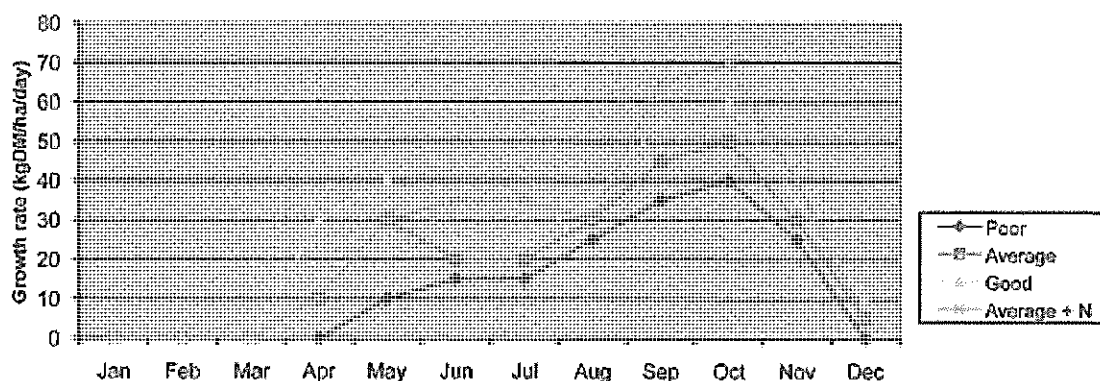


Figure 109. Typical dryland pasture growth in the Mount Lofty Ranges

Typical Pasture Growth for Irrigated Pastures in the Mt Lofty Ranges

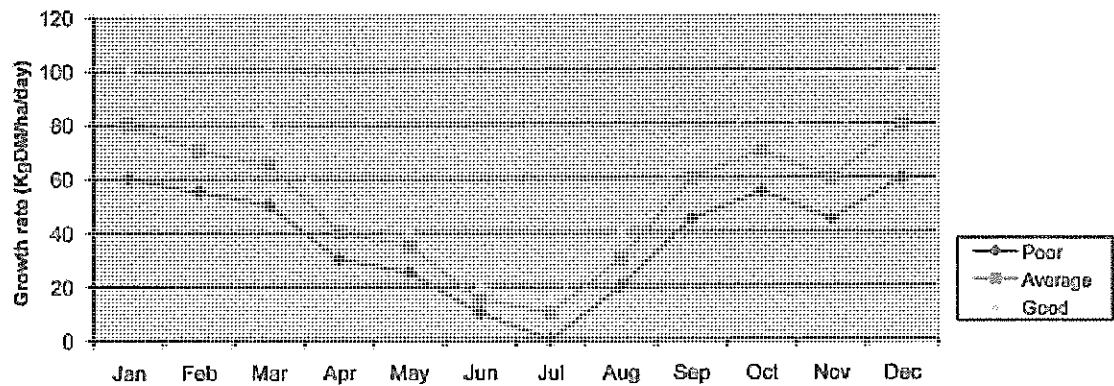


Figure 110. Typical irrigated pasture growth in the Mount Lofty Ranges

15.2 Food on offer (herbage mass)

Pasture availability in a paddock can be determined by:

- visually estimating
- measuring plant height
- cutting, drying and weighing sample quadrants.

The latter method is accurate but time consuming since a number of samples need to be taken from each paddock to be accurate. Visually assessing the paddock is less accurate but quicker, so where pasture heights can be measured the final result can be more reliable (Table 25). Note: 1500 kg of dry matter (DM) per hectare is regarded as the minimum pasture height to maintain good pastures and protect soil from erosion.

Table 25. Generalised relationship between green pasture height and pasture availability

Green Pasture Height (cm)	Pasture Availability (kg DM/ha)
1	500
2	600
3	1100
4	1400
5	1700
6	2100

Estimating pasture availability relies on individuals refining their skills to the point where they can reliably predict herbage mass. Where clover makes up a significant proportion of the pasture, herbage mass tends to be overestimated, when using height alone, while estimating pasture density can be problematic.

Prograze training courses which focus on developing these field techniques are offered to landholders. Enquiries can be made with the Adelaide and Mount Lofty Ranges NRM Board or Meat and Livestock Australia.

Another useful technique is to use photographic benchmarks when assessing herbage mass (food on offer) in the field. The following photographs have taken into account pasture height, legume content and plant density and were sourced courtesy of Primary Industries and Resources SA and the Appila Bundaleer Pasture Group.

Legume grass mixes

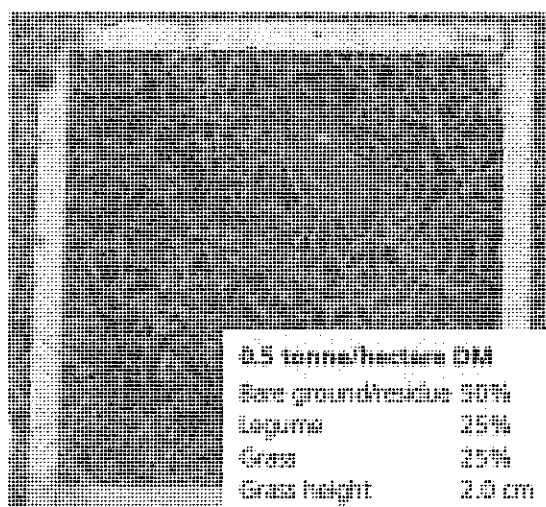


Figure 111. Legume grass pasture showing 0.5 tonne/hectare of dry matter

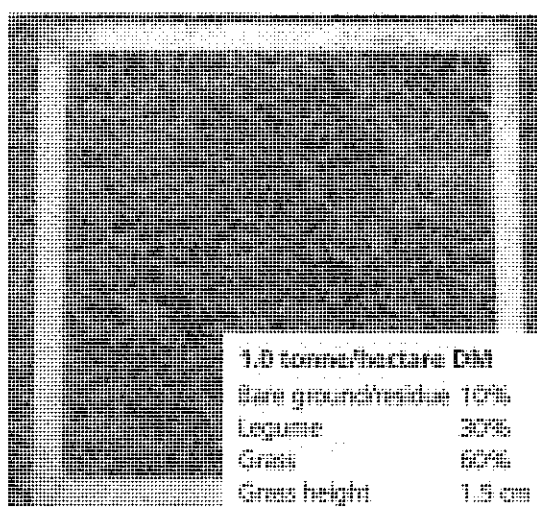


Figure 112. Legume grass pasture showing 1.0 tonne/hectare of dry matter

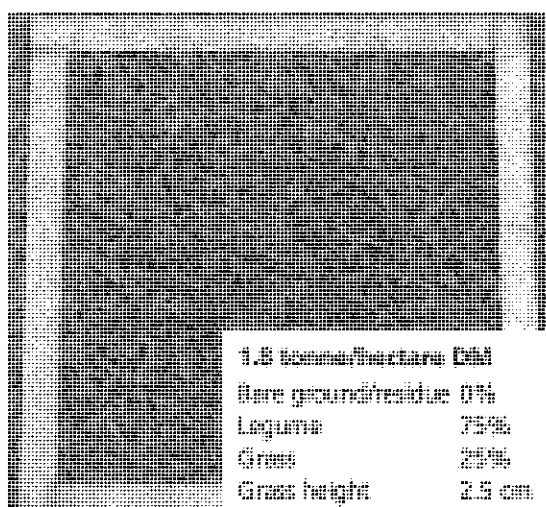


Figure 113. Legume grass pasture showing 1.8 tonnes/hectare of dry matter

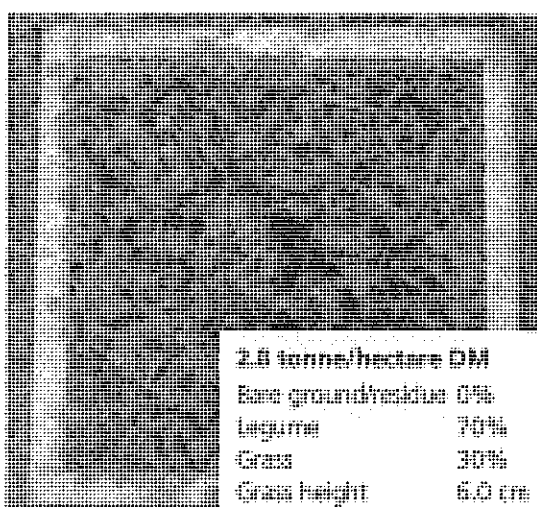


Figure 114. Legume grass pasture showing 2.8 tonnes/hectare of dry matter

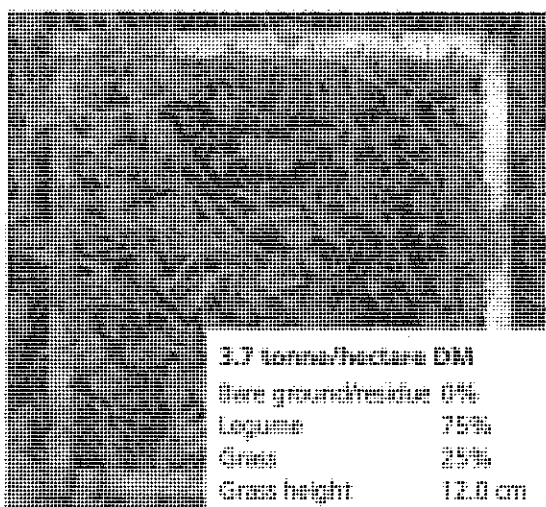


Figure 115. Legume grass pasture showing 3.7 tonnes/hectare of dry matter

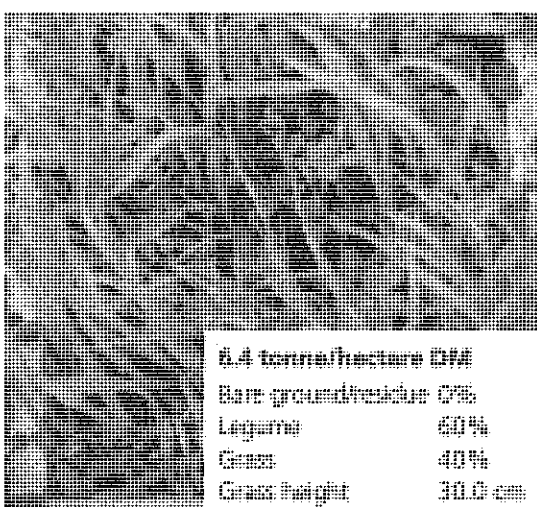


Figure 116. Legume grass pasture showing 6.4 tonnes/hectare of dry matter

15.3 Feed budgeting

Balancing livestock numbers with pasture availability to ensure the nutritional needs of animals are met and paddocks are not overgrazed is a fundamental responsibility of any landholder managing a grazing property.

Observing pastures to ensure paddock feed levels do not fall beyond 1500 kg DM/ha (approximately 4 to 5 cm) during the growing seasons is one way of encouraging efficient pasture re-growth, and avoiding bare ground which can lead to soil erosion. This approach can be very successful provided the stocking rate for the property matches pasture production and fodder is being conserved in spring (hay making).

However, there are situations where simple feed budgeting can be helpful, such as deciding whether to increase livestock numbers or when it may be necessary to sell. The following is an example of a simple feed budget.

How long will a 5 ha paddock last if stocked with 40 yearling steers (weighing 400 kg and gaining 0.5 kg per day), ensuring pasture is kept above a minimum level to meet livestock requirements?

Herbage mass currently in the paddock (use photographs above)	2800 kg DM/ha
Minus required minimum pasture mass	1500 kg DM/ha
Available pasture	1300 kg DM/ha
Daily growth rate of pasture (Table 26)	25 kg DM/ha
Stocking density (40 steers divided by 5 hectares)	8 steers/ha
Daily livestock requirements (Table 28) (9.6 kg dry matter/ha/day × 8 steers/ha + spoilage 15%)	88 kg DM/ha
Net pasture loss (88 kg DM/ha minus 25 kg DM/ha)	63 kg DM/ha
How long will the paddock last? (1300 kg DM/ha divided by 63 kg DM/ha)	21 days

In this example, if livestock are allowed to remain in the paddock for any substantial period after 21 days, paddock feed will fall below 1500 kg/ha dry matter (i.e. approximately 4 to 5 cm in height). As a consequence, not only is the condition of animals likely to decline, but ground cover will become less, and the risk of soil erosion will increase.

Pasture growth rates will vary according to the composition of the pasture, the location and whether they are being irrigated. The following tables provide some generalised figures for daily pasture growth in the Mount Lofty Ranges and Fleurieu Peninsula.

Table 26. Estimated daily dryland pasture growth rate (mid month) kg DM/ha/day for specific pasture types

Pasture type	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
Potential grass and sub clover, relevant to all ranges	0	0	0	10	20	15	15	20	30	40	25	10
Potential grass and sub clover, Burrendi Peninsula (good quality)	0	0	0	10	15	15	15	25	35	50	35	10
Potential grass and sub clover, Burrendi Peninsula (average quality)	0	0	0	10	20	20	20	20	30	40	30	5
Potential grass and sub clover, Burrendi Peninsula (poor quality)	0	0	0	0	15	15	15	25	35	40	25	0

15.4 Energy and protein content of various feeds

While benchmark figures are available for how much to feed particular classes of animals, knowing the energy and protein values of specific types of feed will enable landholders to calculate how much of a particular feed type is required

to meet the all the nutritional requirements of different livestock classes. The cost of feed can then be considered and a more economic approach to supplementary feeding can be adopted.

Table 27. Metabolisable energy and crude protein contents of feeds

Feed	Crude protein (%)	Metabolisable energy (MJ/kg)
Grain hay	90	9.0
Wheat hay	90	8.0
Pasture hay, mature grass	90	8.5
Pasture hay, good quality	90	9.0
Pasture hay, average quality	90	9.0
Pasture hay, poor quality	90	7.0
Lucerne hay	90	9.0
Chow hay	90	9.0
Grass hay	90	9.5
Stage 1 good quality	40	10.0
Dry paddock pasture	90	9.0
Barley grain	100	10.5
Oats grain	90	11.5
Lupin grain	90	11.5
Faba bean grain	90	11.5
Field pea grain	100	11.5
Barley straw (good)	90	6.5
Peanut straw	60	7.0

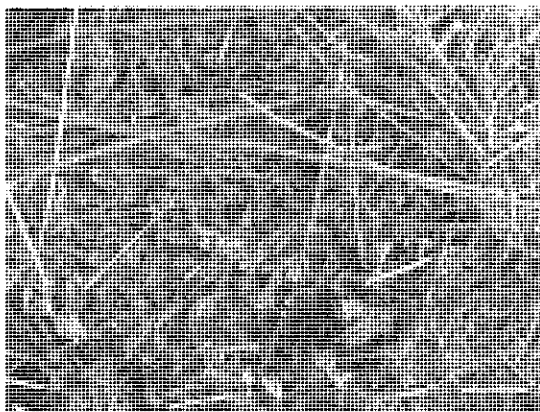


Figure 117. Lucerne Hay
Photo: Will Hannaford

SAMPLE NUMBER E13/011475-001
CLIENT REF [REDACTED]
DESCRIPTION [REDACTED]

Components	Dry Matter	
% Dry Matter	81.7	1
% ME (MJ/kg)	10.4	2
% DMD	89.01	3
% Crude Protein	24.7	4
% Starch	2.3	5
% Water Soluble Carbs	4.6	6
% Acid Detergent Fiber	31.1	7
% Crude Fat	2.2	8
	153	9

Figure 118. Lucerne Hay nutrition
Photo: Will Hannaford

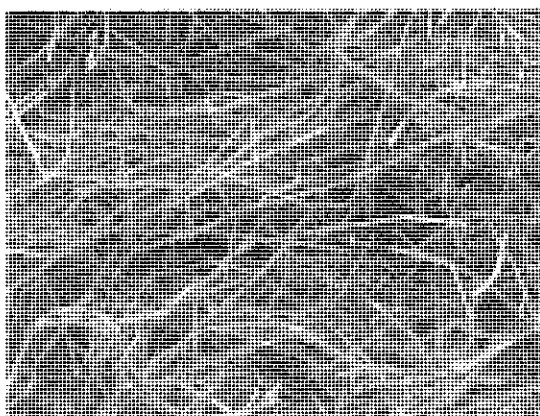


Figure 119. Meadow Hay
Photo: Will Hannaford

SAMPLE NUMBER E13/011541-002
CLIENT REF [REDACTED]
DESCRIPTION [REDACTED]

Components	Dry Matter	
% Dry Matter	81.0	% Ca
% ME (MJ/kg)	9.30	% Ph
% DMD	87.66	% Mn
% Crude Protein	12.4	% P
% Starch	1.4	% S
% Water Soluble Carbs	9.1	% Ch
% Acid Detergent Fiber	40.6	
% Crude Fat	2.7	

Figure 120. Meadow Hay nutrition
Photo: Will Hannaford

The quality of hay can vary significantly, depending on the quality of the pasture and how the cutting and baling process was carried out, so for the inexperienced landholder what seems good feed may well be low in both protein and energy. One way of reducing the risk of purchasing poor quality feed is to conduct a visual assessment of the hay.

Good quality hay should:

- be green in colour – not yellow
- be sweet smelling
- have good legume leaf (avoid too much stalk in lucerne)
- be free of weeds and weed seed heads
- be pliable but not brittle
- have pasture grass seed heads which are flowering, and do not contain mature seed
- have the seeds at the watery ripe stage for cereal oaten hay.

However, if an accurate nutritional value is required hay must be tested in a laboratory. As well as crude protein % and energy MJ/kg DM, dry matter digestibility (DMD) is also measured. Once digestibility (DMD) declines below 65% for lactating stock and 55% for dry stock, then, no matter how much pasture is available, these animals are likely to experience unsatisfactory performance levels, i.e. increasing weight loss.

15.5 Livestock nutritional requirements

Most small farms rely on hay supplements when paddock feed is low, but there are a variety of feed types which can be given to livestock which will provide animals with the necessary daily energy and protein levels. In order to determine how much to feed, the energy and protein requirements for different classes of animals need to be known. The following tables provide some of this information.

Table 28. Energy and protein requirements – sheep and cattle

Category	Energy requirements (MJ/kg liveweight)	Protein requirements (g/kg liveweight)	Protein requirements (g/kg liveweight)
Adult dry sheep 60kg	4.0	8.0	2.0
Adult dry sheep 140kg	4.5	8.0	2.0
Pregnant ewes (last 6 weeks)	5.5	13.0	2.8
Lactating ewes (last 2 months)	10.1	14.0	4.1
Woolshed sheep (140kg)	5.5	15.0	3.8
Dry cows	41.0	8.0	1.8
Lactating cows (last 2 months)	97.0	14.0	3.5
Lactating cows (last 7 months)	101.0	14.0	3.5
Woolshed calves	10.0	15.0	3.5
Steers (200 kg) growing 0.5 kg/day	57.0	10.0	2.5
Steers (400 kg) growing 0.5 kg/day	71.0	7.5	2.4

Table 29. Energy requirements for horses at various levels of work

Category	400kg	450kg	500kg
Maintenance energy requirements (MJ/day)	58.0	65.0	70.0
Additional energy required per hour for:			
Trailing	0.44	1.05	1.38
Shoeing, farrier, some carting	8.3	10.5	12.6
Exercising, carting, some jumping	21.0	26.7	31.4
Carting, packwork, jumping	36.5	45.1	53.6
Strenuous work, pack racing at full speed	65.3	81.6	94.0
Steers (400 kg) growing 0.5 kg/day	71.0	7.5	2.4

Table 30. Daily energy and protein requirements for different categories of horses

Source: 'Grazing and feeding', Agriculture Victoria, formerly Victorian DPI

Category	Energy (MJ/day)	Protein (g/day)	Energy (MJ/day)	Protein (g/day)
Yearling 6 months	400	0.04	61.5	678
	500	0.05	60.2	729
	600	0.06	60.0	805
Yearling 9 months, moderate exercise	400	0.05	64.0	640
	500	0.05	61.8	700
	600	0.05	70.1	850
Yearling 12 months, light exercise	400	0.07	60.7	722
	500	0.05	73.0	800
	600	0.05	80.3	900
Yearling 12 months, moderate exercise	400	0.08	65.3	700
	500	0.08	71.5	850
	600	0.05	85.0	1000

Table 30. continued

Category	Weight (kg)	Protein (g/kg)	Energy (MJ/kg)	Energy (MJ/day)
Weaned (12 months) feed grade	400	0.140	71.5	770
	500	0.145	89.1	950
	600	0.140	105.6	1127
18 months	400	0.15	66.5	710
	500	0.15	82.6	873
	600	0.15	100.00	1077
2 years	400	0.15	64.0	690
	500	0.10	78.7	830
	600	0.10	94.5	999
Maintenance	400		56.1	593
	500		68.8	728
	600		81.7	866
Pregnant (9 months)	400		62.3	654
	500		76.1	801
	600		90.0	947
Pregnant (11 months)	400		67.4	708
	500		82.4	866
	600		97.5	1030
Lactating (lamb) (12 months)	400		92.8	974
	500		118.4	1247
	600		141.0	1471
Lactating (11 months) to weanling	400		63.4	670
	500		80.7	849
	600		100.9	1058

Alpacas consume 2% of their body weight in feed per day and prefer to graze shorter pastures. Ideally the fibre or roughage component of their diets should not fall below 25%.

The energy requirements for alpacas are generally 30% less than those of sheep, because fibre provides a significant amount of additional energy. A dry hembra, or wether, weighing 65 kg requires approximately 7 MJ of energy each day which can be supplied by 1.3 kg of hay each day.

Protein requirements for alpacas are relatively low compared with other animals.

The following protein levels are provided as a guide:

- maintenance 8% to 10% crude protein
- rapid growth from weaning 16% crude protein
- pregnancy and lactation 12% to 14.5% crude protein.

15.6 Livestock feed consumption

A dryland pasture comprised of grasses and legumes will usually provide a balanced diet for livestock while paddock feed is available. However, during the dry seasons of summer and early autumn landholders will usually have to consider supplementary feeding with hays or grains.

When feeding grain, animal health problems can be encountered if grain is not introduced gradually after livestock have been grazing on pasture. If feeding grain to sheep, start with only 50 grams per head per day, increasing to 430 grams per head per day by the 14th day.

Further information on supplementary sheep feeding can be found in *Feeding and managing sheep in dry times*, visit: www.wool.com and search for 'Feeding and managing sheep in dry times'.

Meat and Livestock Australia provide information and feed calculators on the feeding and finishing section of their website: www.mla.com.au and search for 'Feed calculators'.

16. Weed and pest control

16.1 Weed management

Good land management remains the key to controlling most weeds in pastures. There are a number of pasture management techniques which will help to keep weeds from becoming a serious problem.

These include:

- soil testing and adding appropriate fertilisers
- liming acid soils
- rotational grazing
- keeping good ground cover
- over-sowing with perennial grass and clover
- hard grazing in spring to reduce seed set of annual grasses
- rotating hay paddocks to avoid a build-up of annual grasses
- using low toxicity herbicides, if necessary
- integrating biological control measures where possible.

Annual broadleaf pasture weeds (e.g. capeweed, geranium and salvation Jane)

Most landholders think of using herbicides when confronted with paddocks full of capeweed (*Arctotheca calendula*), storksbill (*Erodium* spp.) or salvation Jane (*Echium plantagineum*). Whilst herbicide use is an important tool for controlling these plants, it is only one of the management options available.

If paddocks becomes bare, weed seeds present in the soil are likely to germinate – especially in autumn. Establishing and maintaining a perennial pasture in high rainfall areas will help to combat this problem. Perennial pastures consisting of cocksfoot, phalaris, ryegrass and clover will allow grazing, and provide competition for germinating broad leaf weeds, as well as reduce the reliance on herbicide use.

If using herbicides to control annual broadleaf weeds, spraying should occur early in the season when plants are small and lower rates can be applied. Early spraying encourages more desirable plants to grow without competition from aggressive weeds. Selective herbicides are available to help control these weeds.

A technique known as 'spray-grazing' can be effective in reducing weeds. This involves applying MCPA* or 24D amine and then grazing sheep and cattle at four to five times the normal stocking rate. This is not recommended for horses because it can be detrimental to the health of these animals.

Metsulfuron-methyl can be used to control flowering salvation Jane in early spring.

***Warning:** Do not use products with MCPA (or similar volatile chemicals) before mid-May or after end of August within 1 km of vineyards or horticultural crops etc. since damage to these crop can occur.

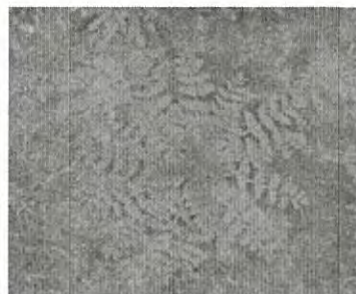


Figure 121. Common annual broadleaf pasture weeds
Capeweed, storksbill and salvation Jane

Biological control can be used as part of an integrated weed management program. In the case of salvation Jane there are four main insects that are the focus of biological control. The crown weevil larvae attack the growing crown of the plant, whilst the root weevil larvae feed on the taproot, effectively 'ring-barking' the root. The flea beetle larvae also attack the primary and secondary roots. The impact of the pollen beetle is to reduce the amount of seed set.

If herbicides need to be used to control particular weeds, it is important that landholders investigate the impact of these chemicals on useful insects. In some circumstances it may be necessary to leave untreated strips so the biological control agents are not wiped out.

For advice on biological control agents and their possible availability, contact your local natural resources centre.

Perennial broadleaf pasture weeds (e.g. catsear and dock)

Perennial broadleaf weeds can be difficult to control. They often have well established roots systems and very effective seed dispersal mechanisms. The light seeds of catsear (*Hypochoeris radicata*), which are distributed by wind, make this a very common weed in high rainfall areas. Dock plants (*Rumex* spp.) generally have a very deep tap root which seeks out sub soil moisture at depth, while the variegated thistle

(*Silybum marianum*) is unlikely to be eaten by stock and so freely sets seed. Good pasture management and improved soil fertility will help to keep these weeds under control, but if herbicides are required, Dicamba/MCPA and Metsulfuron-methyl are effective if sprayed when plants are actively growing. It is important to seek professional advice before selecting and using chemicals, and to ensure label directions are followed.

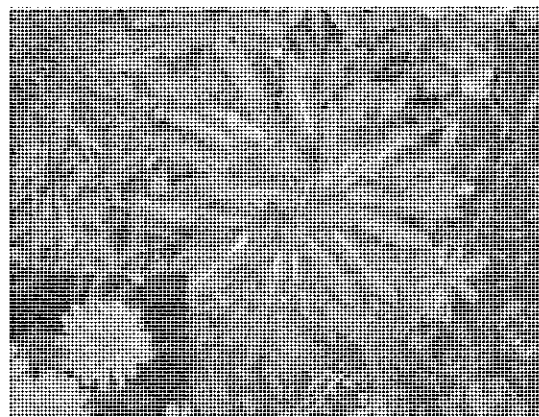
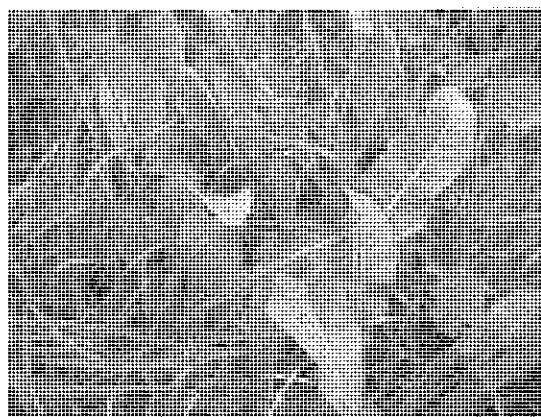


Figure 122. Common perennial broadleaf pasture weeds
Dock and catsear

Bulbous weeds (e.g. guildford grass, cape tulip and watsonia)

Despite its name guildford grass is not a grass. It belongs to the family Iridaceae and is a bulb. Guildford grass (*Romulea rosea*), sometimes referred to as 'onion grass', has long, tough leaves up to 12.5 cm and thrives in low fertility soils found throughout the high rainfall areas of the Mount Lofty Ranges. Landholders may also discover lesser guildford grass (*Romulea minutiflora*) which has a similar distribution.

It has been known to create problems for livestock (especially horses and cattle) when it forms a tough fibrous ball, blocking the animals digestive tract. In some cases this can be fatal.

Poor pasture management, coupled with low fertility soils, encourages the spread of this 'allelopathic' weed, and as a result, pasture growth is suppressed. Studies in Victoria have shown that adding 10–15 kg/Ha of phosphorus, depending on soil type, can prevent it from invading perennial grass/subterranean clover pastures.

Herbicide applications may be necessary where this weed has become dominant. Metsulfuron-methyl applied at 15 g/ha is effective in controlling Guildford grass, provided it is applied in late July. It may be necessary to re-seed pastures in autumn if applying this chemical because it will kill subterranean clover and can damage or kill perennial ryegrass. Professional advice should be sought for particular situations.

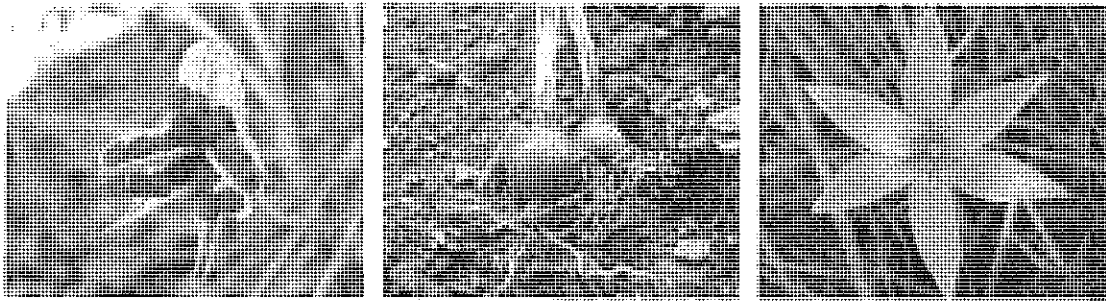


Figure 123. Guildford grass (*Romulea rosea*)
Seeds, bulb and flower (pale to bright pink)

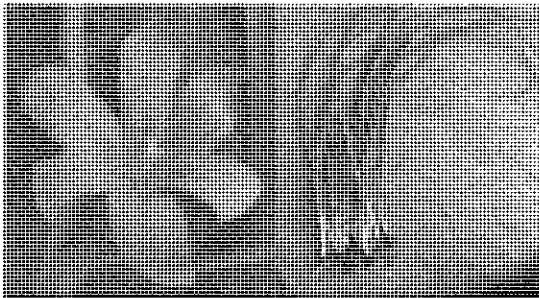


Figure 124. Cape tulip (*Homeris* spp.)



Figure 125. Watsonia (*Watsonia bulbilifera*)

Other bulb weeds include watsonia and cape tulip which can become quite invasive. Digging out the bulbs before they have time to flower can

be effective for small patches, however, if landholders need to rely on chemical control, metsulfuron methyl is effective against cape tulip while Glyphosate is effective against watsonia.

Annual grass weeds (e.g. barley grass, silver grass and wild oats)

These types of weeds can be a problem in pastures which have been overgrazed, so it is important not to graze pastures below 5 cm while they are growing, and 3 cm over summer. In high rainfall areas, a dense permanent pasture with a good percentage of perennial grasses will make it hard for annual grasses to become established. However, once established, these weeds are difficult to eradicate and landholders will need to employ a range of tactics in order to control them. The following section on 'barley grass control' includes a range of management options which can be employed.

Barley grass control

Some barley grass seed can remain viable for 2 or 3 years, so landholders should be watchful during this period when dealing with badly-infested pastures. However, usually over 90% germination occurs during the autumn break, so after a two year period significant control should be observed. If this weed is a problem across the whole of the property it may be prudent not to target all paddocks in one year since a lot of paddock feed will be lost and reduced livestock carrying capacity will need to be addressed. A staged program over 2 or 3 years may be preferable.



Figure 126. Use a range of techniques to control barley grass in permanent pastures

Using post emergent herbicides

Post emergent herbicides are available which will control barley grass if sprayed 4 to 6 weeks after the opening rains in autumn. Landholders should seek professional advice when using these herbicides since damage to perennial grasses can occur in some situations.

Patch spraying

In paddocks where the barley grass is patchy, these areas can be sprayed out with glyphosate in spring before seeds have formed. New pasture can then be re-sown in autumn provided livestock can be excluded from the site while the pasture becomes established.

Deferred grazing

When grazing is deferred for a period of 20 days after the autumn break, and the paddock heavily stocked continuously throughout the rest of the growing season, many plants will be eradicated before setting seed. If deferred grazing occurs earlier, or later, than the 20 day period, selective grazing of livestock may reduce the effectiveness of this type of control.

Spray topping

This process involves spraying the barley grass with a low rate of Glyphosate or Gramoxone after seed head emergence. The plant is not killed, but a small amount of the herbicide is absorbed by the seed which dies. If embarking on this approach, it is important to heavily graze pastures during early spring (September) to ensure an even crop of barley grass seed heads. Livestock should be removed 2 to 3 weeks before target weed has set seed, but seed heads have emerged. Spraying should be delayed until the last seed heads at the bottom of the plant have emerged and initial signs of yellowing appear. If spraying with Glyphosate 450 the rate is 240 ml to 360 ml per hectare.

Using herbicides

If the use of chemicals is necessary, the application of appropriate herbicides at the correct time of the year will be better for the environment, be more effective and help to reduce costs.

Effective control of weeds will avoid the necessity to apply more chemicals at a later stage to eradicate larger plants. The following chart outlines the most appropriate times to control weeds.

Table 33. Calendar of chemical control of weeds

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blackberry, Broom												
Coarse												
Grassseed												
Horsetail												
Olive (naked)												
Sedgemoor, Line and Thistle												
Broadfoot pasture weeds												
Cape Tulip												
Grasscraper												
Mosses												
Watercress												

Legend	Optimum	Suitable	Seek advice	Not suitable
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When using herbicides landholders should always read the label carefully to ensure that chemicals are being applied as directed. Application of chemicals must comply with the registered use as specified on the label or the Material Safety Data Sheet (MSDS).

The MSDS describes the properties of a material and provides advice on safe handling and use of the material. In Australia chemical manufacturers and importers must produce an MSDS for any chemical that is a hazardous substance and make it freely available to workers handling the substance. The MSDS for each chemical product is generally available at the point of sale. The manufacturer of the product can be contacted if these are not available.

In addition, equipment should be calibrated so that the rate of application matches the manufacturers' recommendations. If assistance is required contact staff at your local natural resources centre or your local land management consultant, who will be able to explain the process.

Declared weeds

Declared plants are those that are regulated under the *Natural Resources Management Act 2004*. They have been assessed as significant weed threats to South Australia's primary production industries, natural environments and public safety. Every landowner in South Australia has a legal responsibility to manage declared plants

Plant species can be declared under various sections of the NRM Act, relating to:

Movement – Some declared plants must not be moved on a public road (e.g. as a cutting, seed or potted specimen). Inadvertent movement of the plant on animals, soil, vehicles, machinery or produce may also be illegal.

Sale – Many declared plants must not be sold at any outlet including nurseries, pet shops and market stalls. Sale of items contaminated with the plant may also be illegal.

Notification – The presence and locations of some declared plants on your own land must be reported to your regional NRM board.

Control – Landholders are required to take action to destroy or control many declared plant species which are growing on their property, regardless of whether it is used as a business, residence or for other purposes. The AMLR NRM Board (along with all other NRM boards) will also control certain declared plants found on road reserves. Costs can be recovered from the adjoining landowners.

Some of the more common pasture weeds found in the region are listed in Table 34.

Table 34. Common declared pasture weeds of the region

Common Name	Scientific Name
Blackberry	<i>Rubus fruticosus</i> L. agg.
Black Medick	<i>Medicago lupulina</i> L.
Caltrop	<i>Tribulus terrestris</i> L.
Hardwood	<i>Albizia julibrissin</i> Desf.
Parthenocarp	<i>Cipripedium acaule</i> L.
Schubert's rose	<i>Schubertia neriifolia</i> L.
Stargrass	<i>Stachytarpheta jamaicensis</i> (L.) Vahl
Spiney Pigeon	<i>Crotalaria retusa</i> L.
White clover	<i>Trifolium repens</i> L.

For more information on declared weeds contact your local natural resources centre or go to www.naturalresources.sa.gov.au/adelaidemtloftyranges

16.2 Pasture pests

Highly productive and persistent pastures can be severely damaged by pests and diseases unless land managers are able to recognise the symptoms and deal with them before they become a problem. Carrying capacity can be reduced when pastures lose vigour, creating a risk of overgrazing and soil erosion.

Pests

The most common pasture pests include red legged earth mite, lucerne flea and blackheaded pasture cockchafer. Severe damage can result from large infestations.

Redlegged earth mite

The redlegged earth mite (*Halotydeus destructor*) is a major pest of pastures, especially subterranean clover, annual medics and lucerne. It thrives in the Adelaide and Mount Lofty Ranges region which experiences cool wet winters and hot dry summers. The use of pesticides is a common method of control, however, alternative non chemical options are being embraced as evidence emerges that mites are exhibiting resistance to chemical sprays. Typical damage from these mites is seen as 'silvering' or 'whitening' of leaves (Figure 127). It is important to kill adult mites before they are able to lay eggs in spring which ultimately hatch in autumn. The optimum dates can be predicted by accessing the TIMERITE website program (www.timerite.com.au). Systemic pesticides can be applied to the seed coat when sowing a new pasture, however, it is still necessary to check young pastures to determine the extent of any infestations as these mites have the capacity to destroy the legume component of any pasture. Biological control can play a part in reducing redlegged earth mite numbers. There are a number of predators, in particular a predatory mite (*Anystis wallacei*), however, the dispersal rate for this mite is slow. Controlling weeds, such as thistles and capeweed, which act as host plants for the redlegged earth mite, will reduce breeding sites.

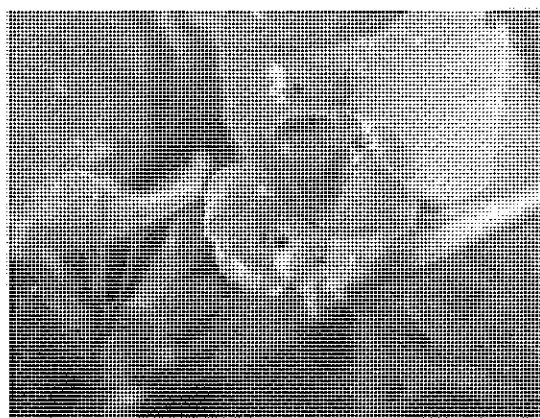


Figure 127. Redlegged earth mite damage

Lucerne flea

Adult lucerne fleas (*Sminthurus viridis*) are approximately 3 mm long, wingless (Figure 128) and lay eggs which remain dormant over summer and hatch during March and April. They can inflict considerable damage to clovers, lucerne and capeweed. They tend to be a problem on loam/clay soils, but generally not on sandy soils. Monitoring the development and spread of these pests is important so that chemical applications can be timed to act on young fleas which have not had a chance to breed. Systemic sprays can be used when damage is first detected. There are known predators of this pest, but these are unlikely to be an effective control measure on their own. A good grazing regime coupled with sound weed control of host plants should be adopted to avoid total reliance on chemicals.

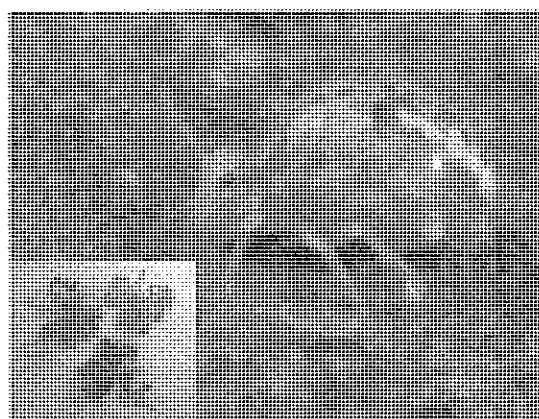


Figure 128. Adult lucerne flea
Photo: Victorian DPI, Agnote 0415

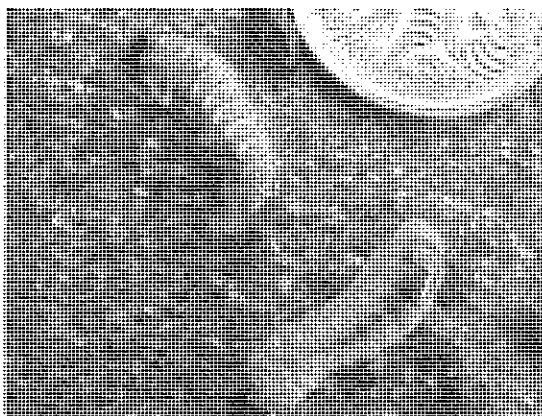


Figure 129. Black Headed Pasture Cockchafer

Blackheaded pasture cockchafer

The larval stage of this insect pest (*Aphodius tasmaniae*) is responsible for damaging pasture. Clovers and ryegrass are particularly susceptible. Larvae can reach 15 to 20 mm in length (Figure 129) while the adult beetles are generally 10 to 11 mm. Eggs are laid in soil and when larvae emerge they feed on pasture plants resulting in bare patches and exposed soil. Eggs hatch in early November with larvae doing considerable damage during April to early August. May and June is the optimum feeding time of larvae. In severe cases insecticides can be used since these insects are surface feeders. The best time to spray is just before rain or when heavy dew is expected. Avoid spraying after July as larvae will be difficult to eradicate. To confirm that bare patches are the result of the pasture cockchafer, holes need to be dug to a depth of 150 mm to identify the insect larvae and determine the density of the infestation.

Diseases

There are a number of diseases of pasture plants including rust, leaf spot, blight and a range of viruses. Young seedlings can also suffer from 'damping off' which occurs when a fungus attacks the stems of newly emerged seedlings. Soil conditions contribute significantly to this problem. It is important to use clean certified seed when sowing new pastures and to ensure that pastures are selected for their resistance to known diseases of the area. Appropriate management of soils and pastures will help to reduce the likelihood of disease becoming a problem. If disease is suspected, seek professional advice.

16.3 Feral animal control

Rabbits

European rabbits (*Oryctolagus cuniculus*) are a declared pest under the *Natural Resources Management Act 2004*, and are regarded as a serious invasive pest throughout the state. They cause millions of dollars in damage to crops and pastures annually, and are detrimental to the natural environment.

There are a number of methods that can be used to control rabbits. To achieve good results it is best to use a range of ongoing approaches.

For example:

- baiting
- warren destruction by ripping
- fumigation.

Biological controls in the form of Myxomatosis and Rabbit Hemorrhagic Disease are present in Australia, but their effectiveness varies considerably from year to year since they are dependent upon a range of environmental factors.

Trapping is generally not regarded as an effective way to reduce high numbers of rabbits quickly, since it requires a significant amount of time and effort. However, some local councils hire out cage traps to residents for the trapping of pest animals.

It is best to adopt a range of strategies for effective control. Technical support and advice is available from Natural Resources Adelaide and Mount Lofty Ranges.

Foxes

The fox (*Vulpes vulpes*) is a declared animal under the NRM Act, and is one of the most successful predators in the world. They are a major threat to livestock and small native mammals, birds and reptiles. It is the responsibility of property owners to control them. It is also illegal to keep foxes as pets.

Fox management and control options include:

- destroying fox shelters
- fumigation using carbon monoxide gas cartridges
- trapping
- poisoning.

Traps are available from your local natural resources centre.

Sodium fluoroacetate, commonly called 1080 (ten-eighty), is the only poison registered for fox control in South Australia. Foxes are extremely susceptible to this poison. However, due to the risk of poisoning other animals, such as dogs, its use is highly regulated. Landholders can only access 1080 through their local natural resources centre.

Deer

Farmed deer (*Family: Cervidae*) which are kept for commercial or non-commercial use, should be permanently identified and confined behind deer fencing in compliance with the *Natural Resource Management Regulations 2005*. These herds need to be registered under the *Livestock Regulations 1998*.

Deer that lack identification, are not confined by appropriate fencing, and are on land without the consent of the owner, are regarded as feral deer.

Landholders are responsible for the satisfactory control of the feral deer on their properties. The AMLR NRM Board requires landholders to eradicate new populations of feral deer that have established as the result of recent escapes or recent migrations. The control of established feral herds on private and public lands is the responsibility of the landholder. The board is also responsible for determining the level of control that will manage the impact of feral deer within the region.

It is an offence to wilfully or negligently release deer into the wild.

For further information on feral animal control contact Natural Resources Adelaide and Mount Lofty Ranges.

17. Enterprise management – specific issues

17.1 Horse management

Horse keeping

Under the *Natural Resources Management Act 2004*, owners and managers of land have a duty of care to protect natural resources and to ensure that land is not degraded. Intensive horse keeping, along with other intensive livestock systems, have the potential to damage natural resources (i.e. soil, water, air and vegetation) so it is important that appropriate management systems are in place to protect the environment.

The term 'horse keeping' is defined in the regulations pertaining to the *Development Act 1993* and refers to situations where landholders keep more than one horse for every three hectares (7.4 acres) of land, or where hand feeding of horses is involved. In these situations approval may be required from your local council.

If you intend to keep two horses on three hectares of land you are undertaking horse keeping.

Local councils have their own zoning regulations, so check with your council before embarking on a horse keeping venture or intensive horse management system, regarding your rights and obligations managing horses.

Horse management systems

Many thousands of land owners in this region have purchased properties to manage horses for recreational purposes. While some landholders have a few hectares for equestrian sports or for family members to ride horses and ponies, others operate a more intensive management system where larger numbers of horses are kept for agistment purposes.

Deciding on the best management system will depend on the number of horses to be kept, as well as how they will be fed and cared for, since managing horses can be quite time consuming compared with raising other livestock.

As a general rule, three management systems are recognised as suitable for managing horses, all of which will ensure that no environmental damage occurs, provided landholders follow a few simple rules with respect to grazing strategies, manure management and hygiene.

These systems include:

- low input (grazing, no yards)
- medium input (controlled grazing, some hand feeding)
- high input (limited grazing, mainly stabled).

Low input (grazing, no yards)

In this situation horses are not hand fed. All feed requirements are provided by pasture. Therefore stocking rates should be in line with district averages and grazing strategies adopted which maximise pasture productivity (Chapters 11 and 12).

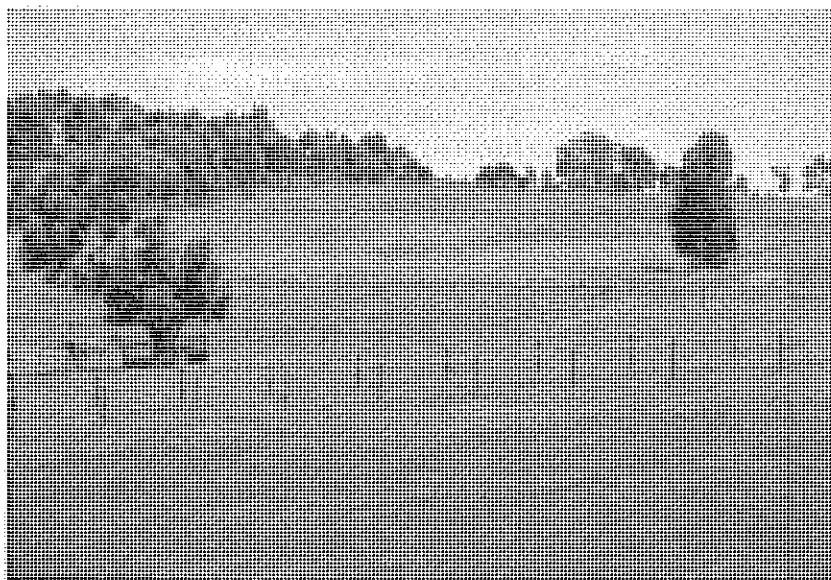


Figure 130. A well-designed 'low input' horse management system

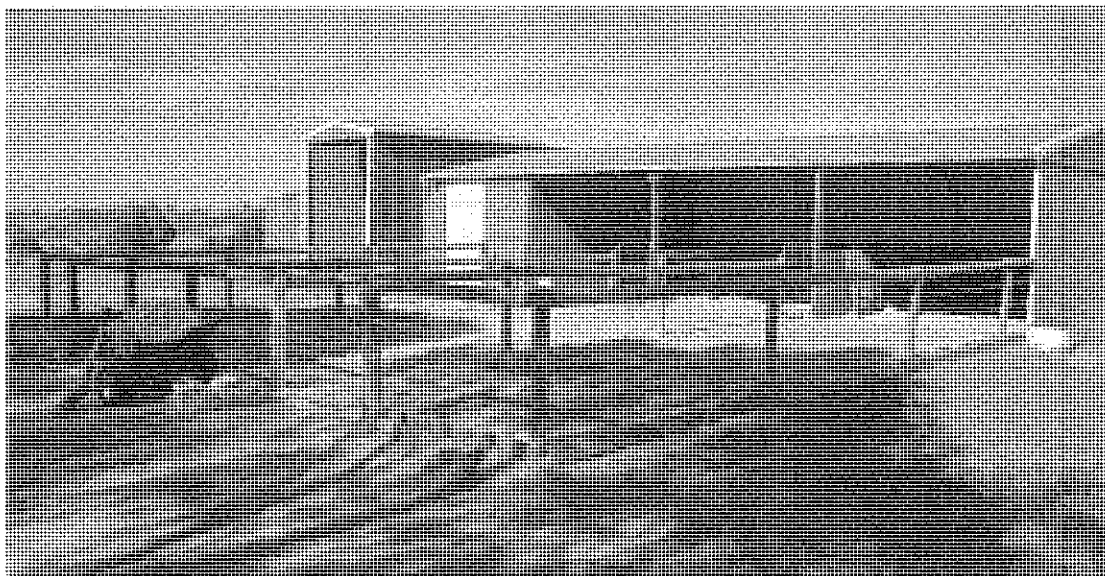


Figure 131. Well-designed day yards help to control grazing on a 'medium input' horse management system

No stables or yards are necessary, so shelterbelts become the primary source of protection in the paddock. Good pasture management should be practiced at all times.

Medium input system (controlled grazing, some hand feeding)

Paddock feed alone will not match the nutritional requirements of all the horses on the property in these circumstances. Consequently stables or yards must be used to control how long paddocks are grazed. This approach allows pastures to be rested, ensuring good ground cover and avoiding bare ground with the potential for erosion and dust problems. Some hand feeding will be required.

High input system (limited grazing, mainly stabled)

Hand feeding is the primary means of providing the nutritional requirements of horses. Grazing is limited to only a few hours each day whilst horses spend the majority of their time in stables or yards.

Cleanliness and hygiene of yards become important considerations with this system.

Manure management

Landholders have an obligation to ensure that manure is not a source of off-site pollution. Manure left in paddocks not only poses a risk of environmental pollution, but can result in pastures not being fully utilised, since stock will avoid grazing near manure.

Numbers of harmful intestinal worms can also build up in paddocks and re-infect individuals.

Manure should be removed daily from stables, yards and exercise areas and stored where rain and surface run-off will not leach pollutants into watercourses. On small properties manure can be picked up from paddocks, bagged and used by home gardeners.

Spreading manure using a piece of weldmesh or light harrows is an effective way of recycling nutrients in larger paddocks.

17.2 National livestock identification system

The national livestock identification system (NLIS) is a national database used to identify and track cattle, sheep and goats, and so improves stock identification and traceability.

The NLIS ensures that livestock can be tracked electronically from their property of birth to their place of slaughter. This tracking is important for food safety, disease control and market access. Animals can be traced quickly in the event of a disease outbreak which will minimise possible impacts on the industry.

Further information on NLIS can be found at the Meat and Livestock Australia website www.mla.com.au

17.3 Livestock health issues

Poor land management can often contribute to poor animal health. Problems can range from poor condition to severe illness and in some cases fatalities.

A detailed description of these health issues is beyond the scope of this manual, but landholder are advised to become familiar with ways to avoid some of the more common problems.

Horses can be susceptible to:

- annual ryegrass toxicity (ARGT) – caused by a bacterial toxin and can be fatal
- grass staggers – caused by an endophyte fungi in perennial ryegrass
- sand colic – often associated with ingesting sand when fed on bare ground
- greasy heel – an infection of hooves and legs when horses are kept in mud
- founder – inflammation of horses feet caused by feeding on lush pasture
- toxic plant poisoning – e.g. salvation Jane which produces a liver toxin.

Further information can be found at www.horseslandwater.com

Cattle are perhaps less prone to diseases and infections compared with horses, but a number of common health issues are worthy of note:

- perennial ryegrass staggers and annual ryegrass toxicity bloat – caused by grazing lush grass or lucerne
- clostridial diseases – e.g. tetanus
- grass tetany – caused by a lack of magnesium in feed often due to low levels in the soil
- internal parasites – e.g. the brown stomach worm
- lice – require chemical treatment.

On the whole, sheep are quite hardy animals, but they do require some basic animal husbandry to ensure they remain healthy.

Landholders should be aware of:

- clostridial diseases – e.g. pulpy kidney (Enterotoxaemia) which can be fatal and often results from sudden changes in nutrition, such as grain feeding or improved lush paddock feed
- flystrike – caused by flies laying eggs in wool
- lameness – due to foot abscess
- phalaris staggers – caused by plant toxins, and can be fatal
- internal parasites – worms.

Further information on cattle and sheep health can be found at www.mla.com.au

Alpacas are hardy animals, low maintenance, and do not require crutching, tail docking or mulesing since flystrike is rare. They are resistant to internal parasites, and their soft pads help to prevent outbreaks of foot infections.

However, they are susceptible to:

- perennial ryegrass staggers
- clostridial diseases
- internal parasitic worms in younger animals such as crias and weaners.

Information on alpaca health issues can be found at www.alpaca.asn.au

18. Case studies

18.1 Jacqueline and Bob Raphael

Property location:	Kudla, Northern Adelaide Plains
Current enterprises:	Horses (recreational)
Average annual rainfall:	480 mm (approx.)
Soil type:	Red clay loam
Features:	This idyllic property stands out as one of the best examples of an intensive horse keeping property in a low rainfall area of the Adelaide Plains. Day yards, shelterbelts and native pastures are abundant.

Jacqueline and Bob have dedicated much of their time during the last 10 years turning a wasteland of salvation Jane (*Echium plantagineum*) and capeweed (*Arctotheca calendula*), without a single tree to be seen, into one of the most well managed horse properties in the region.

Careful planning, research and a genuine affinity for sustainable land management has been the foundation for their achievements.

After purchasing their 2 hectares of land, Jacqueline and Bob embarked on a search for information and guidance to help them develop the property using sustainable land management practices. Jacqueline enrolled in the Adelaide and Mount Lofty Ranges Natural Resources Management Board's Rural Land Management Course, and attended numerous field days and workshops to understand the importance of good pasture management, rotational grazing, using day yards and incorporating shelterbelts to provide shade and protection. Drawing up a property management plan to incorporate sound environmental principles has been a vital part of their success.



Figure 132. Small horse paddocks can be grazed and still have excellent cover

The property is home to five horses and two Shetland ponies. Internal electric fencing has been used to divide the property into nine small paddocks, and the strategic use of day yards, allows individual paddocks to be rested once pasture levels become low. This often means that horses only graze for a few hours when paddock feed levels are falling. The use of a small sacrifice paddock is carefully managed so that horses can exercise and be hand fed. Consequently ground cover overall is nearly 100% all year round. Despite its size, Jacqueline has incorporated a round yard, arena and exercise yard all strategically positioned with native shelterbelts.

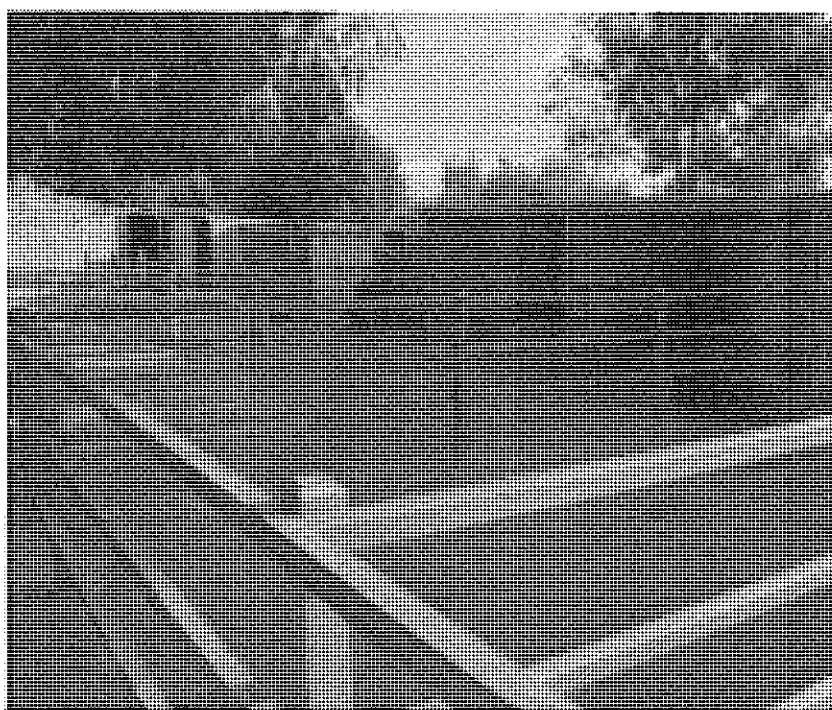


Figure 133. The use of day yards enables pastures to be rested so overgrazing is avoided

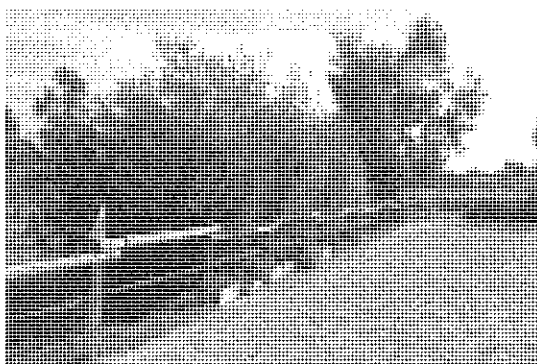


Figure 134. Revegetation to create shelterbelts provides shade, protection and a haven for birds

Efficient rain capture from all roof areas provides water for horses and newly planted shelterbelts. The property is quite exposed to cold winds during winter and extreme sun in summer so the planting of shelterbelts has become an integral part of the whole design. Researching the appropriate local native trees and shrubs has led to a series of shelterbelts being planted to provide shade and shelter, and create a haven for native birds. Larger trees include river red gums (*Eucalyptus camaldulensis*) and sheoaks (*Allocasuarina* spp.)

One of the biggest challenges confronting Jacqueline and Bob when the property was first purchased was the control of salvation Jane and capeweed. A combination of low toxicity herbicide applications and re-seeding has seen dense pastures establish themselves. Very few broadleaf weeds are now found on the property but if they are, Jacqueline and Bob are quick to grub them out before they seed, or spot spray with a selective herbicide to retain, and encourage the good grasses.

Native grasses form a substantial component of most paddocks. Wallaby grasses (*Rytidosperma* spp.), brush-wire grass (*Aristida behriana*) and windmill grass (*Chloris truncata*) are abundant. Self-seeding of native grasses is encouraged by removing horses from paddocks when grasses are seeding. Slashing then follows to help to spread mature seed.

The careful use of low toxicity sprays, and low fertiliser rates has also contributed to the spread of these native grasses. Horse manure and an organic fertiliser are applied each year, while every few years a soil test is conducted to monitor soil nutrients.



Figure 135. Dense native wallaby grass is a major component of most pastures

Introduced pasture species include cocksfoot (*Dactylis glomerata*), phalaris (*Phalaris aquatica*), kikuyu (*Pennisetum clandestinum*) and couch (*Cynodon dactylon*). Any bare areas, which occasionally appear, are quickly over-sown with a mixture of annual ryegrass, cocksfoot, phalaris and snail medics, or planted to kikuyu runners. Careful management of these pastures is a key priority for Jacqueline and Bob.

Horse manure is collected weekly from paddocks, and daily from yards, with some being bagged and distributed through the community, while the rest is composted or used as a mulch around native trees and shrubs.

Jacqueline and Bob are proud of what they have achieved and yet they continue to look at ways to improve the property. Jacqueline believes that you are always learning and by attending field days and workshops, as well as searching for information from other sources, further improvements can be made to the property.

The key principles of sustainable land management which Jacqueline and Bob have followed closely include:

- * developing a property management plan
- * avoiding overgrazing of pastures
- * controlling weeds to allow pastures to thrive
- * revegetating with native trees and shrubs
- * avoiding contamination of the environment through manure and dust
- * managing the land to its capability.

18.2 Marc and Alyssa Fox

Property location:	Lobethal, Central Adelaide Hills
Current enterprises:	Beef cattle
Average annual rainfall:	840 mm (approx.)
Soil type:	Acidic sandy loam over brown or red clay with deeper sandy loams near creek flats
Features:	Significant pasture improvement, fencing to land class, plenty of revegetation and reduced stock numbers are all the result of a carefully produced property management plan.

Balancing family life and work can sometimes be a challenge, but when you add managing the family farm of 48 hectares, there has to be commitment and enthusiasm. Fortunately Marc has plenty of both. The farm was established in the early 1900s and like most farms the land was pushed to its limits. When Marc took over managing the farm some 10 years ago he wanted to improve the whole property to the point where it was environmentally and economically sustainable. He brought a fresh approach to land management which recognised the land classes, protected vulnerable areas and increased production off the better land.

Marc enrolled in the Adelaide and Mount Lofty Ranges Natural Resources Management Board's rural land management course, and attended numerous field days and workshops. The result was the development of a property management plan based upon sustainable land management principles. Putting the plan into action has been the result of hard work with some support from the board.

Improving pastures, reducing livestock numbers, and introducing a better grazing strategy have been significant changes. The property now runs 27 breeding cows comfortably, with yearlings sold in early autumn. This enables good ground cover to be maintained throughout the year.



Figure 136. Fencing to land class is an important land management practice

Irrigation is limited to only a few paddocks which are sown to perennial ryegrass (*Lolium perenne*), white clover (*Trifolium repens*) and red clover (*Trifolium pratense*). Selecting appropriate pasture species to match soil type and rainfall is a key strategy and Marc places a high value on using perennial grasses such as perennial ryegrass, cocksfoot (*Dactylis glomerata*) and phalaris (*Phalaris aquatica*), especially on steep slopes where the potential for soil erosion is high (Figure 137).

Understanding how pastures respond to rainfall and soil type is important to avoid overgrazing. Some dryland pasture paddocks struggle to hold adequate soil moisture over summer and autumn, and so stock are removed early to rest paddocks and encourage the perennial grasses to persist. The farm is divided into 13 paddocks which supports rotational grazing and allows some paddocks to be cut for hay each year.

Soil testing is a regular activity with one paddock being tested annually. As a result 20 hectares were recently limed at a rate of 3 tonnes per hectare to counter soil acidity.

Careful planning has underpinned a series of positive changes over time. The main watercourse has been fenced off for a number of years now, allowing additional trees and shrubs to be planted where original plantings have struggled to survive.



Figure 137. Establishing perennial grass pastures on steeper slopes helps soil conservation



Figure 138. Revegetation is an integral part of good land management

Steep gullies showing signs of erosion have also been fenced off and revegetated.

Some areas of the property were infested with woody weeds such as blackberry (*Rubus fruticosus*) and broome (*Genista monspessulana*) and while stock used to graze these areas, there was little feed value.

Consequently a woody weed control program was implemented which involved fencing the sites off, using appropriate herbicides and revegetating with local native species (Figure 138).

Marc is convinced that the starting point to transform the farm into a low maintenance and easily managed property was drawing up a property management plan based upon fencing to land class.

Even further improvements are imminent, since Alyssa is in the process of establishing a small flock of Dorper sheep, which she will manage, and which reflects their view that the property is a family farm, now and into the future.

The key principles of sustainable land management which Marc and Alyssa have followed closely include:

- developing a property management plan, based upon fencing to land class
- avoiding overgrazing of pastures
- matching livestock numbers with pasture feed production
- controlling weeds to allow pastures to thrive
- revegetating with native trees and shrubs
- soil conservation.

18.3 Hugh and Yvonne Bygott

Property location:	Kersbrook, Northern Adelaide Hills
Current enterprises:	Dorper sheep stud
Average annual rainfall:	740 mm (approx.)
Soil type:	Acidic sandy loam over brown or red clay
Features:	Situated amongst the gently rolling hills of Kersbrook next to the South Para Reservoir, this ideal grazing property is undergoing a transformation. Shelterbelts are being established and paddock subdivision is well underway to enable efficient rotational grazing. Fencing to land class underpins a sustainable approach to land management.

Hugh and Yvonne moved on to this 32 hectare property with a view to enjoying the lifestyle, improving the land and seeing whether the property could provide some extra income. Having purchased the land a few years earlier there was time to consider a sustainable approach to land management and understand the delicate nature of some areas of the property.

The land classes are distinctly variable. A small watercourse runs through the property which has a large dam, gently rolling hills and some steeper slopes. Lower flat land offers a number of challenges since it is often waterlogged during winter and is mildly saline.

When Hugh and Yvonne took over the property it was quite degraded, pastures were void of perennial grasses due to overgrazing, stocking rates were high and paddock feed low. Delicate areas of the property were not protected from livestock and the dam was unfenced.

Having embraced the concept of sustainable land management, they set about re-designing the property. Some boundary fences needed upgrading as a priority, and revegetation was seen as a must in some areas. The dam and watercourse is now fenced off with significant revegetation established to help stabilise the wet areas below the dam. This has increased the

level of rotational grazing which has helped with weed control and pasture improvement.

Shelterbelts have been established with local indigenous species carefully selected to promote biodiversity, provide shade and protection for livestock, and encourage native birds.

Property planning underpins most of what Hugh and Yvonne decide with respect to infrastructure. Hugh's strong belief in good animal husbandry is in keeping with the property being a registered stud. Careful thought is currently being given to dividing the main paddock to enable more rotational grazing, and deciding on the most appropriate location for yards and small paddocks. Ease of vehicle and stock access are key considerations.

The quality of pasture varies, with fog grass (*Holcus lanatus*) and subterranean clover (*Trifolium subterraneum*) isolated to steeper slopes, and phalaris (*Phalaris aquatica*) established on low lying wetter areas. Large areas are in need of pasture improvement and Hugh sees this as an important task before stock numbers can increase.

Soil testing is conducted regularly and as a result the need to apply lime has been identified.

Hugh and Yvonne have a good understanding of the capability of the land and have been quick to stock numbers in line with pasture production.



Figure 139. Fencing of the dam was a top priority



Figure 140. Fencing off the watercourse and establishing native vegetation has helped to protect water quality



Figure 141. Strategic placement of fences and shelter-belts are key improvements

Currently 50 breeding ewes with lambs, plus rams are managed on the property. Being careful not to overstock, many of the young rams are sold before January when paddock feed begins to decline.

Future activities will include establishing more shelterbelts, liming, paddock division and pasture improvement.

Hugh and Yvonne believe they have a responsibility to ensure that their land management practices do not harm the environment, or pollute water draining into the South Para Reservoir. Consequently chemical use is kept to a minimum.

Careful planning, research, attending workshops and field days, and a genuine affinity for sustainable land management has been the foundation for their achievements to date.

Hugh and Yvonne have a strong community focus having worked closely with the South Para Biodiversity Group. Until recently Hugh was President of the Dorper Sheep Society of Australia – Central Region.

Improving their property is a work in progress, but what they have achieved to date is highly significant and with their eagerness to learn more, this property is set to become exemplary.

The key principles of sustainable land management which Hugh and Yvonne have followed closely include:

- strategic planning
- avoiding overgrazing of pastures
- controlling weeds to allow pastures to thrive
- revegetating with native trees and shrubs
- avoiding contamination of the environment by minimum chemical use
- fencing to land class
- positioning of yards and raceways.

18.4 Michele and Robert Wilson

Property location:	Millbrook, Central Adelaide Hills
Current enterprises:	Alpacas
Average annual rainfall:	800 mm (approx.)
Soil type:	Shallow stony sandy loam over brown clay and rock
Features:	This small eight hectare property with its steep rolling hills, isolated Eucalypts and two dams is representative of many lifestyle properties in this location. Managing alpacas has been relatively problem free to date, but subdividing paddocks for better weed control and grazing is now a key element of a recently developed property management plan.

Michele and Robert's alpaca farm could be described as the ideal lifestyle property, and for the most part this is true, however, running alpacas on a small acreage throws up challenges which can be frustrating as well as rewarding.

Before purchasing their Millbrook property Michele and Robert embarked on a process of careful research into managing land and attended various courses, to gather information on rural land management. One of the first things they did on purchasing their property, three years ago, was to enrol in the Adelaide and Mount Lofty Ranges Natural Resources Management Board's Rural Land Management Course. This gave them a good foundation to manage the land sustainably and avoid making decisions which would cost them dearly in the long run.

As a consequence of attending this course, a soil test was carried out to determine fertiliser and liming needs. No lime was required but the paddocks were low in phosphorus prompting them to apply fertiliser in the first year.

Michele was keen not to overstock initially and so information on the potential stocking rate for the property was sought. They now run 34 alpacas and a handful of sheep and goats, which closely matches pasture production.

As new landholders, the initial challenges related to getting a better understanding of livestock husbandry and ensuring the health and welfare of their alpacas, which require annual injections for vitamin D, foot trimming and shearing.



Figure 142. Alpacas are generally hardy and low maintenance

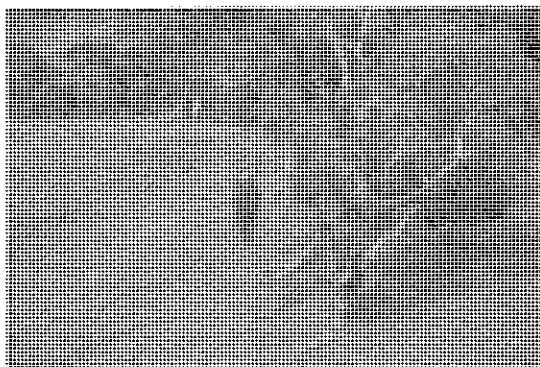


Figure 143. Isolated Eucalypts have suffered from the recent drought and mistletoe has invaded

With this now well in hand Michele and Robert are revisiting their initial property management plan with a view to improving the property. Some of their challenges relate to revegetation, pasture management, weed control and improved grazing.

Isolated Eucalypts have suffered from the recent drought and mistletoe has now invaded with dire consequences for some trees. Whilst some trees have been fenced off from livestock, in the hope they will recover, others will need to be replaced, and so a program of revegetation is underway.

The pasture is essentially unimproved with the main grasses being fog grass (*Holcus lanatus*) and isolated perennial ryegrass (*Lolium perenne*), along with a range of annual grasses. Patches of wallaby grass (*Rytidosperma* spp.) are also present. Subterranean clover (*Trifolium subterraneum*) is widespread in places. The grazing nature of alpacas has created patches of capeweed (*Arctotheca calendula*) and storksbill geranium (*Erodium* spp.) both of which will be the subject of some effective weed control in the near future.

Whilst some spraying may be necessary to keep weeds under control, Michele and Robert acknowledge the need to change from set stocking to rotational grazing so that paddocks can be rested to help improve pastures.

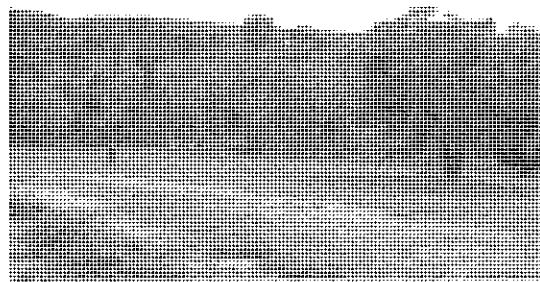


Figure 144. Plans to divide this paddock will assist a change from set stocking to rotational grazing

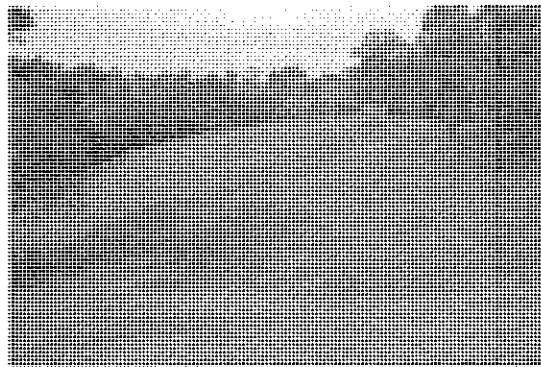


Figure 145. Steep slopes will make fencing and pasture improvement challenging

This has raised questions about placement of internal fencing to create more paddocks and how to deal with very steep slopes on the southern side of the property. Consideration is also being given to a reticulated watering system as paddock numbers increase. All of this will require careful planning.

Michele and Robert have achieved a great deal in a short space of time, but they have now reached a stage where they want to re-evaluate their initial property management plan so that improvements can be made to their land management practices.

They acknowledge the need for sensible planning with realistic time-lines since at the moment both of them work and finding time is a major hurdle.

The key principles of sustainable land management which Michele and Robert have followed closely include:

- developing a property management plan
- avoiding overgrazing of pastures
- controlling capeweed to allow pastures to thrive
- revegetating with native trees and shrubs
- soil testing and improving soil fertility
- managing the land to its capability.

19. Helpful tools

A range of tools and calculators are available to assist landholders make informed decisions regarding pasture management and stocking rates. Some can be purchased as individual software programs, others can be used online, while trial programs can be located at particular websites.

19.1 Meat and Livestock Australia

Feed budget template

www.makingmorefromsheep.com.au/turn-pasture-into-product/tool_8.4.htm

This program enables landholders to calculate simple feed budgets manually, without using a computer.

To complete the budget template you will need to:

- measure the pasture mass (kg green DM/ha) in the paddock you have allocated to the stock to get your starting point
- estimate pasture quality
- determine the estimated intake of livestock
- look up typical pasture growth rates for your pasture type and soil fertility
- define the minimum target pasture mass (kg green DM/ha) for the class of stock
- convert pasture mass to feed on offer, by adding 300 kg DM/ha.

Stocking rate calculator

www.mla.com.au/publications-tools-and-events/tools-and-calculators/stocking-rate-calculator

This calculator is designed to determine the number of cattle or sheep landholders should put into a paddock based on its carrying capacity.

Feed demand calculator

www.mla.com.au/Publications-tools-and-events/Tools-and-calculators/Feed-demand-calculator

The feed demand calculator allows producers to gain an appreciation of the pattern of feed supply and demand over a twelve-month period, the location of "feed gaps" and the ways in which modifying the livestock enterprise might help to close these gaps. The calculator can be used to assist red meat producers in the planning process of their enterprise.

Rainfall to pasture growth outlook tool

www.mla.com.au/Publications-tools-and-events/Tools-and-calculators/Rainfall-to-pasture-growth-outlook-tool

This outlook tool presents the actual rainfall and indices of soil moisture and pasture growth for the past nine months and an outlook for the next three months for over 3300 locations across southern Australia.

It enables producers to factor this information into enterprise planning. The tool covers a diverse range of soil and pasture types across southern Australia, and provides an index of potential pasture growth.

The pasture growth index should be interpreted in light of local knowledge as to species, soil type, fertiliser history and aspect.

Daily pasture growth estimates

www.makingmorefromsheep.com.au/turn-pasture-into-product/tool_8.2.htm

This tool allows landholders to determine the average pasture supply, and likely variability, based on long-term weather records. The mid-monthly estimates of pasture growth rates (kg DM/ha/day) are for average seasonal conditions for a range of localities and regions across the high rainfall and wheat-sheep zones of Australia. Although there is a large variation in rainfall pattern and feed supply within any year, when put together these monthly values reflect pasture growth in a 'typical' year for the locality or region without reference to growth in the previous month. These estimates provide a basis to assist with the calculations for short to medium term decision making. They are intended as a guide and will assist with the calculations in feed budgets.

19.2 Evergraze tools and calculators

Feed budget and rotational planner

www.evergraze.com.au/library-content/feedbase-planning-and-budgeting-tool/

This program will help landholders to plan rotational grazing systems, determine appropriate stocking rates, calculate pasture growth rates, determine how long paddock feed will last and calculate the most economical ration for stock.

Pasture improvement calculator

www.evergraze.com.au/library-content/pasture-improvement-calculator/

This calculator helps work out the costs and benefits of re-sowing pastures.

It allows inputs of:

- costs of re-sowing
- the benefits of the re-sown pastures to livestock
- soils and the environment at any given financial values.

The tool uses Microsoft Excel and allows a comparison of two different re-sowing options compared with current practice.

19.3 Commonwealth Scientific and Industrial Research Organisation

CSIRO Plant Industry has developed the following successful decision support tools, based on computer modelling of farming systems and validated by research to promote more profitable farm management.

GrassGro

www.hzn.com.au/grassgro.php

GrassGro is a decision support tool developed by CSIRO Plant Industry to examine variability in pasture and animal production and assist decision making in sheep and beef enterprises.

It can be applied to the following range of issues:

- assessment of land capability and production benchmarking
- real time review of management tactics during the current season
- testing long term decisions about herd or flock management
- resource sustainability (ground cover, water balance, nutrient deficiency)
- drought management and climate variability scenarios
- location testing (pasture types, animal bloodlines, enterprise analysis)
- financial testing – tactical and strategic (stocking rate, calving and lambing dates, supplementary feed policy, market specification for livestock)
- supply chain analysis.

Grazfeed

www.hzn.com.au/grazfeed.php

GrazFeed is an easy to use computer program which calculates the energy and protein requirements of sheep and cattle grazing a particular pasture or even being lot fed.

Feed requirements are based on the Australian Feeding Standards. It takes into account the type of animal, the availability and quality of pasture, selective grazing and interaction with supplementary feeds (e.g. the substitution of supplement for pasture).

MetAccess

www.hzn.com.au/metaccess.php

This program analyses historical weather data in a flexible way to quantify variability and assess the likelihood of weather events as it impacts on business, research and everyday life.

AusFarm

www.hzn.com.au/ausfarm.php

AusFarm optimises management strategies for livestock, grassland and cropping operations on a mixed farm or across a variable landscape. The model allows problems to be analysed simulating the physical and biological systems. The software contains powerful facilities for analysing risk over both short and long term.

19.4 Primary Industries and Regions SA – Soil acidity in South Australia

Information, maps, fact sheets, tools and cases studies

agex.org.au/project/soil-acidity

To assist landholders and advisers to make better decisions in treating soil acidity computer decision support tools have been developed. These include the impact of acidification on production (cost of not liming); lime requirement rate; a cost comparison of liming sources; and maintenance rate of lime.

19.5 Australian Wool Innovation Ltd

Timerite

www.timerite.com.au

Redlegged earth mite is an introduced pasture and crop pest in southern Australia. It is estimated that this mite infests 20 million ha of pasture, causing \$200 million damage to the wool industry alone.

Timerite is a program which predicts the optimal date for spraying in spring to achieve optimal control of the pest the following autumn.

When managing Redlegged earth mites, the first step is to check whether your pastures have it. Once you've checked, it is important, before you spray, to understand the risk level your paddock has for damage next autumn. If you have Redlegged earth mites in spring then spraying on your paddock's Timerite® date is the safest way to minimise the damage to pastures next autumn. Entering your location (latitude and longitude) will enable the program to generate a spring spray date for your property.

20. Glossary

Allelopathic plants – Plants which can inhibit the growth, survival, and reproduction of other plants.

AMLNR Board – Adelaide and Mount Lofty Ranges Natural Resources Management Board

Biodiversity – The degree of variation of life forms within a given ecosystem, biome, or an entire planet. Biodiversity is a measure of the health of ecosystems.

Buffering capacity – The ability of a soil to resist changes to pH (a measure of soil acidity and alkalinity).

Contour bank – An earth embankment with a shallow channel on one side which follow the contour of the land with a drain on the up-slope side. It is built with a slight gradient (1–3% only) so that water can drain slowly without causing erosion.

Direct drilling – This involves sowing seed into undisturbed soil following the use of a herbicide to control weeds.

Dry matter pasture production – The amount of feed produced by a pasture (by weight) once the water content has been removed.

Erosion – Natural breakdown and movement of soil and rock by water, wind or ice. The process may be accelerated by human activities.

Hembra – Female alpaca

Land – Whether under water or not, and includes an interest in land and any building or structure fixed to the land.

Land capability – The ability of the land to accept a type and intensity of use without sustaining long-term damage.

Land class – Land classes are based upon the limitations for agricultural production. Land class 1 is assessed as having no significant limitations while class 8 is assessed as having no value for primary production.

Native species – Any animal and plant species originally in Australia.

Natural resources – Natural resources consist of soil; water resources; geological features and landscapes; native vegetation, native animals and other native organisms; and ecosystems.

NRM – Natural Resources Management consists of all activities that involve the use or development of natural resources and/or that impact on the state and condition of natural resources, whether positively or negatively.

Pasture – Grassland used for the production of grazing animals such as sheep and cattle.

PIRSA – Primary Industries and Regions South Australia (Government of South Australia).

SARDI – South Australian Research and Development Institute, a division of PIRSA.

SLMU – Soil landscape mapping unit is an area of land (typically 0.5 to 50 km² in area) with recognisable and repeating pattern of topographical features and a limited range of soil types.

Sodicity – A term given to the amount of sodium held in a soil. Sodium is a cation (positive ion) that is held loosely on clay particles in soil.

Soil compaction – A process where heavy machinery or livestock cause a loss of soil structure, resulting in air being displaced from the pores between the soil grains. Plant roots find difficulty growing through this dense soil which lacks sufficient air and water.

Soil types – Soil types are determined by the relative proportions of the soil components, sand, silt and clay.

Weaning – Young animals are removed from their mothers and no longer rely on the supply of her milk.

21. Further information

The following publications and websites were referred to when compiling this manual. They provide a useful source of information for those landholders who may wish to investigate particular topics in further detail. A list of local contacts is also provided.

21.1 References

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21.2 Helpful websites

Australian Alpaca Association

www.alpaca.asn.au

Agriculture Victoria

www.agriculture.vic.gov.au

Dorper Sheep Society of Australia

www.dorper.com.au

Environment Protection Authority

www.epa.sa.gov.au

Feed test – analysing the nutritional value of your stock feed

www.feedtest.com.au

Healthy Soils for Sustainable Farms

<http://soilhealthknowledge.com.au>

Heritage Seeds

www.heritageseeds.com.au

Horses, Land and Water

www.horseslandwater.com

Meat and Livestock Australia

www.mla.com.au/Home

Meat and Livestock Australia / National Livestock Identification System

www.mla.com.au/Meat-safety-and-traceability/Livestock-identification

New South Wales Department of Primary Industries

www.dpi.nsw.gov.au

Pasture Genetics

www.pasturegenetics.com

Valley Seeds

www.valleyseeds.com

21.3 Local contacts

Adelaide and Mount Lofty Ranges

Natural Resources Management Board

Eastwood Natural Resources Centre

205 Greenhill Road, Eastwood SA 5063

T: 8273 9100

Gawler Natural Resources Centre

8 Adelaide Road, Gawler South SA 5118

T: 8523 7700

Black Hill Natural Resources Centre

115 Maryvale Road, Athelstone SA 5076

T: 8336 0901

Victor Harbor Natural Resources Centre

3 Eyre Terrace, Victor Harbor SA 5211

T: 8552 0300

Willunga Natural Resources Centre

5 Aldinga Road, Willunga SA 5172

T: 8550 3400

www.naturalresources.sa.gov.au/adelaidentloftyranges

Country Fire Service

Bushfire Information Hotline: 1300 362 361

Mount Lofty Ranges Headquarters: 8391 1866

www.cfs.sa.gov.au

Department of Environment, Water and Natural Resources

T: 8204 1910

www.environment.sa.gov.au

Horse SA

www.horsesa.asn.au

Primary Industries and Regions SA

25 Grenfell Street, Adelaide SA 5000

T: 8226 0900

www.pir.sa.gov.au/

Royal Society for the Prevention of Cruelty to Animals (RSPCA)

T: 1300 477 722

www.rspcasa.org.au

State Flora

Belair nursery: 8278 7777

Murray Bridge nursery: 8539 2105

www.stateflora.sa.gov.au

Trees For Life

T: 8406 0500

www.treesforlife.org.au

21.4 Local government contacts

Adelaide Hills Council

T: 8408 0400

E: mail@ahc.sa.gov.au

www.ahc.sa.gov.au

Alexandrina Council

T: 8555 7000

E: alex@alexandrina.sa.gov.au

www.alexandrina.sa.gov.au

Barossa Council

T: 8563 8444

E: Barossa@barossa.sa.gov.au

www.barossa.sa.gov.au

City of Mitcham

T: 8372 8888

E: mitcham@mitchamcouncil.sa.gov.au

www.mitchamcouncil.sa.gov.au

City of Onkaparinga

T: 8384 0666

E: mail@onkaparinga.sa.gov.au

www.onkaparingacity.com

City of Playford

T: 8256 0333

E: playford@playford.sa.gov.au

www.playford.sa.gov.au

City of Tea Tree Gully

T: 8397 7444

E: cttg@cttg.sa.gov.au

www.teatreegully.sa.gov.au

City of Victor Harbor

T: 8551 0500

E: localgov@victor.sa.gov.au

www.victor.sa.gov.au

District Council of Yankalilla

T: 8558 0200

E: council@yankalilla.sa.gov.au

www.yankalilla.sa.gov.au

Light Regional Council

T: 8525 3200

E: light@light.sa.gov.au

www.light.sa.gov.au

Town of Gawler

T: 8522 9211

E: council@gawler.sa.gov.au

www.gawler.sa.gov.au

Adelaide Plains Council

T: 8527 0200

E: info@apc.sa.gov.au

www.apc.sa.gov.au

Appendix A. Rainfall stations across the region

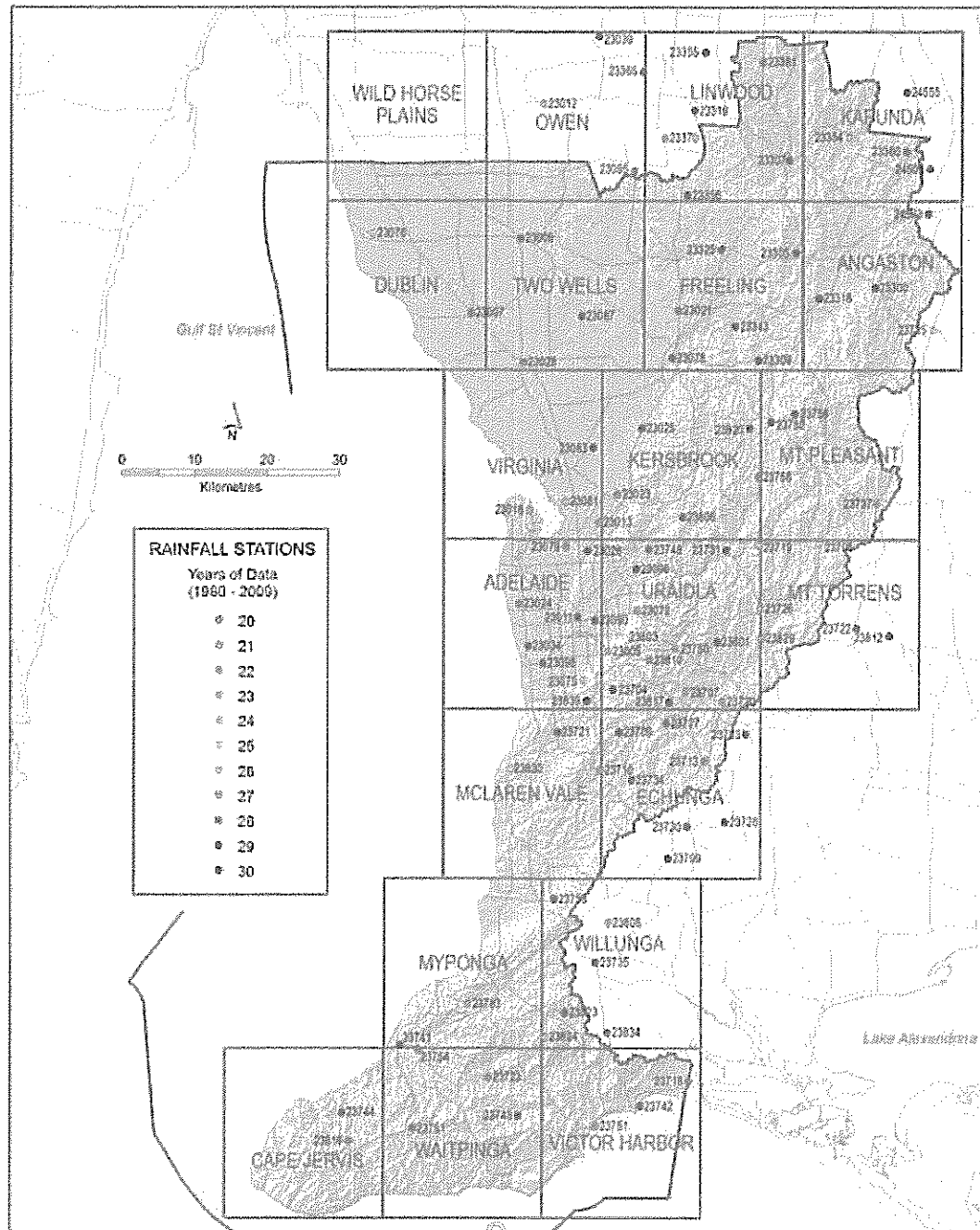


Figure 146. Rainfall stations – numbers relate to Appendix B 'Average annual rainfall across the region'.
Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

Appendix B. Average annual rainfall

Table 35. Average annual rainfall for locations in the AMLR NRM Board region

Source: Science Resource Centre, Department of Environment, Water and Natural Resources, formerly DENR 2011

Location	Coordinates	1991-2000		2001-2010	
		mm	mm	mm	mm
23005	Aradale (Flora Centre)	76	425	110	517
23007	Lower Light	71	382	83	386
23008	Nullara	79	360	125	471
23011	North Adelaide	76	437	124	542
23012	Quinn	75	404	95	434
23013	Parakeet Airport	67	418	65	453
23016	Aradale (Barren Island)	73	407	74	434
23021	Pennington	74	445	121	444
23023	Pennington	73	414	134	485
23024	Aradale (Gulliver)	70	450	98	444
23025	North Hill	70	484	111	471
23026	Aradale (Museum)	70	461	132	484
23028	North Hill	70	391	120	488
23034	Aradale Airport	61	434	94	442
23035	Parakeet (St. Marys)	60	407	92	471
23072	Aradale (High Training Centre)	67	617	44	647
23073	Aradale (Cliff Road)	64	617	49	618
23075	Port Pirie	65	334	25	354
23078	Gayden Council Depot	69	424	101	463
23079	Dry Creek (Hawthorn)	68	417	48	423
23081	Edgar (Hawthorn Creek)	64	403	30	423
23083	Edgar (Hill Road)	60	413	37	406
23087	Beever Park (Hawthorn Park)	60	403	25	406
23096	Aradale (Hill Road)	60	504	32	504
23097	Harley Bridge	78	434	74	418
23098	Aradale (Lake Valley Farm)	60	500	30	500
23099	Aradale (Lake Valley Farm)	69	474	58	459
23100	Aradale	70	549	126	558
23101	Greenock	60	511	131	531
23102	Aradale	60	463	143	463

Table 35. continued

Property ID	Property Name	2010-2011		2011-2012	
		Area (ha)	Average Annual Rainfall (mm)	Area (ha)	Average Annual Rainfall (mm)
23300	Lynbrook	10	510	123	457
23319	Dunrobin	10	532	103	547
23319	Dunrobin	10	489	123	470
23329	Feeding	10	483	48	465
23343	Boscobel (Turnerfield Research Station)	10	479	112	468
23354	Kapunda (Horse Well)	18	475	38	481
23355	Boscobel (Horsewell)	10	483	41	509
23356	Harden House (Horsewell)	10	450	40	463
23360	De Kruis	10	466	51	480
23361	Kapunda (Harden)	18	567	48	576
23363	De Kruis (Harden)	10	510	48	512
23370	Wendport (Harden)	11	473	47	462
23374	Helen (East Port Murray)	10	854	123	777
23375	Wendport Dept. of Transport	15	694	107	712
23377	Wendport	17	1036	123	1045
23378	Cherry Gardens	10	493	108	573
23380	Cheriton Post Office	11	774	134	813
23383	Edwards Creek Council	18	768	128	889
23384	Goodwin (Edwards Creek Council)	18	473	102	486
23388	Goodwin	18	762	134	797
23390	Harden Golf Club	17	788	121	850
23391	Happy Valley (Harden) SA Water	10	686	135	811
23392	Harden	10	586	131	558
23393	Wendport (Happy Valley)	18	723	75	700
23395	Wendport	15	496	63	511
23396	Wendport	16	888	121	858
23397	Wendport	10	669	50	867
23398	Wendport	10	676	121	731
23399	Wendport	10	821	110	829
23401	Cypress Creek (Wendport)	10	837	104	858
23411	Moana Park	10	711	149	764
23414	Moana Park Reserve	10	707	70	708
23415	Moana Reserve	10	815	61	841
23417	Moana Reserve	17	616	119	661
23441	Moana Park	10	513	112	522
23442	Port Lincoln (Moana Park)	10	483	141	501

Table 35. continued

Property ID	Property Name	2015-2016		2016-2017	
		Area (ha)	Average Annual Rainfall (mm)	Area (ha)	Average Annual Rainfall (mm)
23742	Victor Harbor (Parramatta Group)	30	670	99	609
23743	Barrow Valley (Parramatta)	30	402	132	619
23746	Ardenlee (Two Tree Creek Council)	29	583	124	664
23750	Quaila	27	1053	146	1032
23751	Victor Harbor	24	528	145	536
23752	Williamstown	10	635	125	683
23753	Williamstown	19	604	141	606
23754	Verdella	16	552	119	574
23756	Williamstown (Older Culture)	10	701	56	687
23758	Kembridge (Mabouga)	26	717	55	741
23761	Parramatta (Sharon)	18	503	53	582
23763	Edinburgh (Parramatta)	17	661	43	688
23765	Edinburgh (Mabouga)	15	743	41	630
23801	Lonsdale Research Center	15	1037	42	1011
23802	Arthur Creek	21	1055	66	1011
23804	Hemlock Ridge	21	619	17	645
23805	Wood	22	811	44	451
23810	Clarendon Preservation Park	28	966	38	989
23813	Brickley (Black Heath)	34	503	40	519
23816	Barrow Valley Forest	24	969	31	954
23817	Wentworth	30	1062	40	1077
23820	Williamstown (South Park Reserve)	30	677	43	652
23821	Blackburn (Vale / Fairbairn)	30	666	74	662
23824	Blackburn (Vale / Fairbairn)	30	646	69	687
23825	Ardenlee	23	710	119	604
23830	Verdella	25	683	36	495
23834	Victor Harbor (Parramatta)	30	729	22	747
23839	Kembridge (Mabouga)	30	707	30	707
24503	Carroll	29	646	87	444
24523	Tumbarumba (Mabouga)	30	666	40	490
24571	Truro	30	503	130	494

Appendix C. Grid maps of regional soil groups

The following maps illustrate the major soil groups found in the region and are broad representations based on soil landscape mapping units (SLMU). Each unit is an area of land (typically 0.5 to 50 square kms in area) with recognisable topographic features and a limited range of soil types.

Since there are a number of different soil types within each soil group, the name given to each soil group is determined by the dominant soil type.

While these maps can be a useful guide to determine the likelihood of a particular soil type being present on a property, the only certain way to know what soils exist, is to examine the soil on site. Often cuttings can expose soil profiles, or landholders can use an inexpensive hand held auger to raise the various soil horizons. If necessary professional assistance can be sought to characterise the properties of the soil and gain a better understanding of what restrictions there may be to plant growth, and how best to manage that soil.

Descriptions of the major soil types in the region are given in Chapter 6.

Rainfall station numbers are also provided to enable landholders to obtain average annual rainfall data for some locations (refer to Appendix B).

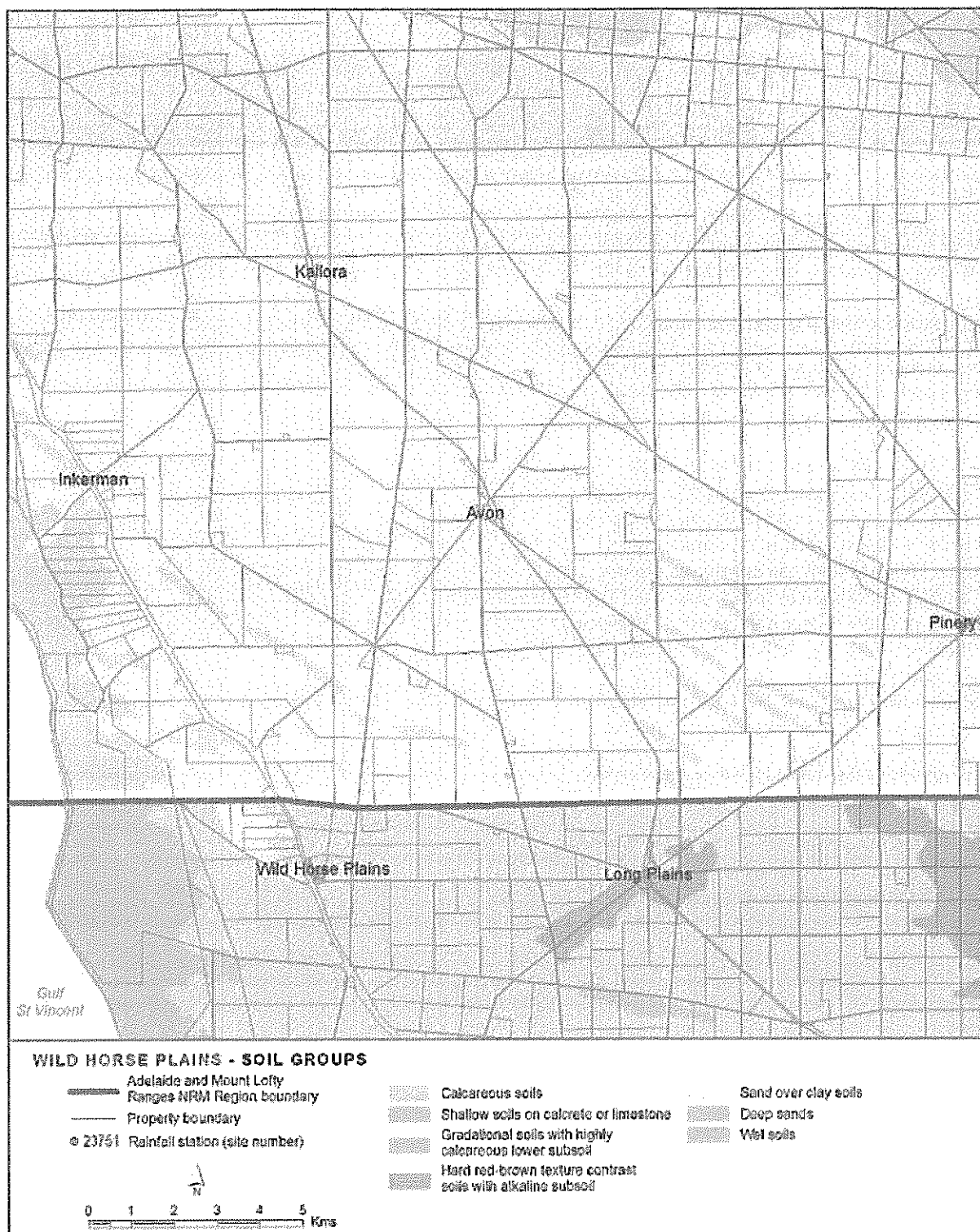


Figure 147. Wild Horse Plains soil groups
Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

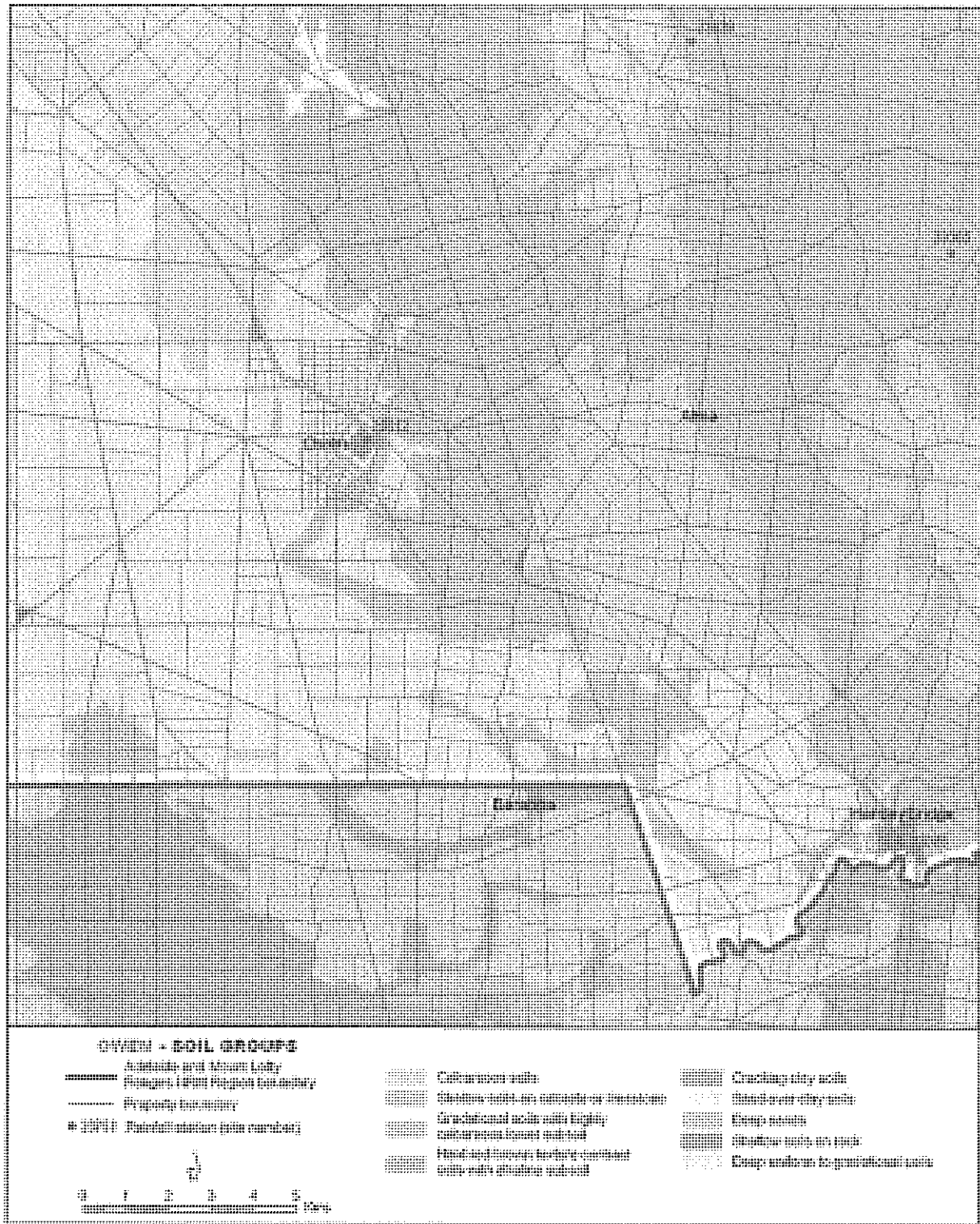


Figure 148. Owen soil groups

Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

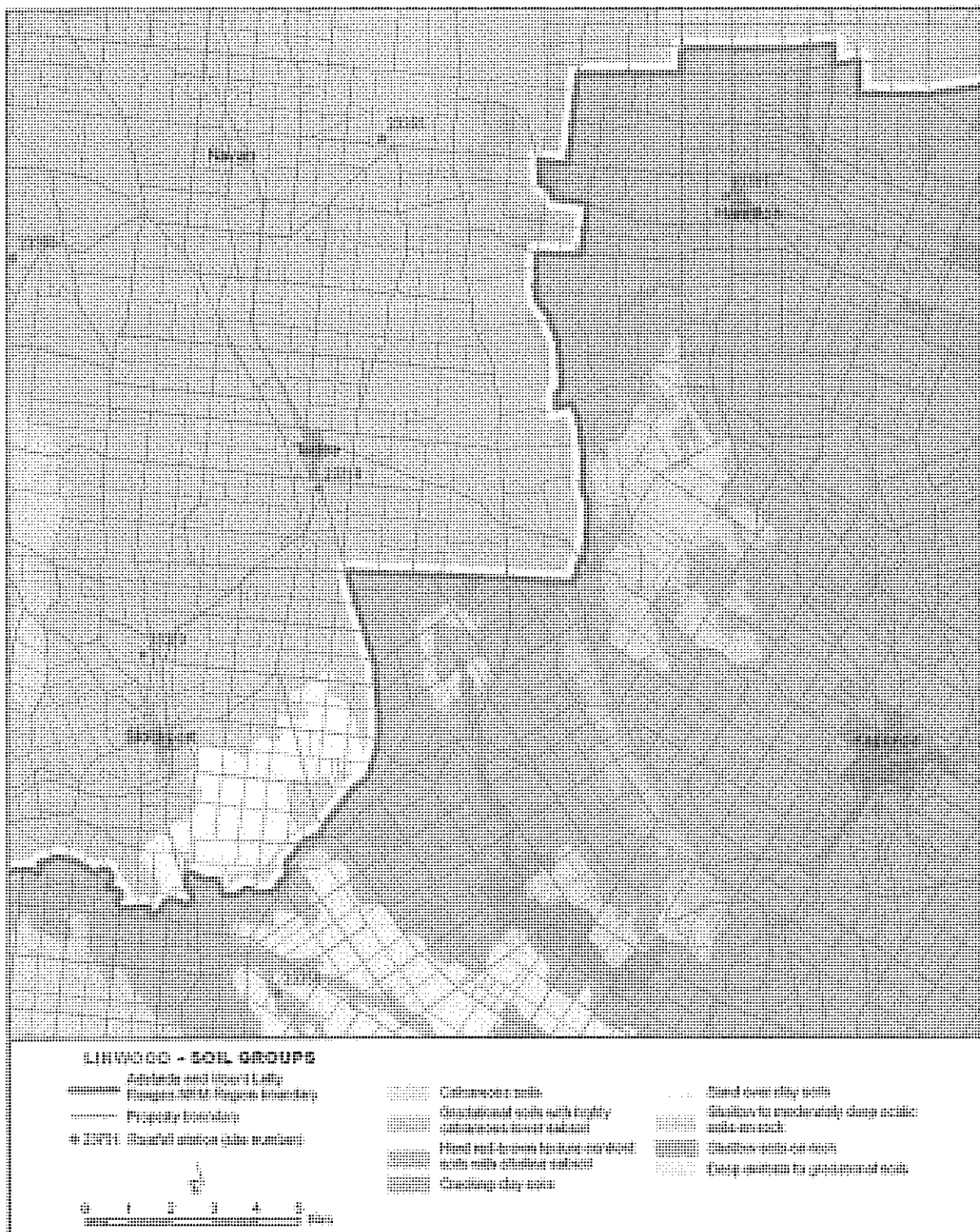


Figure 149. Linwood soil groups
 Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

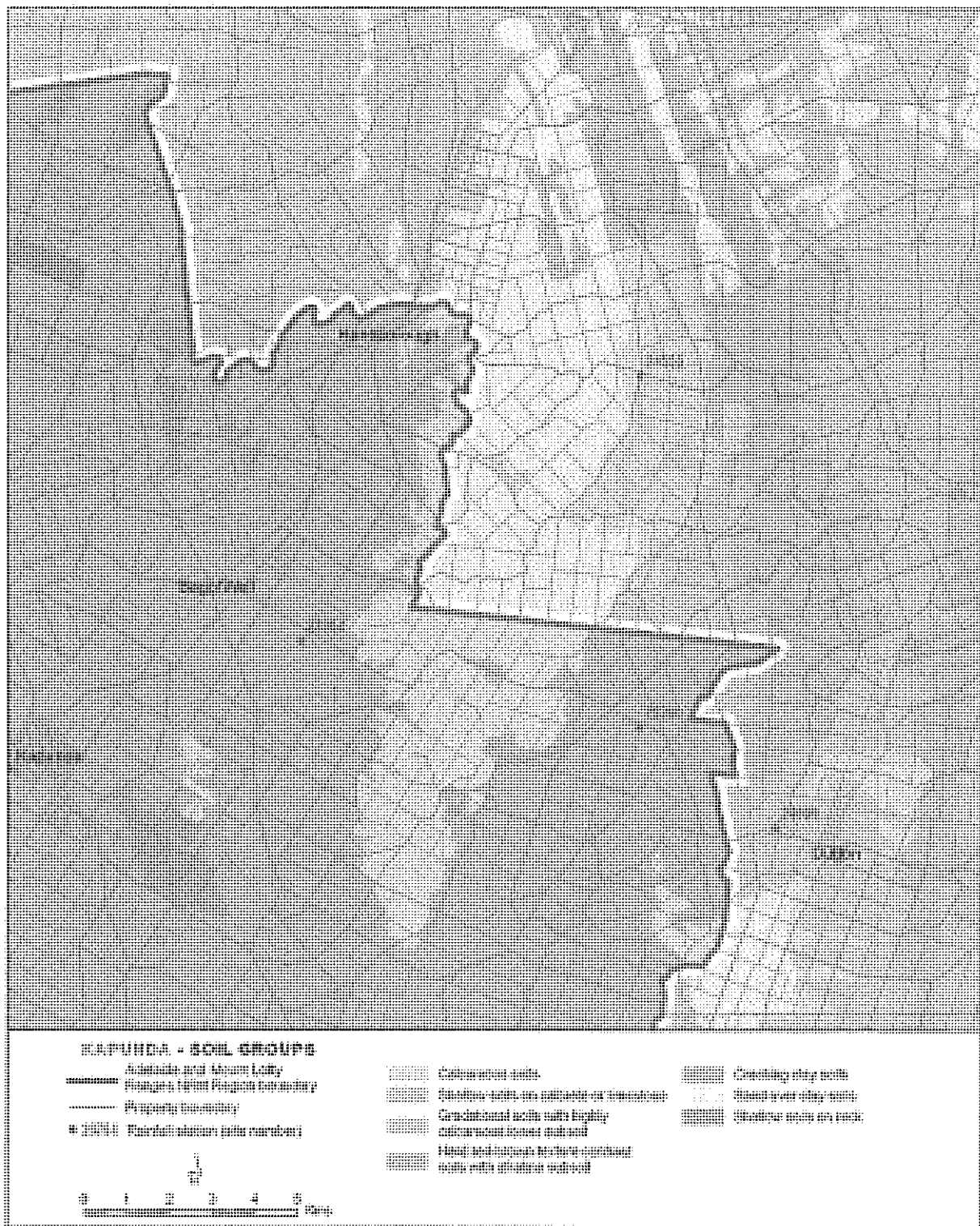


Figure 150. Kapunda soil groups
Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

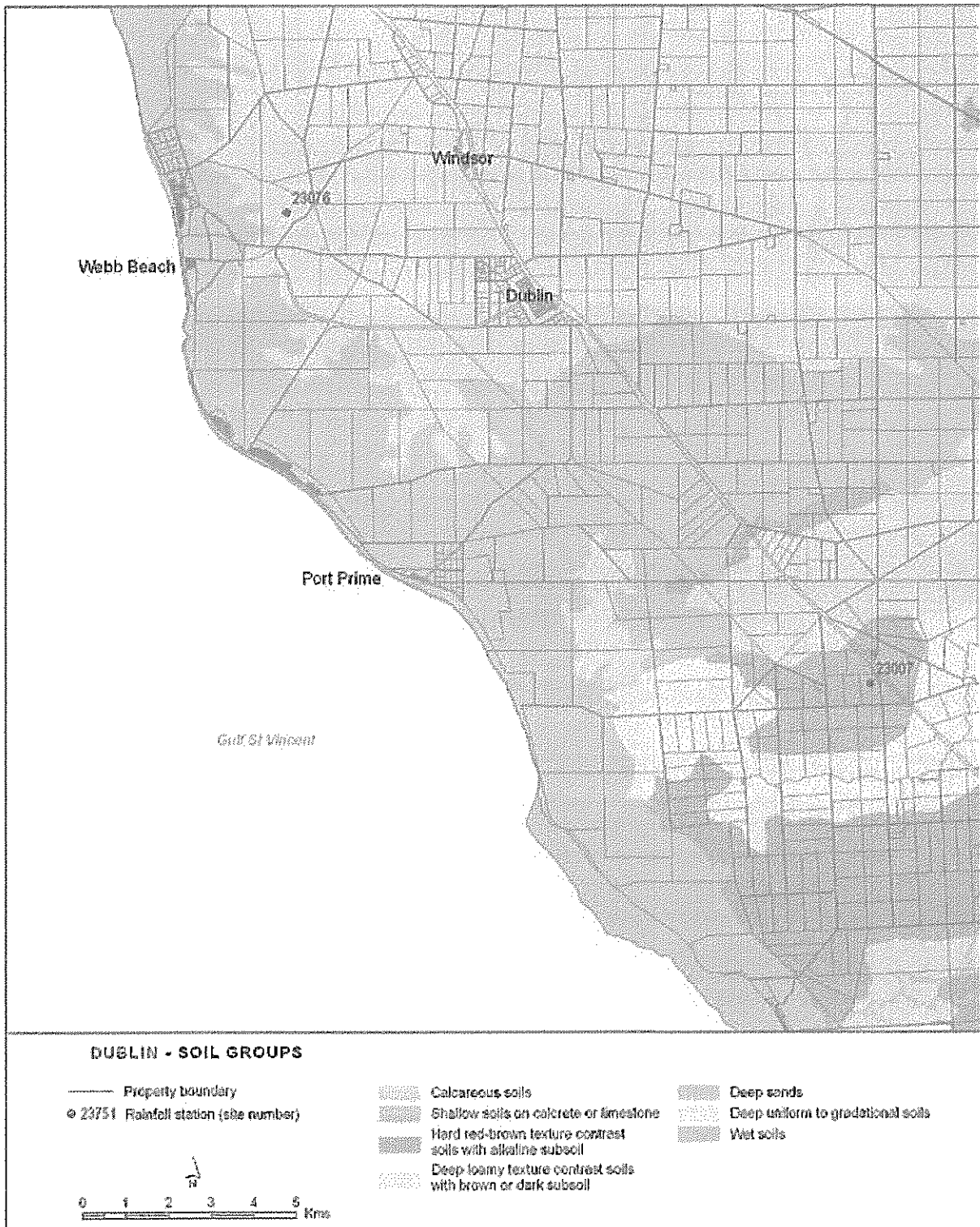


Figure 151. Dublin soil groups
 Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

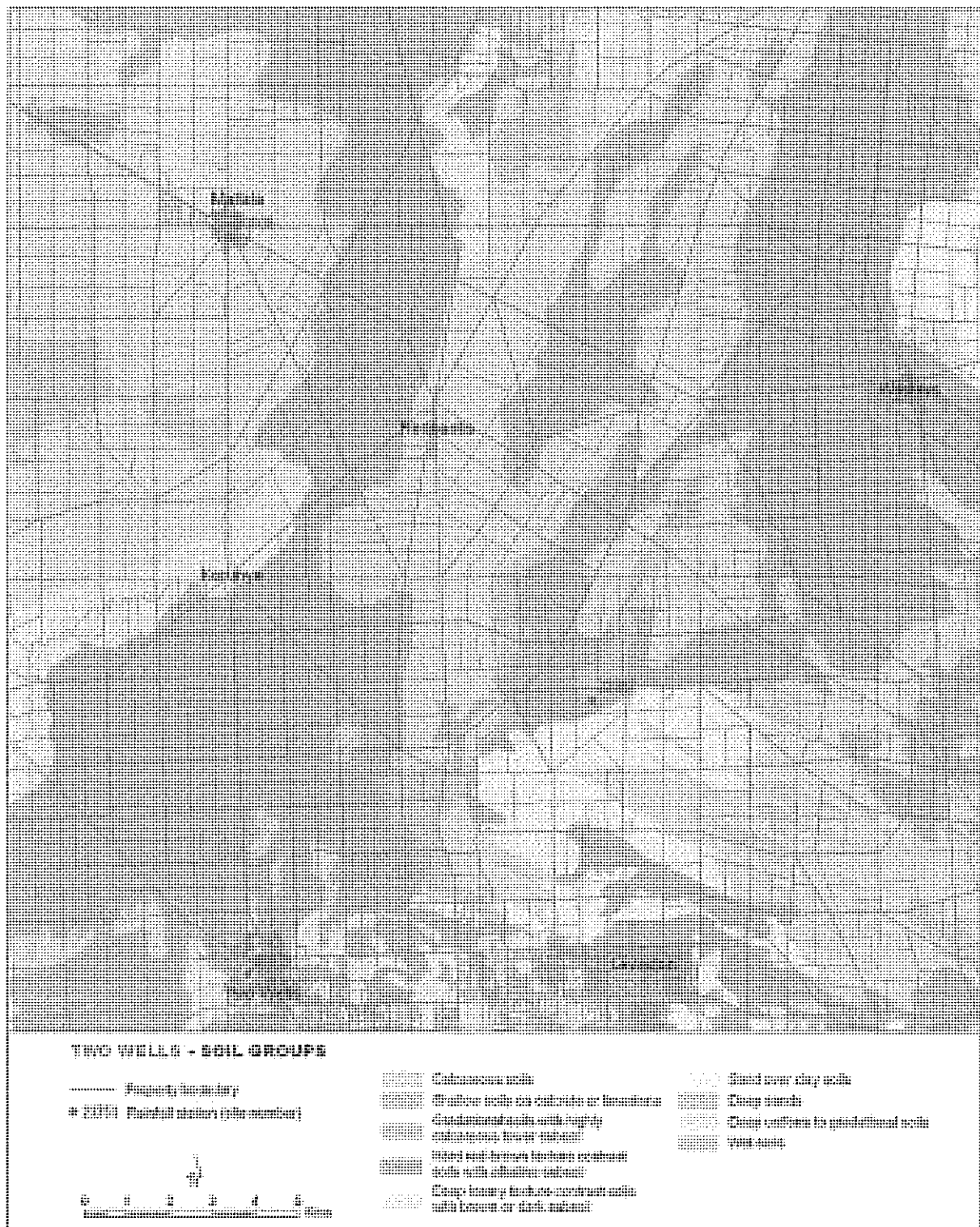


Figure 152. Two Wells soil groups
 Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

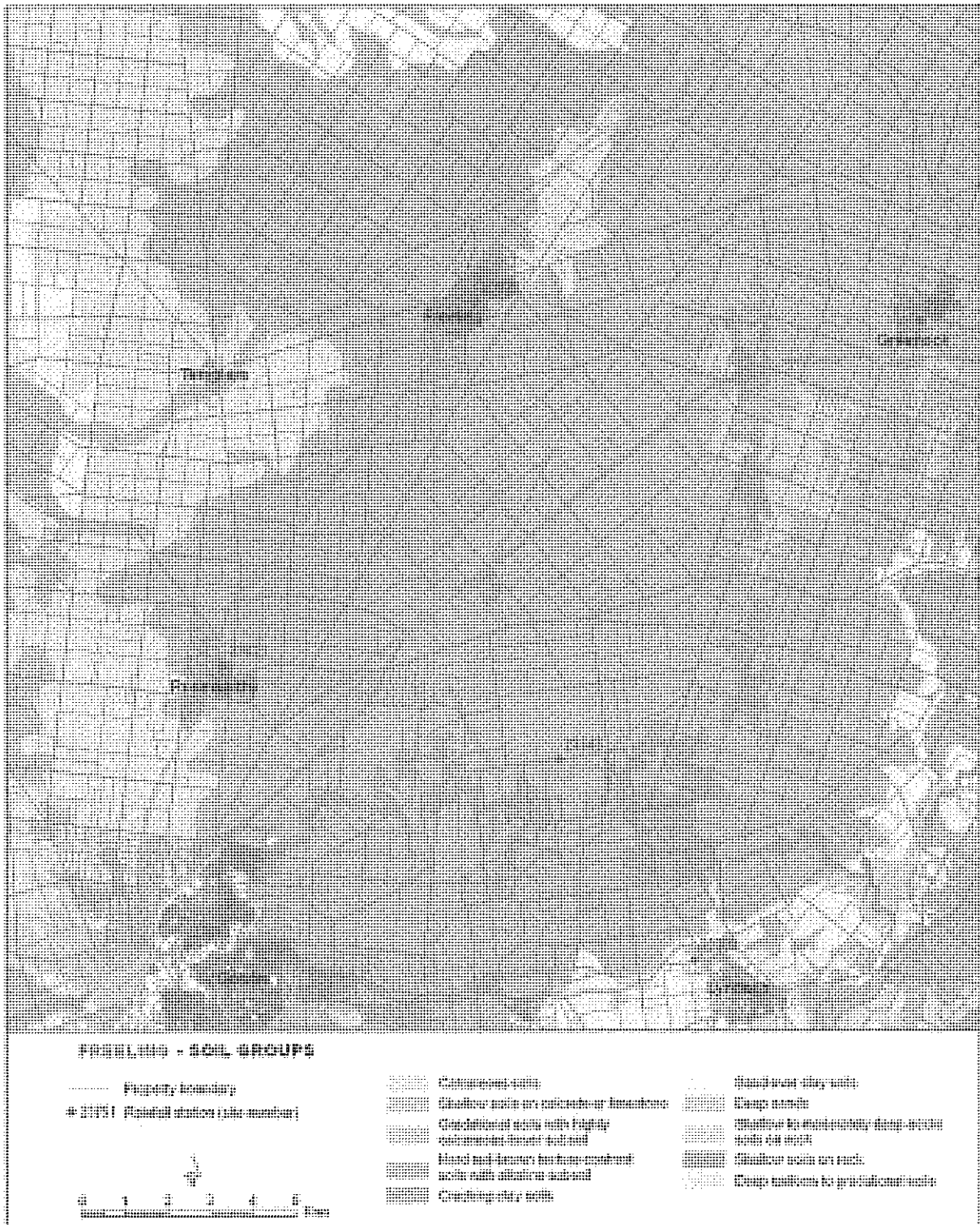


Figure 153. Freeling soil groups
 Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

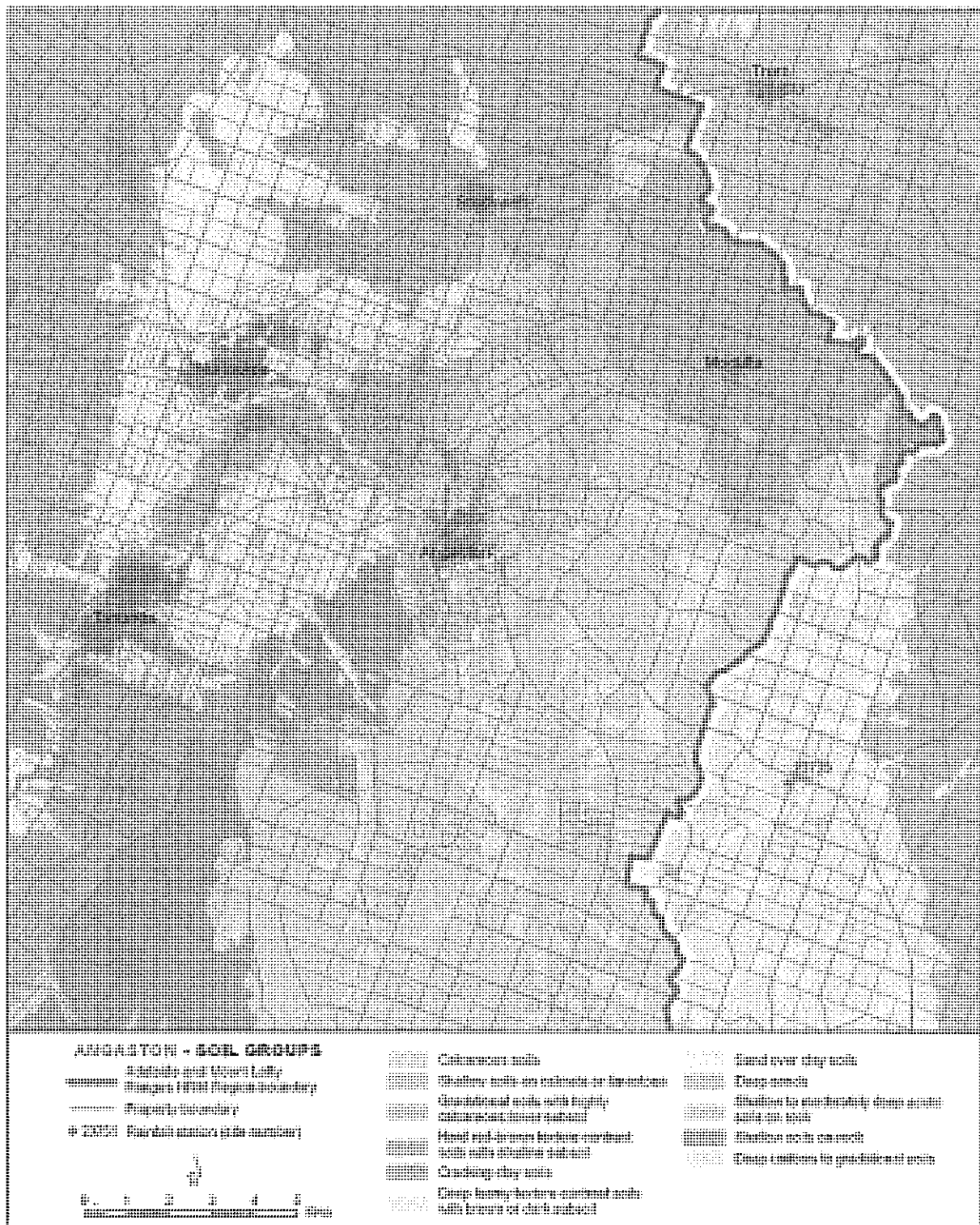


Figure 154. Angaston soil groups
Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

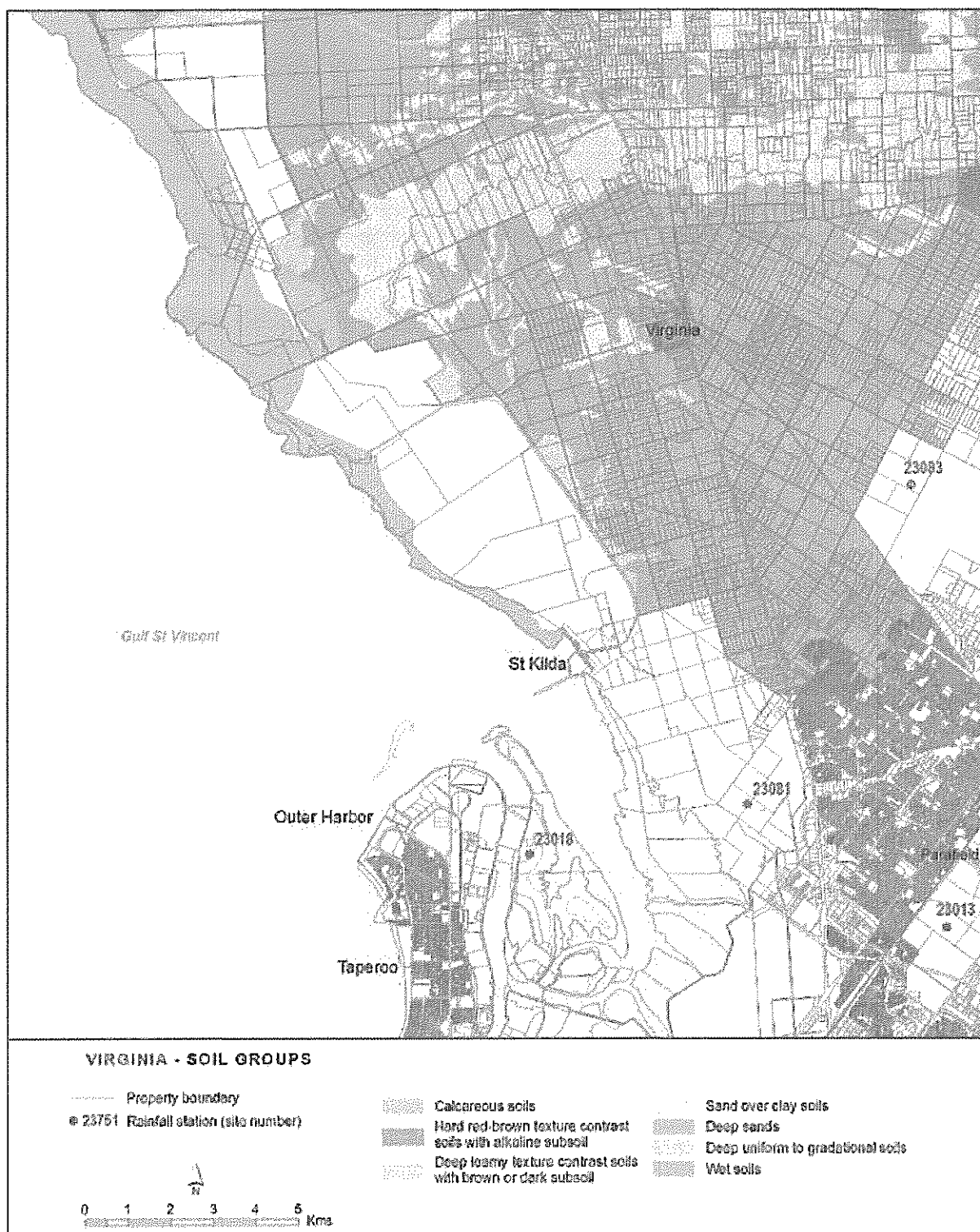


Figure 155. Virginia soil groups
 Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

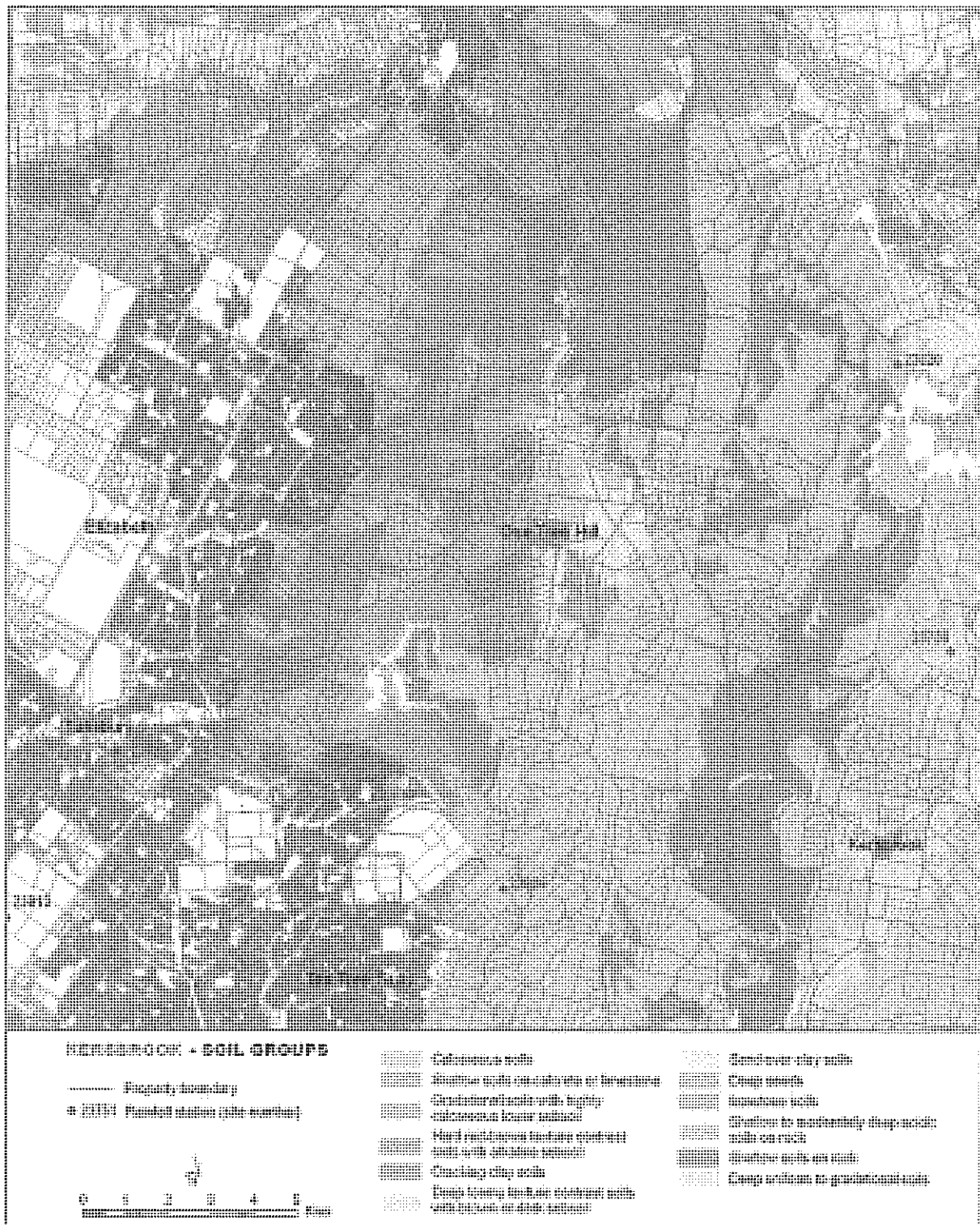


Figure 156. Kersbrook soil groups

Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

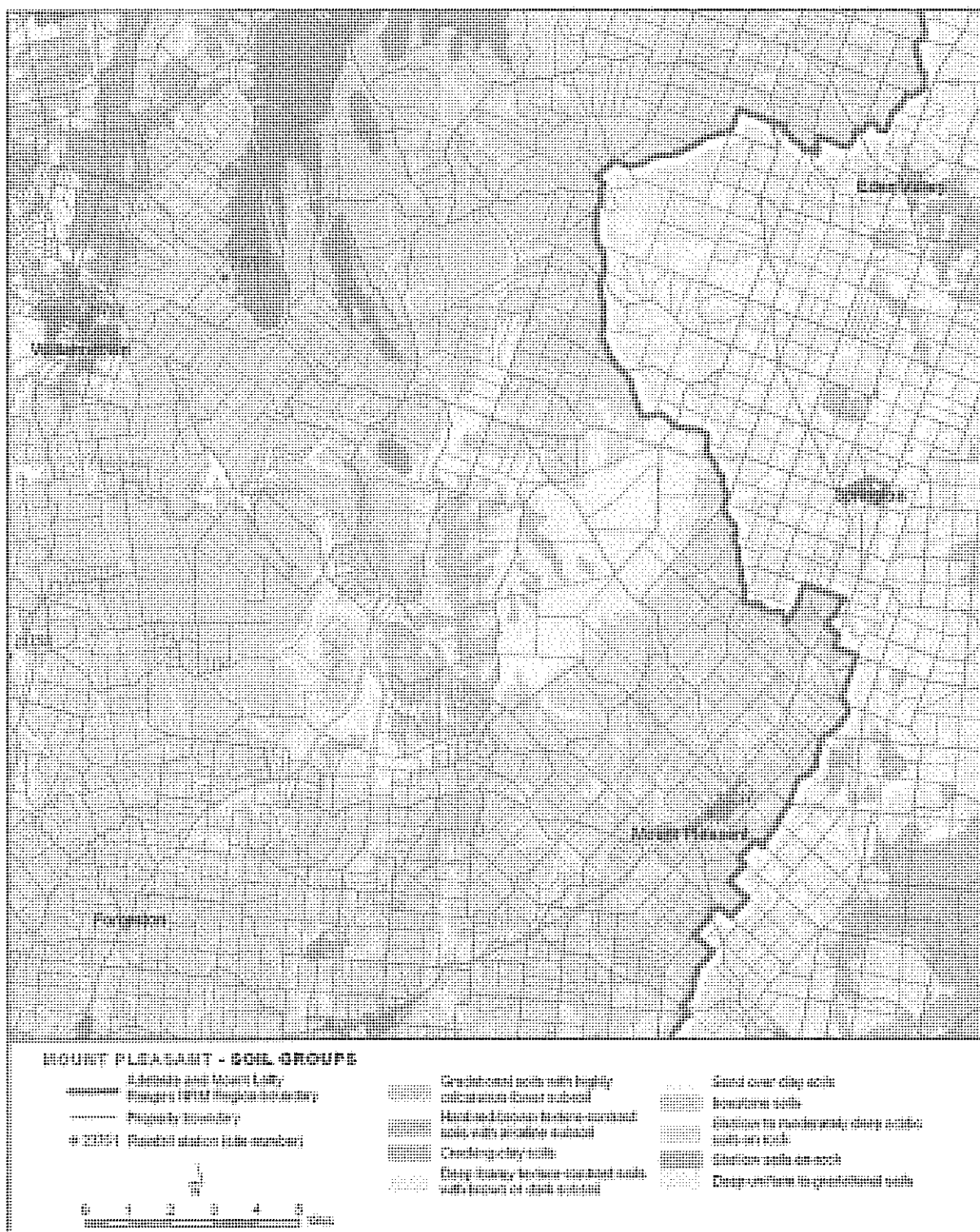


Figure 157. Mount Pleasant soil groups

Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011



Figure 158. Adelaide soil groups

Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

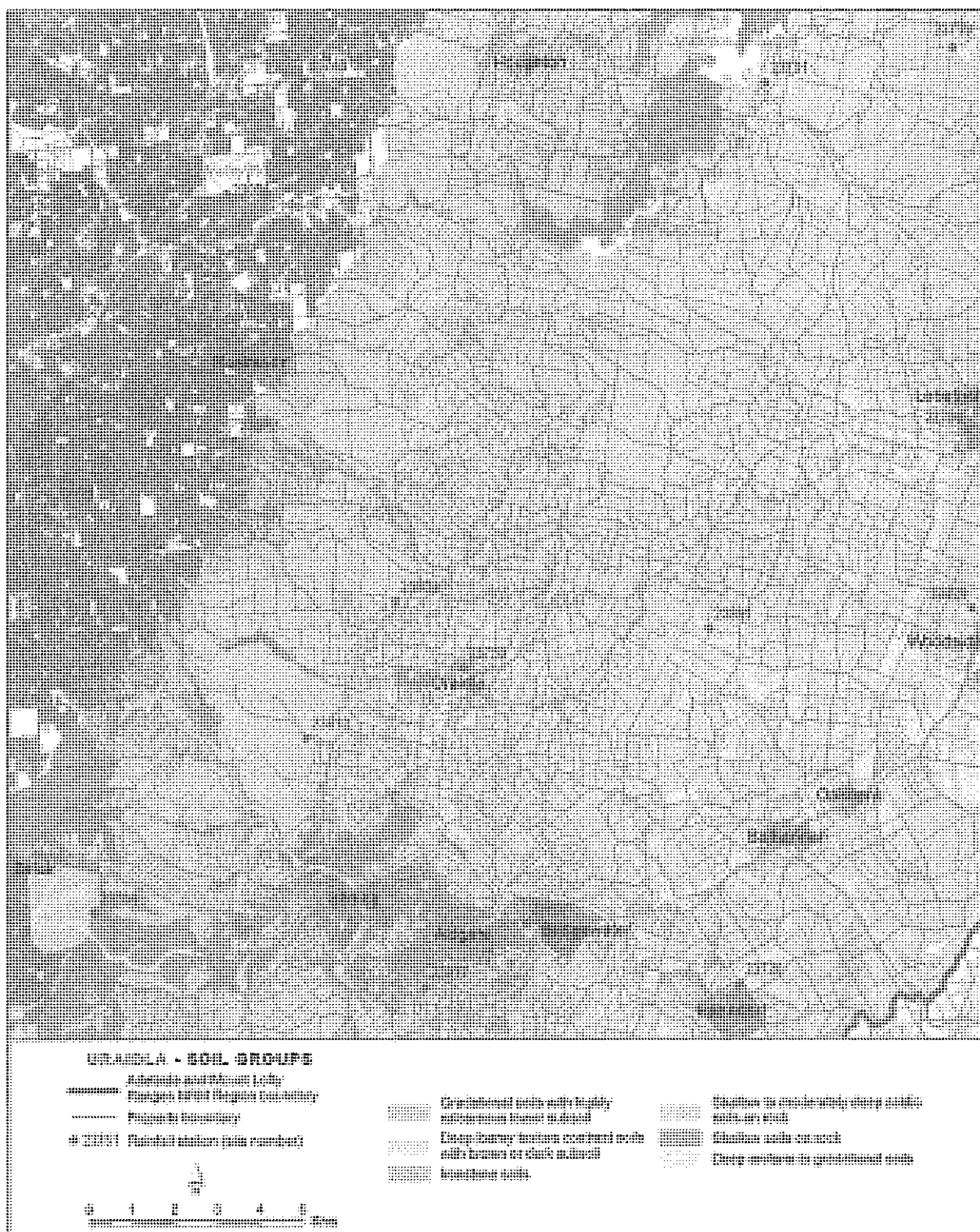


Figure 159. Uraidla soil groups
Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

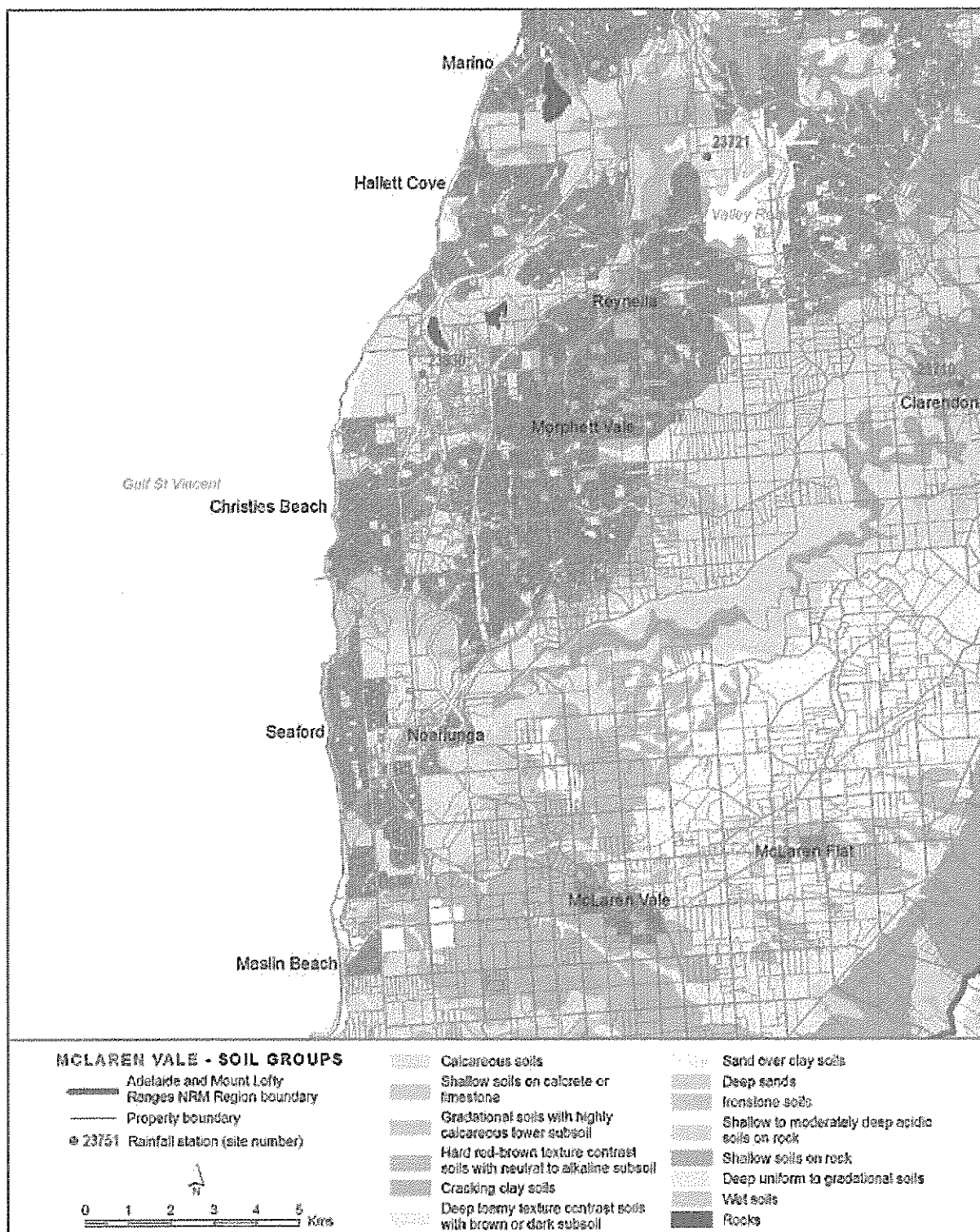


Figure 161. McLaren Vale soil groups

Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

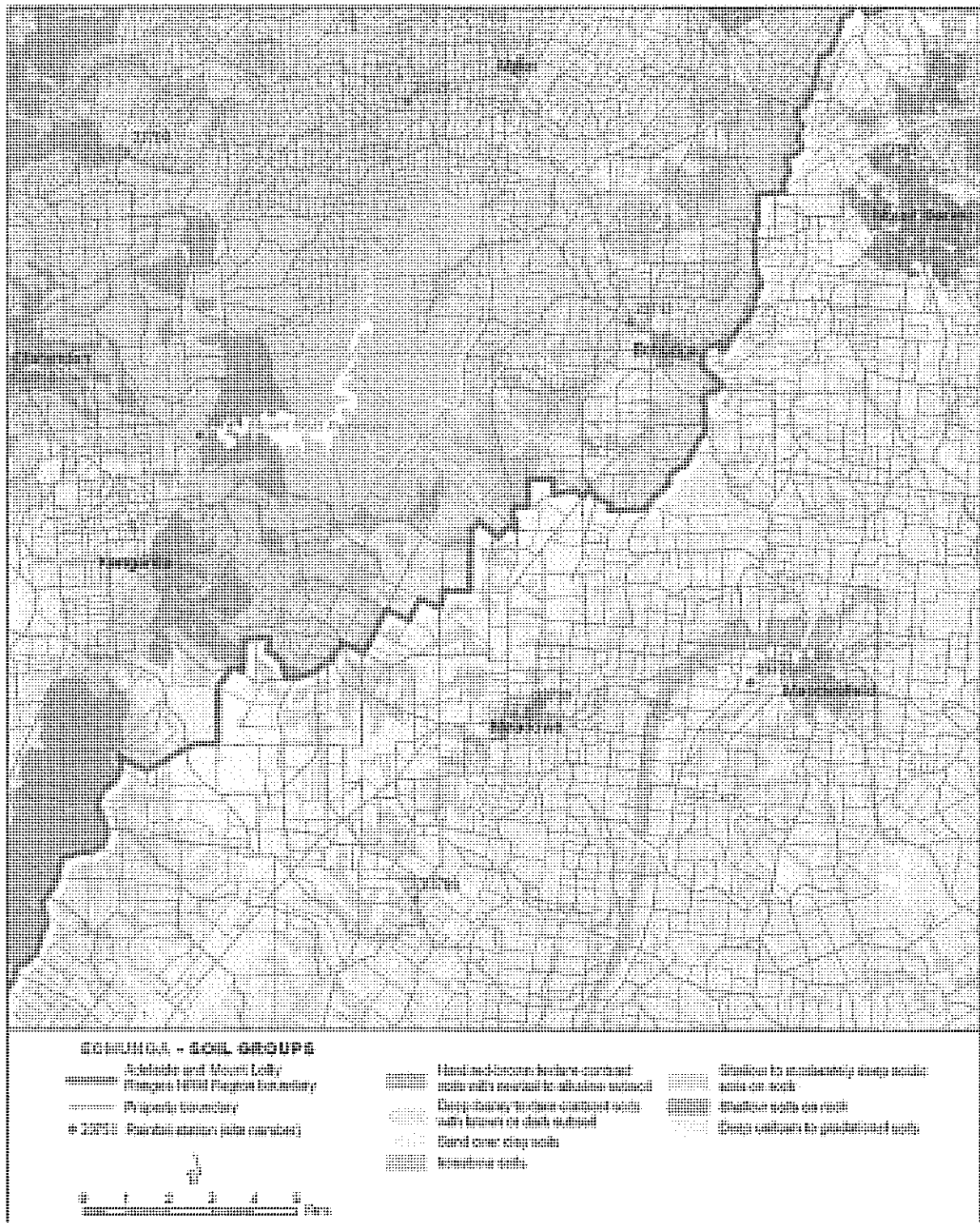


Figure 162. Echunga soil groups
Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

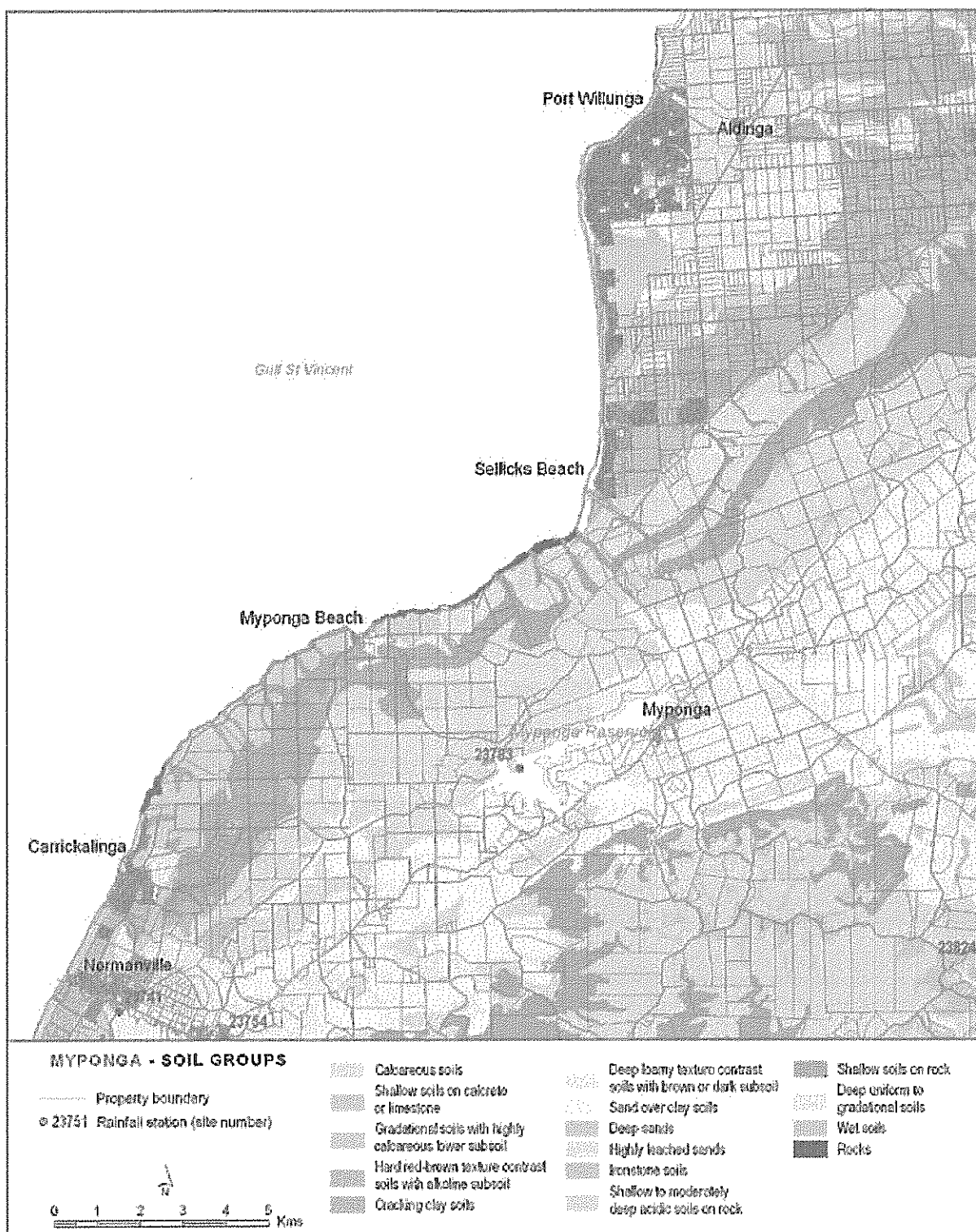


Figure 163. Myponga soil groups
Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

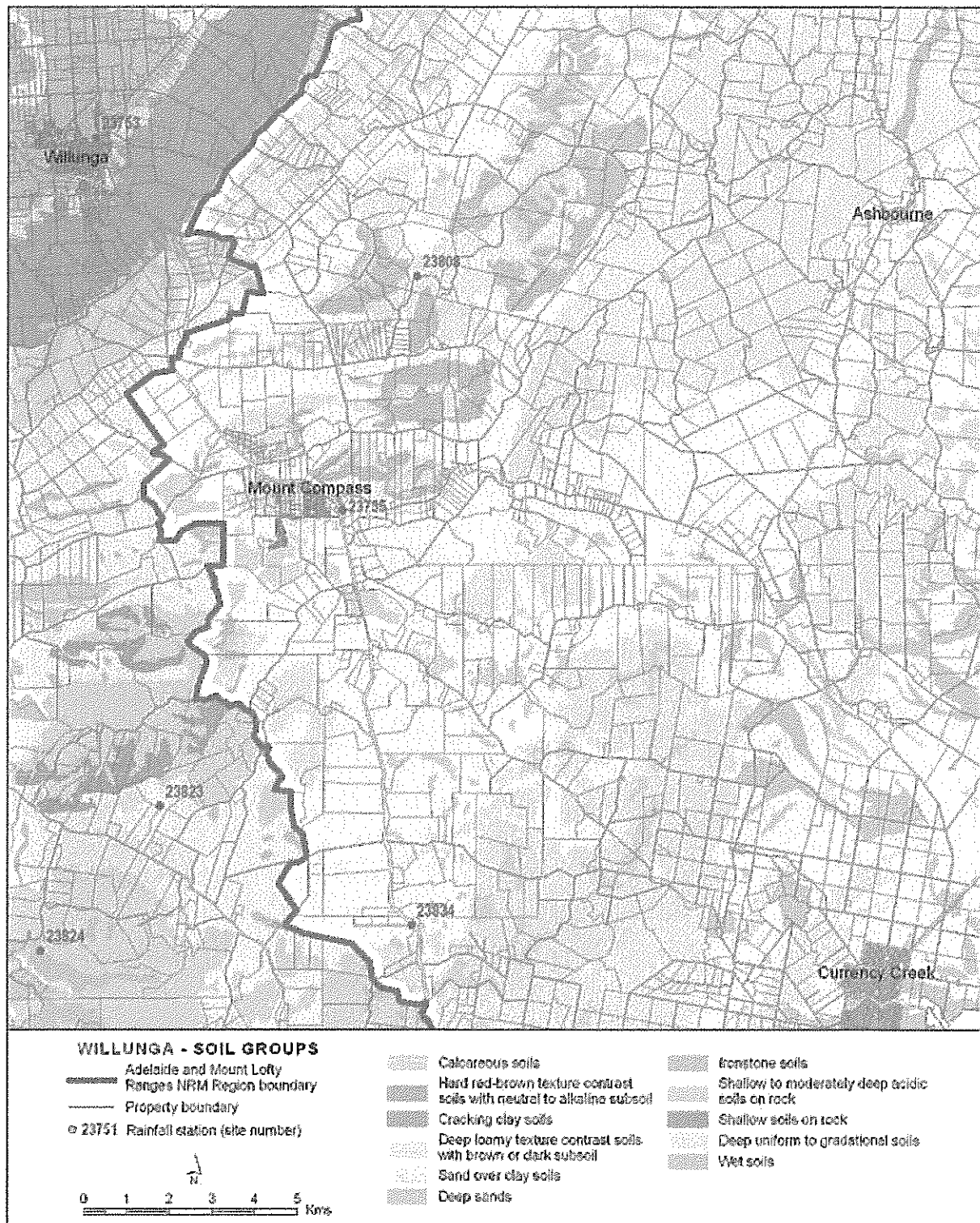


Figure 164. Willunga soil groups

Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

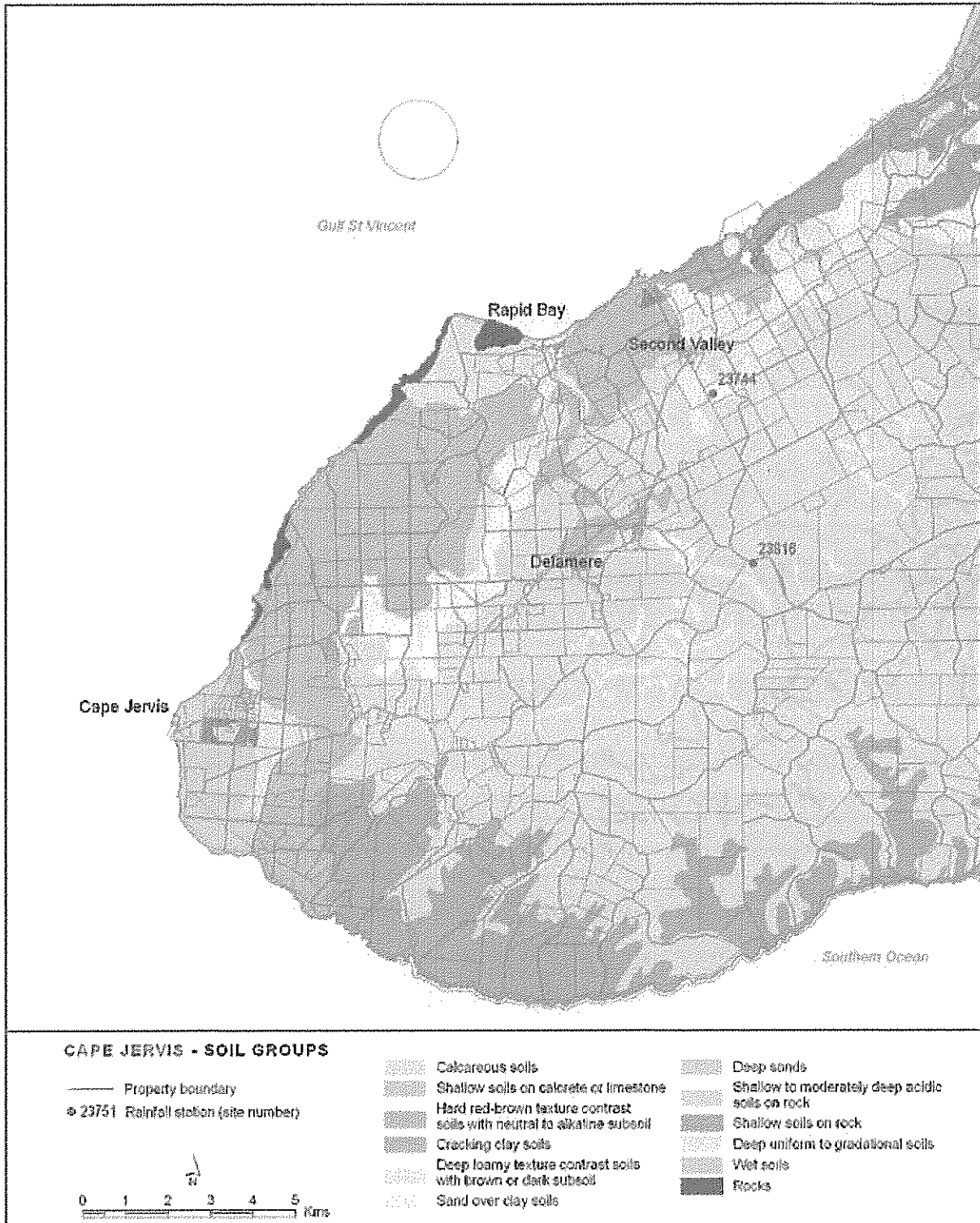


Figure 165. Cape Jervis soil groups
Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

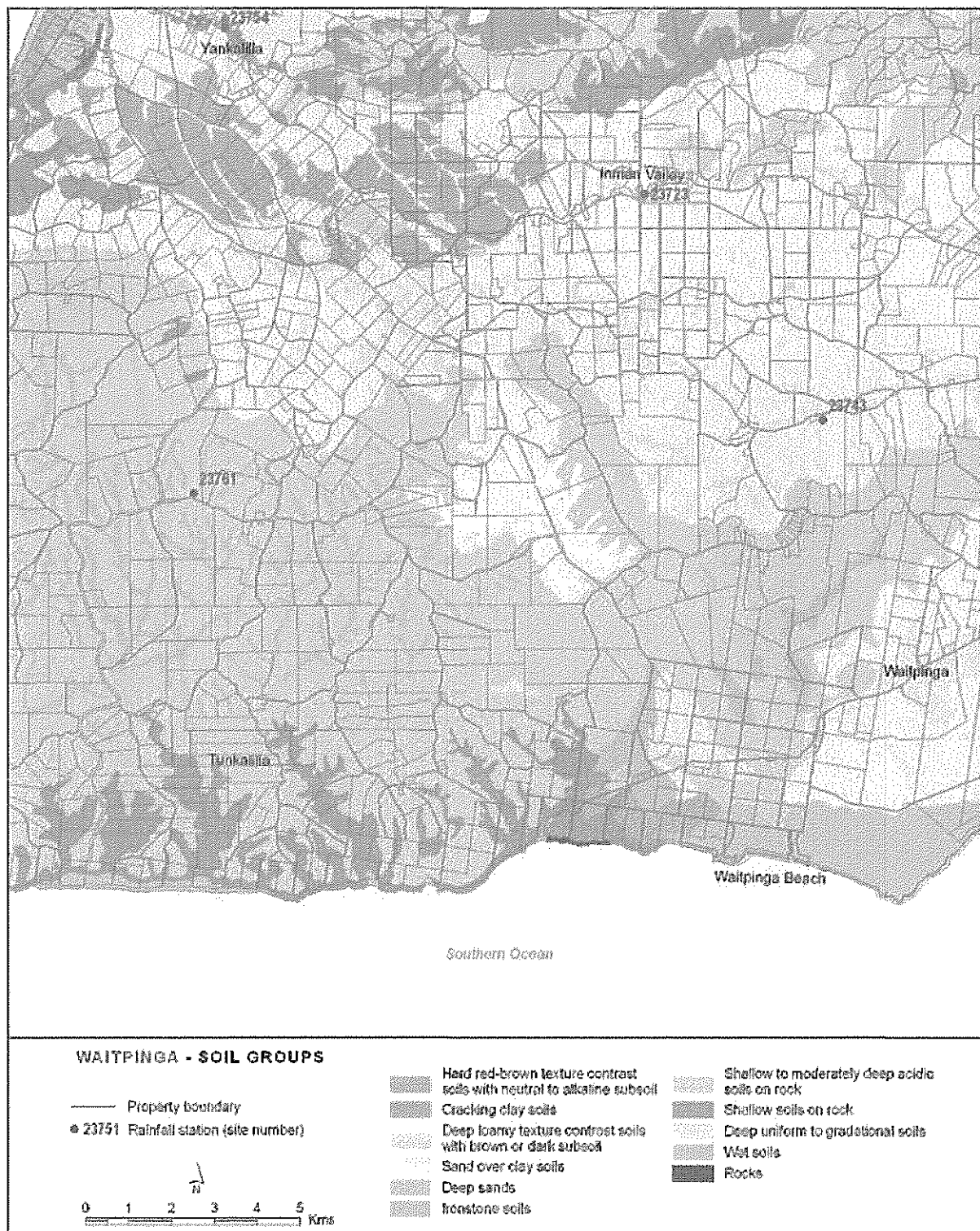


Figure 166. Waitpinga soil groups
Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011

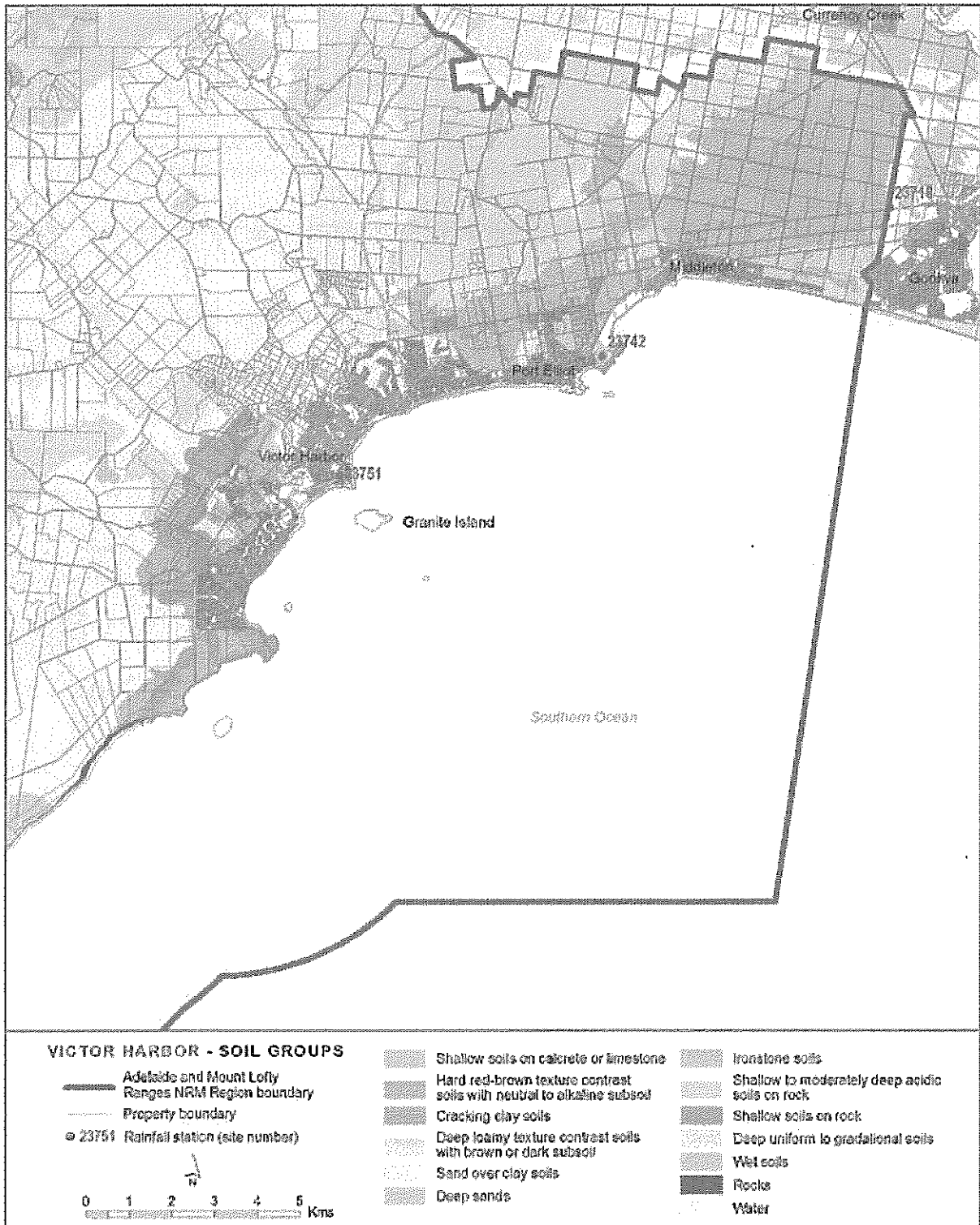
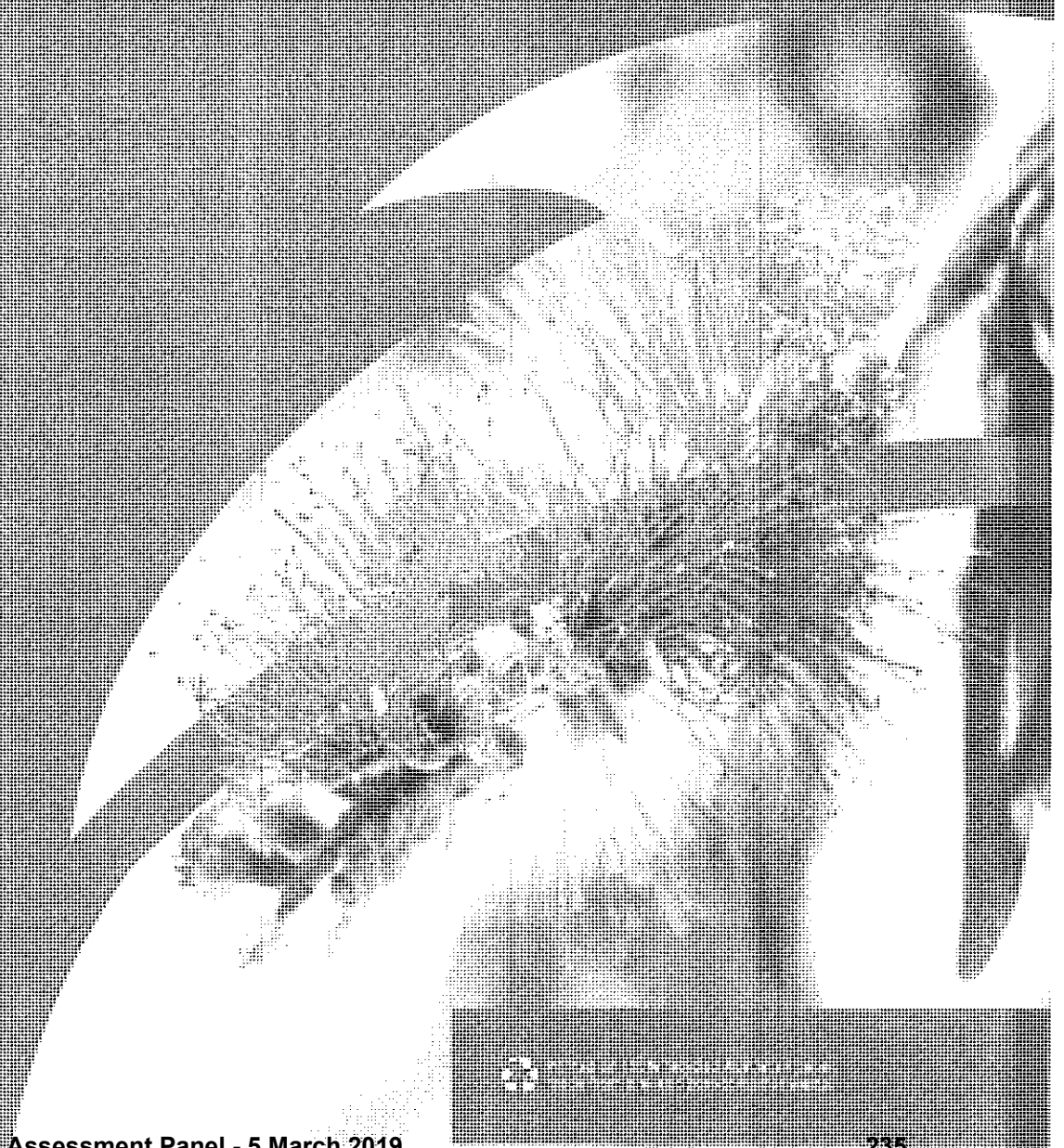


Figure 167. Victor Harbor soil groups
 Map: Science Resource Centre, Department of Environment and Natural Resources, June 2011



2nd January 2019

Janine Lennon
Assessment Officer Planning
Barossa Council
PO Box 867
Nuriootpa, SA 5355

PO Box 67, Springton SA 5235
p. 08 8568 2037 m. 0488 451 970
henri@regionalplanningdirections.com.au
www.regionalplanningdirections.com.au
ABN 80 152 935 852

Dear Janine,

APPLICANTS RESPONSE TO COMMENTS RECEIVED (DA No. 969/533/2018)

I write on behalf of L J and V R Heath (my Clients) in response to the representations from the Category 3 Public Consultation process for their proposal to keep three horses on a rural living property at 41 Randalls Road Flaxman Valley.

Two representations were received including one from Mr. Gibson and Ms. Epstein, and another from Mr. Zander who are owners of adjoining land. The submissions and the issues raised are addressed individually herein.

Representation by Mr. Gibson and Ms. Epstein

The issues raised in the representation are summarized as follows:

- They are in the process of seeking conversion to organic certification for their vineyard and wine making on adjoining property.
- They question the compatibility of the proposal with viticulture through the potential use of pesticides and herbicides.
- They suggest that creosote posts are causing odors, are a known carcinogen with a Hazard rating of H6 and request creosote fencing not be used in order to fit in visually and be free of contaminants.
- They want measures to be taken to prevent toxic substances from entering their property.
- They expressed concern about odors from urine and faeces from horses and potential for odours to mask Rett a serious fault affecting some wineries and vineyards.
- Potential for windborne dust due to overstocking of horses.
- Applicants need to commit to monitoring, evaluation, and adjusting management strategies to reduce the potential for introduction of weed seeds and soil management, to prevent spread of disease, weeds, and reduce chemical use.
- The applicant should establish screen planting of locally indigenous species or move permanent horse fixtures well south of the property boundary.
- Request shed service areas be screened to overcome untidy appearance visible from their property.

Applicant's response

The applicants have considered the issues in the representation and provide the following response:

- Many of the issues raised emanate from the organic certification process. Organic certification usually relies on an internal buffer and in this instance my Client's are being asked to provide the buffer. Mr. Gibson and Ms. Epstein should consult with neighbors about the certification process. Furthermore we are not aware that a winery had Development Authorization for the adjoining property.
- The area comprises a mix of land use including rural living, viticulture, grazing, tourism, and dog kenneling. The proposal is only for 3 horses, is to be combined with a sustainable management regime, and as such would be a compatible activity.
- According to the local distributor (Farmer Johns) the creosote posts used are a H4 category suitable for farm fencing and they do not have a H6 rating. Nevertheless my Client is prepared to use normal post and wire fencing to replace the remaining boundary fences on the subject land in conjunction with the neighbors. However the small sections of creosote post fences already installed will remain as Mr. Gibson was consulted about the replacement fencing on his southern boundary and had no objection at the time.
- Chemical use will be in accordance with chemical guidelines for use in rural areas although my Clients are prepared to consider any reasonable requests. As mentioned Mr. Gibson and Ms. Epstein should consult with my Clients regarding special needs for organic certification particularly if they need an organic buffer to extend onto neighboring properties.
- Five horses have been kept on the property for the past 4 years and the proposal reduces the number to three horses whilst introducing appropriate management.
- According to an experienced local Vigneron, Rett does not smell like horses, is not caused by horses, and can be difficult to detect regardless of whether horses are kept next door.
- The definition of horse keeping is not a standard for the number of horses able to be kept. It is merely a trigger for requiring development authorization and the number of horses has been significantly reduced.
- Clean hay from local sources will be used where possible to minimize the spread of weeds and the use of chemical sprays.
- Dust will be minimized through use of dust free sand on the exercise arena, the round yard, and horse yards, plus through pasture management. My Clients intention is to manage the property in accordance with a property management plan.
- The horse yards and shelter will be moved well south of Mr. Gibson and Ms. Epstein's boundary, and screen planting will be established as per the amended site plan.
- The shed is hardly visible from Mr. Gibson and Ms. Epstein's dwelling. A combination of screen planting along the boundary and existing planting on the neighbour's property will further screen the shed.
- The area could also benefit from a major clean up of Mr. Gibson's property in the highly visible location adjacent to Randalls Road where a significantly untidy outdoor storage area has been established adjacent to the subject land and directly visible from the neighbour's dwelling.

Mr. Gibson and Ms. Epstein did not indicate whether they wanted to be heard by the Council Assessment Panel (CAP).

Representation by Mr. Ben Zander

The issues raised in the representation are summarized as follows:

- Mr. Zander's family has owned and operated farms in Flaxman Valley for 98 years including the two properties adjacent to the applicant's used for viticulture and grazing.
- The property is visited by world-class sommeliers and other VIP guests for wine tasting and two have expressed concerns about the horse related infrastructure close to the vineyards.
- The new outbuilding is visually obtrusive although not part of the application.
- The retaining walls, round yard, day yards, exercise area and associated equipment detracts from the visual amenity.
- He suggests that Principle 7 requires a 30 metre buffer from boundaries for all yards including the round yard and exercise arena.
- The round yard and rectangular exercise yard are located adjacent to the western boundary not the eastern.
- There should be three shelters with one per horse located at least 30m from property boundary. The shelters are smaller than 4mx4m.
- There are only 1.25ha for grazing 3 horses plus 1.52 in the spelling paddock. The stocking rate would be equivalent to 40 Dry Stock Equivalents (DSE) at 13.5 DSE / horse and the stocking rate should be 3 to 4 DSE per hectare equating to between 1 and 2 horses.
- He is concerned with the storage of manure in the shed being closer than 30m from the boundary
- He suggests the use of creosote and specific horse fencing will be visually imposing and inconsistent with the character of rural fencing in the area.
- 30% groundcover would not be enough for sloping sites particularly close to the water course on the adjoining property and should be more like 70%
- He suggests that the existing fire fighting supply should not be used to reticulate to water troughs as this would mean the fire fighting supply would no longer be dedicated.
- He is not aware of attempts by the Applicant to plant shelterbelts and is concerned that day yards, round yard, and exercise arena would not leave sufficient space to plant along the boundary.
- The other neighbors have shortened their vineyards and planted trees to reduce odour impacts from the Applicants property.
- He questions the rainfall figure indicated in the Property Management Plan as not being consistent with his own recordings and the 2009 Water Allocation Plan.
- The plan is a futuristic plan and is not currently reflected in the activities.
- The horses are to be kept in yards adjacent to our property boundary for summer months when pasture is limited raising concerns about a lack of buffers.
- He is concerned that the Applicant will introduce weeds to the area.
- He questions the planting of native pine, as it is uncommon in the area.
- He suggests that the keeping of more than one horse per hectare is intensive animal keeping and the intensive animal keeping guidelines would apply. He suggests the

adjoining eight properties should be notified of an intensive animal keeping operation and does not support approving the application, as it is an intensive animal keeping operation.

- His objection would be overcome if the applicant have more regard for their neighbors and the local area in terms of visual effects, and siting of stables, shelters and associated yards and two horses would be the maximum supportable.
- A final concern raised by Mr. Zander was that the two horses removed from the property had been moved across the road and not to Eudunda as previously stated and he was concerned that my Clients may be intending to move them back onto the subject land once development authorization has been obtained.

Mr. Zander indicated that he did not want to address the panel in relation to his representation unless the panel wanted to ask him any questions.

Applicant's response

The applicants have considered the issues in the representation and provide the following response:

- Although Mr. Zander's family has been in the area for a while he does not reside on the adjoining properties, no dwelling is located there, and the family is unlikely to have owned the two properties for 98 years.
- It cannot be confirmed whether comments from visiting sommeliers would have only been in relation to my Client's property or if they included reference to the appearance of Randalls Road more generally. Currently the untidiness in the locality is not due to my Client's horse keeping as Mr. Gibson's property currently has the appearance of an outdoor storage yard and it is unfair to single out my Client's for blame.
- Nevertheless my Client's are thankful for Mr. Zander's neighborly assistance with the erection of the creosote fence posts adjacent to his and Mr. Gibson's property but it would have been preferable if both Mr. Zander and Mr. Gibson had voiced their objections at the time. As it is rural post and wire fencing is not the only legitimate form of fencing in the locality including extensive corrugated iron fencing.
- The existing outbuilding has already been approved and as such its appearance is not relevant to the application.
- The exercise arena will be reduced by 1.5metres from the western boundary to create space for screen planting (see amended plan). Sand will be removed and replaced by topsoil so that the boundary wall retains less than 1m in depth.
- Principle 7 applies to yards associated with horse shelters and stables. The yards associated with the shelters will be moved at least 30 metres from the property boundary (see amended plan). The shelters are purpose designed for horses and only fall slightly short of the guideline of 4m x 4m. In addition the two small yards adjacent to the round yard will be removed and screen planting provided.
- Dust from the exercise yard and round yard will be minimized by using special dust free sand for horses.
- We agree that the statement should read "adjacent to the western boundary" as pointed out by Mr. Zander.
- Stocking rates are for horse grazing throughout the year with minimal supplementary feeding and are not for horse keeping where groundcover is maintained through

rotational grazing, supplementary feeding, destocking, and keeping of horses in day yards with shelters.

- Manure will be moved to the garden area to the south of the dwelling and will be used in the garden with any excess bagged up and sold or given away.
- The aesthetic of the horse fence is relative and whereas it may offend some it is a mark of a horse keeping property consistent with fencing in rural areas. Nevertheless my Clients are no longer proposing to erect horse fencing using creosote along remaining boundaries where they have not already been erected but rather will replace substandard fencing with stock proof fencing and will be seeking a share of the cost from the neighbors in accordance with the Fences Act. Creosote fencing will still be used for internal fencing as it is the safest form of fencing for horses.
- A 70% groundcover minimum will be adopted as the standard for the steeper area within the spelling paddock closest to the watercourse.
- The existing fire fighting supply will be maintained exclusively for fire fighting purposes. Water for horse troughs will be supplied from a tank at the rear of the house and replenished from the existing dam.
- My Clients have planted considerable trees in the past but these were eaten by the neighbor's livestock. The proposal includes planting of shelterbelts along the property boundary adjacent to Mr. Zander's vineyards. The exercise arena will be reduced by 1.5m from Mr. Zander's boundary and the two existing horse yards will be removed to facilitate planting as per comments above.
- Mr. Zander speculates on the reasons for the other neighbor increasing the setback from his vines to the property boundary and providing a vegetated buffer. It is more likely to have been required to accommodate an internal buffer to satisfy criteria for organic certification.
- Rainfall was taken from a State Government GIS (Nature Maps) and changing it to suit Mr. Zander is immaterial to the application.
- The plan is futuristic as it represents the layout as proposed and subject to minor amendments in light of the representations. The proposed measures will be introduced once approval has been obtained.
- As mentioned earlier stocking rates are for open grazing of horses not for situations involving horsekeeping. The key to sustainable management of pastures is the maintenance of vegetation cover to at least 30% generally and 70% in the spelling paddock.
- As mentioned the small yards adjacent to the round yard and exercise arena will be removed. The exercise yards will only be used for exercising the horses and the other yards adjoining the Zander property are paddocks. Those yards associated with the shelters will be covered in compacted rubble and sand and will be used for destocking the paddocks and supplementary feeding the horses.
- As mentioned earlier the supplementary feed will be sourced from local suppliers with a reputation for clean produce.
- Native pine will be planted as it is a good screening plant and grows in the area albeit that it is uncommon. They could be replaced with *Acacia pycnantha* but these are relatively short lived and look untidy when they die.
- Intensive animal keeping excludes horse keeping and only the policies for horse keeping should apply. Intensive animal keeping includes factory farming and does not

provide a useful comparison to horse keeping especially where only three horses are involved. Three horses as proposed are a significant reduction from the five horses kept there for several years.

- Two horses were only temporarily moved across the road and have since been taken out of the area and will not be brought back to the property.

Summary and Conclusions

Mr. Gibson and Ms. Epstein allege that the number of horses proposed exceeds the allowable amount by three times and have concerns in relation to potential impacts due to visibility of fodder, materials, and obtrusive horse fencing. They are also concerned that horse odors could mask a condition known as Rett, and see the proposal as a threat to their future organic certification from potential chemical use to control weeds and through the use of creosote treated posts.

To overcome their concerns they see a need for strategies to prevent the negative affects, including moving the shelters and day yards away from the boundary, prevention of the use of creosote posts for fencing, and the provision of planting to screen the shed. Mr. Gibson and Ms. Epstein also seem to expect my Client's to maintain an organic buffer.

Mr. Zander expressed concerns about the suitability of horsekeeping in a wine growing area from a visual character, marketing, and brand perspective, and views the proposal as a form of intensive animal keeping potentially degrading the soil and groundcover. He mainly expressed concern in relation to the use of horse fencing, the positioning of yards, shelters, exercise yards, a retaining wall, and exceeding recommended stocking rates. To overcome his concerns Mr. Zander indicated that the Applicants should have more regard for their neighbors and the local area, and supports no more than two horses being kept on the property.

Both representations interpret the definition of horse keeping as a minimum standard. Mr. Zander even suggests that the proposal is a form of intensive animal keeping as it exceeds 1 horse per 3 ha and exceeds the recommended stocking rates for open grazing of horses. However the definition of horsekeeping is not a minimum standard as it only reflects the legal definition and threshold for horses to move from open grazing to a change of land use requiring provisional Development Plan Consent. Furthermore horsekeeping is clearly excluded from the definition of *intensive animal keeping*.

It is also our contention that the stocking rates referred to by Mr. Zander should only apply to open grazing of horses and livestock in general as horsekeeping by its very nature requires a corresponding management regime including pasture management, and supplementary feeding. At the same time it is our position that the proposal is a substantial improvement on the previous unapproved situation and incorporates a sustainable management approach.

Whilst my Clients are willing to accommodate any reasonable requests, it is Mr. Gibson and Ms. Epstein who should be consulting them and other neighbours on the organic conversion process. My Clients aim to minimize any odour impacts by ensuring that faeces is cleaned up daily and is placed in their garden area and it is unlikely that the proposal would result in masking of Rett.

Finally we submit that the proposal is consistent with rural living in a locality of mixed visual and land use character. The views of neighbours have been taken into account in

amendments incorporated in the attached revised site plan including minimizing the extent of horse fencing using creosote, moving the shelters and horse yards well away from boundaries, removing the smaller horse yards adjacent to the western boundary, and reducing the exercise arena to provide room for screen planting.

I hope the above is satisfactory to Council and we again recommend the proposal for favorable consideration.

Please advise when the matter will be considered by the CAP as my Clients would like to attend the meeting.

Should you require additional information or have any questions in relation to the above please do not hesitate to contact me on 08 85682037 or 0488451970 or via email on henri@regionalplanningdirections.com.au

Yours sincerely



Henri Mueller

DIRECTOR – REGIONAL PLANNING DIRECTIONS

Attachments:

Amended Property Management Plan

Amended Site Plan

7. REPORTS – APPLICATIONS TO PROCEED/NOT TO PROCEED TO ASSESSMENT

Nil.

8. REPORTS – DEFERRED APPLICATIONS FOR DECISION

8.1 960/425/2018 (1-15 Murray Street, Nuriootpa)

APPLICATION DETAILS

PROPOSAL	Installation of generator (retrospective)
APPLICANT	The Community Co-Operative Store
OWNER	The Community Co-Operative Store
APPLICATION NO	960/425/2018
CERTIFICATE(S) OF TITLE	CT 6191/67
AREA	6.02ha
CURRENT USE	Shopping Centre
DEVELOPMENT PLAN VERSION	Consolidated - 11 August 2016
ZONE	District Town Centre / Residential
POLICY/PRECINCT AREA	Nil
OVERLAYS	Nil
APPLICATION TYPE	Merit
CATEGORY OF DEVELOPMENT	Category 2
REFERRALS	Nil
PREVIOUS APPLICATIONS	960/439/2014
ASSESSING OFFICER	Dylan Grieve/Janine Lennon
RECOMMENDATION	That Development Plan Consent be GRANTED

BACKGROUND

The proposal was presented to the 13 November 2018 Barossa Assessment Panel for a decision. After hearing the representor's concerns and the applicant's response the Panel determined to defer consideration of the item pending the applicant providing the following:

Additional information in relation to justification for the proposed siting of the generator, setbacks, location of access paths, noise emissions and vibrations and exhaust fumes and consideration of additional conditions.

The requested information was received from the applicant on 11 February 2019, the proposal is therefore now presented to the Panel for a decision.

Attachment 1 provides a copy of the additional information requested by the Panel.

Attachment 2 provides a copy of the report presented to the November 2018 Panel meeting.



Figure 1: Site Photo



Figure 2: Site Photo



Figure 3: Site Photo

APPLICANTS RESPONSE

As detailed in the background, the Panel asked the applicant to provide the following:

Additional information in relation to justification for the proposed siting of the generator, setbacks, location of access paths, noise emissions and vibrations and exhaust fumes and consideration of additional conditions.

These points have been addressed by the applicant as follows:

Proposed siting of the generator

Generator was sited to be in close vicinity to the key electrical services including the transformer and switchboard which serve the facility. The siting is in accordance with manufacturers specifications.

Setbacks

The setbacks are in accordance with manufacturers specifications.

Location of access paths

Access to the generator is from the adjacent open service yard area.

Noise Emissions

A noise assessment has been provided by Sonus stating:

The noise from the generator was measured within and outside the adjacent office on Thursday 19 October, 2017 with the generator idling. The noise from the generator under load was measured outside the adjacent office on Tuesday 8 January 2019. Based on these measurements and the difference between the idling and full load generator, the following noise levels are estimated:

Location	Predicted Generator Contribution
Men's Toilet	43 dB(A)
Women's Toilet	38 dB(A)
Filing Room	37 dB(A)
Office	39 dB(A)
Reception	41 dB(A)
Kitchen	45 dB(A)

The *Environment Protection (Noise) Policy 2007* (the Policy), provides the following standards:

Location	Design Sound Level Range
Executive office	35 to 40 dB(A)
General office area	40 to 45 dB(A)
Toilets	45 to 55 dB(A)
Reception areas	40 to 45 dB(A)
Rest rooms and break-out spaces	40 to 45 dB(A)
Cafeterias	45 to 50 dB(A)

The Sonus report demonstrates that should the generator be running at full load, it is not expected to exceed the Policy noise standards in the adjacent office.

Vibration Emissions

A vibration assessment has been provided by Sonus stating:

To assist in the assessment of the potential impact from ground vibration, reference is made to Australian Standard AS2670.1:2001, "Evaluation of human exposure to whole-body vibration Part 1: General Requirements". The Standard includes:

Perception

Fifty percent of alert, fit persons can just detect a Wk weighted vibration with a peak magnitude of 0.015m/s².

There is a large variation between individuals in their ability to perceive vibration. When the median perception threshold is approximately 0.015 m/s², the interquartile range of responses may extend from about 0.01 m/s² to 0.02 m/s² peak. The level of ground vibration was measured at approximately three metres to the generator on Tuesday 8 January 2019, at a time when the generator was operating at full load. This location was chosen to be similar to the distance where a person might be located in the closest room of the office. A peak weighted vibration (Wk) of 0.002m/s² was recorded at this location. Based on this vibration measurement, it is unlikely that ground vibration from the generator could be perceived at any point within the office.

Masterplan's response does not address building impact with regard to vibration emissions.

Exhaust fumes

The exhaust outlet of the generator is positioned on top of the unit and discharges vertically upwards. The generator has been sited such that the exhaust outlet is located

away from the walls located to the north and east of the unit. The generator is sited in accordance with manufacturers' specifications.

Additional Conditions

Condition(2) Maintenance and testing of the generator shall only occur between 6 .00 pm and 10.00 pm and the occupiers of 17 Murray Street, Nuriootpa shall be given 24 hours' notice of such maintenance and testing.

Given the advice from Sonus is that the generator can operate at full load continuously and meet the goal noise requirements of the EPP, this condition is not necessary and should not be imposed on a consent.

Condition(5) A dilapidation report shall be prepared including photographs and/or video footage to document the pre-development structural condition of all buildings on adjoining land at 17 Murray Street, Nuriootpa. The dilapidation report shall be prepared within six (6) months of Development Approval, with copies provided to the affected adjoining landowner and Council.

Given the advice from Sonus as to the extremely low level of vibration resulting from the operation of the generator, it is considered highly improbable that the generator will impact the structural integrity of surrounding structures, therefore this condition is not necessary and should not be imposed on a consent

Representor suggested condition

The generator hereby approved must be installed in accordance with AS/NZ 3010: 2017 to the satisfaction of Council.

This standard relates specifically to the electrical installation of a generating system. Requirements therein would be covered under other relevant legislation relating to electrical installations. There does not appear to be a reasonable planning purpose for imposing such a condition.

Representor suggested condition

The generator hereby approved shall be mounted on suitable rubber matting within three months of the date of Development Approval to the satisfaction of Council.

Given the advice from Sonus, there does not appear to be a reasonable planning purpose for imposing this proposed condition.

Representor suggested condition

The generator hereby approved shall be installed with an exhaust pipe on the outlet which directs noise away from 17 Murray Street, Nuriootpa within three months of the date of Development Approval to the satisfaction of Council.

Given the advice from Sonus, there does not appear to be a reasonable planning purpose for imposing this proposed condition.

Representor suggested condition

Within three months of the date of Development Approval the existing fence, adjacent to the northern boundary as shown on the endorsed site plan shall be increased in height to a minimum of 2.1 metres above natural ground level. The

height of the fence must be 2.1 metres from ground level at 17 Murray Street, Nuriootpa (CT 6040/310). The details of the design of the fence must be to the satisfaction of Council.

Given the advice from Sonus, there does not appear to be a reasonable planning purpose for this proposed condition as the proposed installation meets the requirements of the EPP, and, it is not clear what other practical purpose the extension of the fence would serve.

REPRESENTORS CONCERNS

Council has sighted a report prepared for the Representor by Triaxial Consulting with regard to the office building at 17 Murray Street, Nuriootpa. This report has not been submitted for inclusion with this Assessment Panel Report.

The Representor states:

The longer this Unit sits there (goes on) the more risk my property is prone to be damaged, if not already, as I believe over the last 16 months since its placement, cracking has occurred with unknown damage to water, sewer and waste pipes under the building concrete slab.

The Triaxial report noted cracks in the building render in numerous locations around the entirety of the building. The report noted that all walls adjacent to the generator appeared in sound condition. It classified the cracks identified in the render as cosmetic to minor in nature and advised that ground vibrations from the generator are unlikely to have a structural impact on the building but cannot be discounted without receiving vibration measurements from site.

It reported that new concrete pavement has been constructed over the septic tank due to recent settlement further noting that according to the property owner, the septic tank has settled as a result of the ground vibrations from the generator. Triaxial observed that the network of underground services along the rear wall adjacent to the generator may be adversely affected by ground vibrations. The water and sewer pipework along the rear wall provides services to a number of wet areas to the southern tenancy and will be laid in trenches of fill. This fill supporting the pipework may consolidate from ground vibrations and may cause differential movement and damage to the pipework, considering the generator is located so close to the building.

The report noted that for human comfort (not building damage) the peak component particle velocity is 0.6mm/s^2 for offices when occupied (British Standard BS 6472, Table 4.1). Whilst acknowledging that the seven metre clearance recommended around the generator by the manufacturer is for sound output considerations, Triaxial states that *a minimum clearance of seven metres from the building would be appropriate to avoid potential damage to underground services by the generator.* They also recommend that a dilapidation report is undertaken to monitor building defects.

DISCUSSION

There are two primary issues arising from the installation and running of the generator:

- (1) Noise and vibration impacts on humans.
- (2) Vibration impacts on building and infrastructure.

Noise and vibration impacts on humans

The Sonus report extrapolated that when running at peak load the noise emanating from the generator would not exceed the maximum standard specified in the *Environment Protection (Noise) Policy 2007* for the adjacent building, noting that running the generator at peak load would be a rare occurrence.

Further to this, Sonus measuring the vibration output of the generator and a peak weighted vibration (Wk) of 0.002m/s^2 was recorded at this location. Sonus quoted the Australian Standard and advised that the median perception threshold is approximately 0.015 m/s^2 , the interquartile range of responses may extend from about 0.01 m/s^2 to 0.02 m/s^2 peak, suggesting that the vibration output of the generator at peak load is well within the Australian Standard for comfort levels.

Triaxial also provided a human comfort level for vibration quoting British Standard BS 6472 at 0.6mm/s^2 , significantly above that measured by Sonus.

It appears that even at peak load the generator meets the relevant Australian Standard and the *Environment Protection (Noise) Policy 2007* for noise and vibration impacts on humans.

Vibration impacts on building and infrastructure

The vibration impact on buildings and infrastructure by the generator is not quantifiable based upon the information available to us. Engineering advice suggests that the potential impact of vibrations on the building is subject to a number of conditions such as the soil under the building, the method of compaction, the type of footings and any existing structural damage.

Triaxial has stated that ground vibrations from the generator are unlikely to have a structural impact on the building but damage cannot be completely discounted. Further stating that the water and sewer pipework along the rear wall provides services to a number of wet areas to the southern tenancy and those services will be laid in trenches of fill. This fill supporting the pipework may consolidate from ground vibrations and may cause differential movement and damage to the pipework, considering the generator is located so close to the building any damage that may occur may be attributable to the generator.

Sonus has measured the vibration emanating from the generator at a peak weighted vibration (Wk) of 0.002m/s^2 , it is at this point that it is worth considering other vibration influences in the locality, namely traffic on Murray Street and Gawler Street. A Study published by the National Research Council of Canada called Traffic Vibrations in Buildings (refer to *Attachment 3*) identified that a truck or bus passing a building at 25km/h can have a vibration impact as high as 10.0mm/s^2 suggesting that the building's vulnerability to vibration may be more influenced by its proximity to traffic than it is by its proximity to the generator.

The applicant contends that the generator has been installed in accordance with the manufacturer's specifications. It is noted that locating the generator so close to an adjacent building increases the potential for amenity impacts, but reports from onsite testing suggests that unreasonable amenity impacts are not occurring. Vibration from the generator could possibly cause impacts to the adjacent building but as the generator is not the only producer of vibration in the locality it would be difficult to isolate the generator as a singular causal factor.

CONCLUSION

When assessed against the relevant provisions of the Development Plan and having regard to the context of the locality and the nature of the proposed development, it is considered that the proposal, as amended on balance, satisfies the relevant provisions of the Development Plan. The proposal is broadly consistent with the desired character of the zone and will not detrimentally impact upon the amenity of the adjoining properties of the locality.

Not seriously at variance

The proposed development is not seriously at variance with the Development Plan.

RECOMMENDATION

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.
- (b) That the proposed development is not seriously at variance with The Barossa Council Development Plan.
- (c) To GRANT Development Plan Consent for Application No. 960/425/2018 by The Community Co-Operative Store to undertake Installation of generator (retrospective) at 1-15 Murray Street, Nuriootpa (CT 6191/67) subject to the following conditions and advisory note:

Council Conditions

- (1) The development shall be undertaken in accordance with the endorsed plans and documentation (as amended) accompanying Application No. 960/425/2018 except where varied by any condition(s) listed below.

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by the Planning Authority.

- (2) Other than for maintenance and testing, the generator shall only be used as an auxiliary power source when power supply from the electricity network is unavailable, unless with the prior consent of Council.

Reason: To maintain amenity within the immediate locality.

- (3) The generator shall be maintained in good working order at all times, particularly the exhaust and vibration measures, and shall be maintained in accordance with the manufacturers recommended schedule.

Reason: To ensure that the development complies with best engineering practice.

- (4) Vibration dampers consistent with manufacturers recommendations be installed on the generator and maintained in a serviceable condition in accordance with manufacturer specifications.

Reason: To ensure the generator is operated and maintained in accordance with manufacturer requirements.

Advisory Note

- (1) The development shall be in accordance with the *Environment Protection Act 1993* (the EP Act), and by the *Environment Protection (Noise) Policy 2007* (Noise Policy).

8.1 Attachment 1

11 February 2019

The Barossa Council
PO Box 867
NURIOTPA SA 5355

Attention: Mr Louis Monteduro

Dear Mr Monteduro

**Re: Development Application 960/425/2018
Alterations and Additions to Existing Shopping Centre – Ancillary Generator
3 Murray Street, Nuriootpa**

On behalf of The Community Cooperative Store (Nuriootpa) Ltd ('the Coop') we refer to the above-mentioned development application.

At its meeting on 13 November 2018, the Council Assessment Panel ('CAP') deferred consideration of the application pending the provision of additional information, viz:

That the Panel defer consideration of Development Application 960/425/2017 to seek additional information in relation to justification for the proposed siting of the generator, setbacks, location of access paths, noise emissions and vibrations and exhaust fumes and consideration of additional conditions.

Please find **attached** to this correspondence amended proposal plans:

- Site Plan DS:50939 B February 2019; and
- Ancillary Generator Plan DA:50939 B February 2019.

These plans substitute for the equivalent plans previously provided to Council.

No changes have been made to the proposal by the amended plans. The amended plans simply provide additional detail and clarification in respect of the proposal, as requested by the CAP.

We will address the issues raised by the CAP in turn.

JUSTIFICATION FOR THE PROPOSED SITING OF THE GENERATOR

The generator is sited in the vicinity of the key electrical services, including the transformer and switchboard which serve the facility.

The generator is sited in accordance with manufacturers specifications.

Consideration of alternative siting options for the generator is not a relevant consideration in the assessment of the application.

SETBACKS

The setbacks of the generator from relevant surrounding buildings, plant and equipment is detailed on the amended site plan.

The setbacks are in accordance with manufacturers specifications.

LOCATION OF ACCESS PATHS

Access to the generator is from the adjacent open service yard area.

NOISE EMISSIONS AND VIBRATION

Whilst we remain firmly of the view that assessment of the noise and vibration impacts of the generator whilst under load is unreasonable given the extremely infrequent nature of such operations, Sonus were commissioned to undertake further assessment of the proposal.

Sonus have attended the site and have taken noise and vibration readings of the generator when under load. They have utilised this data, together with data previously obtained within the adjacent property to model the acoustic and vibration impacts of the proposal.

Correspondence from Sonus detailing their findings is **attached**.

In summarising the correspondence of Sonus, the following key points are noted:

- there are no specific criteria which relate to the circumstance of a generator operating as proposed;
- application of Environment Protection (Noise) Policy 2007 ('the EPP') goal noise levels would permit the generator to operate continuously;

- applying the EPP, the goal noise levels are 45 dB(A) for the kitchen and 42 dB(A) for other rooms; and
- the goal noise levels are predicted to be met for the generator operating at load.

In respect of vibration, Sonus concludes that it is unlikely that vibration from the generator could be perceived at any point within the adjacent office.

The Sonus report confirms our earlier assertions that the acoustic and vibration impacts from the generator are acceptable.

EXHAUST FUMES

The exhaust outlet of the generator is positioned on top of the unit and discharges vertically upwards.

The generator has been sited such that the exhaust outlet is located away from the walls located to the north and east of the unit.

The generator is sited in accordance with manufacturers specifications.

Given this, there is no evidence that there will be adverse impacts from the exhaust from the generator.

PROPOSED CONDITIONS

We note the conditions proposed by Council's administration to be placed on the application.

Given the information that has been obtained in respect of the proposal, we would respectfully request that further consideration be given to the appropriateness of conditions.

We refer to the conditions proposed in the November CAP agenda report.

- (2) *Maintenance and testing of the generator shall only occur between 6 .00 pm and 10.00 pm and the occupiers of 17 Murray Street, Nuriootpa shall be given 24 hours' notice of such maintenance and testing.*

Given the advice from Sonus is that the generator can operate at full load continuously and meet the goal noise requirements of the EPP, this condition is not necessary and should not be imposed on a consent.

- (5) *A dilapidation report shall be prepared including photographs and/or video footage to document the pre-development structural condition of all buildings on adjoining land at 17 Murray Street, Nuriootpa. The dilapidation report shall be prepared within six (6) months of Development Approval, with copies provided to the affected adjoining landowner and Council.*

Given the advice from Sonus as to the extremely low level of vibration resulting from the operation of the generator, it is considered highly improbable that the generator will impact the structural integrity of surrounding structures, therefore this condition is not necessary and should not be imposed on a consent.

We note that a planning consultant acting for the representor proposed additional conditions be applied to any consent during the hearing at the November CAP meeting.

We refer to these additional proposed conditions below.

The generator hereby approved must be installed in accordance with AS/NZ 3010: 2017 to the satisfaction of Council.

This standard relates specifically to the electrical installation of a generating system. Requirements therein would be covered under other relevant legislation relating to electrical installations. There does not appear to be a reasonable planning purpose for imposing such a condition.

The generator hereby approved shall be mounted on suitable rubber matting within three months of the date of Development Approval to the satisfaction of Council.

Given the advice from Sonus, there does not appear to be a reasonable planning purpose for imposing this proposed condition.

The generator hereby approved shall be installed with an exhaust pipe on the outlet which directs noise away from 17 Murray Street, Nuriootpa within three months of the date of Development Approval to the satisfaction of Council.

Given the advice from Sonus, there does not appear to be a reasonable planning purpose for imposing this proposed condition.

Within three months of the date of Development Approval the existing fence, adjacent to the northern boundary as shown on the endorsed site plan shall be increased in height to a minimum of 2.1 metres above natural ground level. The height of the fence must be 2.1 metres from ground level at 17 Murray Street, Nuriootpa (CT 6040/310). The details of the design of the fence must be to the satisfaction of Council.

Given the advice from Sonus, there does not appear to be a reasonable planning purpose for this proposed condition as the proposed installation meets the requirements of the EPP, and, it is not clear what other practical purpose the extension of the fence would serve.

CLOSURE

We trust the additional information provided will address the requests raised by the CAP.

For the reasons set out in this correspondence, and the information previously provided to Council, we consider that the proposal is a wholly appropriate development of the subject site which is located well away from sensitive receptors, and, has been demonstrated through the detailed information provided to appropriately mitigate impacts on the surrounding area.

The proposal warrants Development Plan Consent being granted.

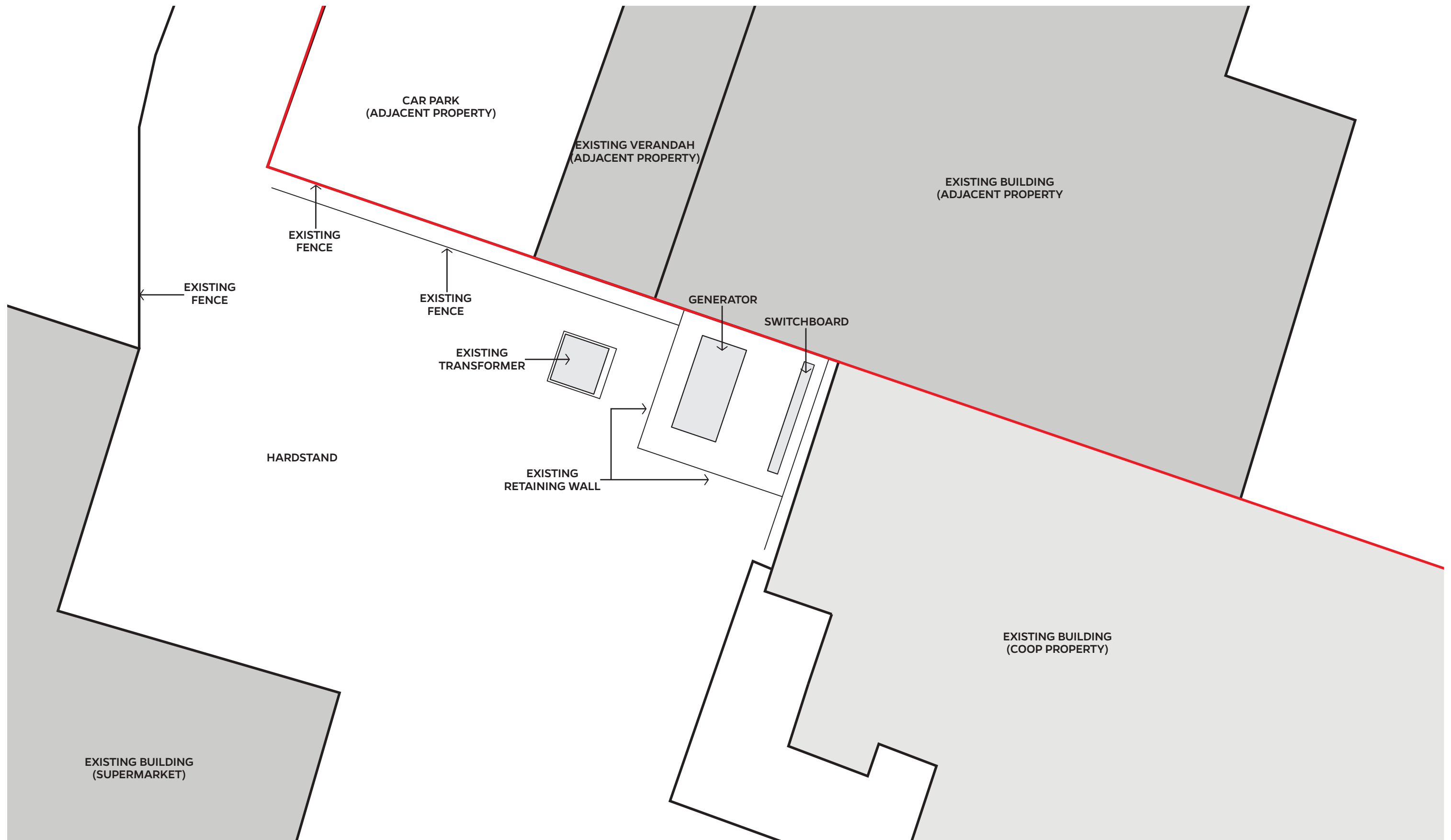
Please advise the writer of the timing and location of the CAP meeting to which the application will be presented, such that we can be present to answer any further questions that CAP members may have in respect of the proposal.

Yours sincerely



Michael Richardson
MasterPlan SA Pty Ltd

enc: Amended Plans (as listed).
Sonus Correspondence.
cc: The Community Cooperative Store (Nuriootpa) Ltd, Att: Mr Neil Retallick (by email).



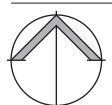
Subject Site

Ancillary Generator SITE PLAN

3 MURRAY STREET
NURIOOTPA

FOR THE COMMUNITY COOPERATIVE
STORE NURIOOTPA LTD

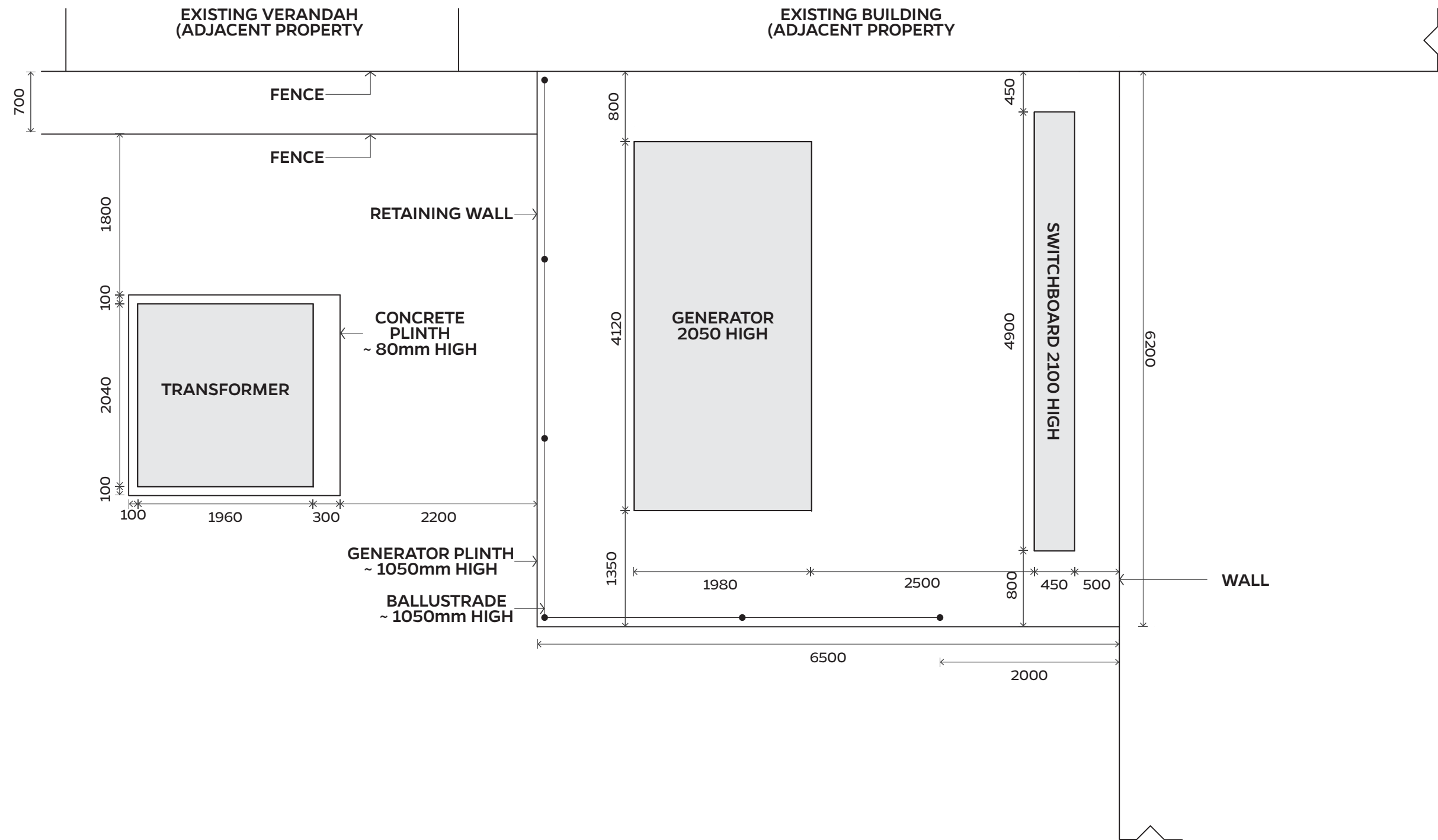
Note: For dimensioned details of plant
see "ANCILLARY GENERATOR" plan



NOT TO SCALE
Agenda - Barossa Assessment Panel - 5 March 2019

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Ancillary Generator

3 MURRAY STREET
NURIOOTPA

FOR THE COMMUNITY COOPERATIVE
STORE NURIOOTPA LTD



Barossa Co-op
3 Murray St
Nuriootpa SA 5355

S4459C8

Attention: Neil Retallick

11 January 2019

Dear Neil,

**NURIOOTPA SHOPPING CENTRE
STANDBY GENERATOR**

BACKGROUND

A generator has been installed within the Nuriootpa Shopping Centre adjacent to an office building and the owner of the adjacent office building has complained about the noise from the generator.

Due to the operating nature and purpose of a generator, such an installation can only unreasonably impact on the amenity of an office building if:

1. The generator often operates during office hours and the level of noise is higher than is suitable for the function of the space; or
2. The generator operates infrequently during office hours but the level of noise is so high that it does not allow the office to continue operating.

It is understood that the generator does not fall into either of the categories. Rather, the generator operates approximately once every four months for maintenance and on occasions when power is not available from the grid. It is understood that in the year of 2018, the generator only operated for maintenance. That is, the generator was not required to operate as a result of power not being available from the grid at any time in 2018.

Notwithstanding the above, Sonus previously made an assessment (Reference S4459C7) of the noise from the standby generator at the Nuriootpa Shopping Centre (the Original Assessment). As part of the original assessment, the generator was operated and noise levels were measured inside the adjacent office. However, as the generator was not supplying electricity to the shopping centre, the generator was idling as it would during maintenance. To determine the difference in noise between the generator operating at idle and full load (as might occur during a power outage), further testing was conducted on Tuesday 8 January 2019. This testing determined the difference in noise associated with full load operation as well as determining the ground vibration present with the generator operating at full load.

NOISE ASSESSMENT

Criteria

There are no specific criteria which relate to the circumstance of a generator which operates as described above.

However, if a noise source which often operated during office hours were to be considered objectively, then the relevant criteria are found within the *Environment Protection (Noise) Policy 2007* (the Policy). The Policy provides goal noise levels based on the Development Plan zone of the noise source and receiver. When these goal noise levels are achieved, no further action can be taken under the *Environment Protection Act*. Where the goals are not achieved, other matters must be taken into account when determining what (if any) action is to be taken. The other matters include:

- (a) the amount in dB(A) by which the noise exceeds the goal level and the frequency and duration of the noise level that give rise to that result;
- (b) any component of the ambient noise or extraneous noise that—
 - (i) has a noise level similar to or greater than the source noise level (continuous); and
 - (ii) has a similar noise character or similar regularity and duration to the noise from the noise source;
- (c) the times of occurrence of the noise from the noise source;
- (d) the number of persons adversely affected by the noise from the noise source and whether there is any special need for quiet at the noise-affected premises;

The above matters are included in the Policy in recognition that the goal noise levels have been established on the basis of a noise source which operates constantly. Therefore, comparing an intermittently operating noise source with the Policy goal noise levels represents a conservative approach.

In accordance with the Policy, the most appropriate place to measure the noise from the generator is in “habitable rooms” of the office building. For a building in a commercial zone, the goal noise level indoors during the day is the higher of:

- 42 dB(A); or
- The recommended satisfactory level from Australian Standard AS2107 (the Standard)

The indoor design sound levels for an office based on the Standard are shown in the table below:

Location	Design Sound Level Range
Executive office	35 to 40 dB(A)
General office area	40 to 45 dB(A)
Toilets	45 to 55 dB(A)
Reception areas	40 to 45 dB(A)
Rest rooms and break-out spaces	40 to 45 dB(A)
Cafeterias	45 to 50 dB(A)

Notes:

1. Toilets are not defined as habitable rooms in accordance with the Policy and therefore no criteria apply for toilets.
2. Previous versions of the Standard defined “recommended satisfactory” and “recommended maximum noise levels” but the current Standard defines a design range.
3. The most appropriate classification for the kitchen is “cafeterias” with a design sound level range of 45 to 50 dB(A).
4. When measuring noise levels for comparison with the Policy, penalties may be applied for each characteristic of tone, impulse, low frequency and modulation of the noise source. Where one characteristic is present, 5 dB(A) is added to the measured level. For a penalty to be applied, the Noise Policy requires the characteristic to be fundamental to the nature and impact of the noise. The characteristic should dominate the overall noise impact, rather than simply be part of it.

Based on the above, the noise goal for the kitchen is 45 dB(A), with 42 dB(A) for other habitable rooms.

Predicted Noise Levels.

The noise from the generator was measured within and outside the adjacent office on Thursday 19 October, 2017 with the generator idling. The noise from the generator under load was measured outside the adjacent office on Tuesday 8 January 2019. Based on these measurements and the difference between the idling and full load generator, the following noise levels are estimated:

Location	Predicted Generator Contribution
Men's Toilet	43 dB(A)
Women's Toilet	38 dB(A)
Filing Room	37 dB(A)
Office	39 dB(A)
Reception	41 dB(A)
Kitchen	45 dB(A)

When reviewing the frequency spectrum, there was no tone which dominated the impact of the noise and therefore a 5 dB(A) penalty is not considered to be warranted.

The estimated noise from the generator is no greater than the goal noise level of the Policy at any location. The estimated noise from the generator is also either within the range or below the design range of the Standard for each room. That is, the noise from the generator at the estimated level would be acceptable if it operated all day, every day. However, given that the generator is expected to operate vary rarely when the office is occupied, it is considered that a noise level well in excess of the goal noise level would still achieve the objectives of the Noise Policy. This approach is similar to the approach taken for activities such as mowing lawn, blowing leaves or construction, which are generally accepted because of the short term and occasional nature.

Based on the above, no measures to reduce the noise to the office are considered to be warranted.

VIBRATION

As for noise, unreasonable impact associated with vibration from the generator installation can only arise during frequent or extreme circumstances, which are not present. Notwithstanding this, a similarly conservative objective assessment of vibration levels has been made.

To assist in the assessment of the potential impact from ground vibration, reference is made to Australian Standard AS2670.1:2001, "Evaluation of human exposure to whole-body vibration Part 1: General Requirements". The Standard includes:

Perception

Fifty percent of alert, fit persons can just detect a W_k weighted vibration with a peak magnitude of 0.015 m/s^2 .

There is a large variation between individuals in their ability to perceive vibration. When the median perception threshold is approximately 0.015 m/s^2 , the interquartile range of responses may extend from about 0.01 m/s^2 to 0.02 m/s^2 peak

The level of ground vibration was measured at approximately 3m to the generator on Tuesday 8 January 2019, at a time when the generator was operating at full load. This location was chosen to be similar to the distance where a person might be located in the closest room of the office. A peak weighted vibration (W_k) of 0.002 m/s^2 was recorded at this location. Based on this vibration measurement, it is unlikely that ground vibration from the generator could be perceived at any point within the office.

If you have any questions or require clarification, please call me.

Yours faithfully
Sonus Pty Ltd



Chris Turnbull
Principal

+61 417 845 720
ct@sonus.com.au

960/425/2018 (1-15 Murray Street Nuriootpa)

Applicant: Michael Richardson from Masterplan on behalf of the applicant
The Community Co-Operative Store

Representor: Graeme Macfarlan

APPLICATION DETAILS

PROPOSAL	Installation of Generator (retrospective)
APPLICANT	The Community Co-Operative Store
OWNER	The Community Co-Operative Store
APPLICATION NO	960/425/2018
CERTIFICATE(S) OF TITLE	CT 6191/67
AREA	6.02ha
CURRENT USE	Shopping Centre
DEVELOPMENT PLAN VERSION	Consolidated - 11 August 2016
ZONE	District Town Centre / Residential
POLICY/PRECINCT AREA	Nil
OVERLAYS	Nil
APPLICATION TYPE	Merit
CATEGORY OF DEVELOPMENT	Category 2
REFERRALS	Nil
PREVIOUS APPLICATIONS	960/439/2014
ASSESSING OFFICER	Dylan Grieve
RECOMMENDATION	That Development Plan Consent be GRANTED

BACKGROUND

In January 2015 the Development Assessment Commission granted Development Plan Consent for alterations and additions to the existing Co-Op shopping centre at Nuriootpa. The approved development increased retail floor area on the site from 5,936 sqm to 11,918 sqm. The main element of this development included the construction of a new supermarket (5,076 sqm) fronting Murray Street, with an associated loading dock.

In 2017, Council was made aware of the installation of the generator and sought legal advice to determine if it constituted development.

The installation of the generator constitutes 'building work' and therefore is 'development' unless exempted by Schedule 3 of the Regulations. The fact that the generator is not placed temporarily on the subject land, that it cannot be lifted and moved easily renders it a 'building' within the definition of that term in Section 4 of the Act.

There are no provisions of Schedule 3 which apply to the generator that exempt it from requiring development approval.

1. The generator cannot be considered an outbuilding under clause 4(1)(a) on the basis that it cannot accommodate any human activity within it.

2. The generator does not fall within clause 4(3)(b) as it is not providing an electricity 'service'. The use of the term 'service' in this clause limits its operation to infrastructure installed by a service provider such as SAPN, SA Water, Telstra or the like.
3. Clause 5(2)(b) does not extend to the 'building work' associated with the installation of the generator.

The installation of the generator constitutes development in the nature of building work only. On the basis of clauses 19 and 6 of Schedule 9 to the Regulations, the generator is also a Category 2 form of development.

The generator is proposed to act as an auxiliary and independent electrical generation source to provide backup power in the event of a power failure to maintain refrigerated and frozen stock held by the supermarket.

The proposed generator is 4.12 metres long, 1.98 metres wide and 1.8 metres high. The colour is most likely colorbond "classic cream". The generator is also freestanding.

Attachment 1 provides a copy of the application and associated documentation.

This application has been referred to the Barossa Assessment Panel for a decision for the following reason:

- (1) Where representations opposing a proposal have been received as a result of category 2 or 3 public notification and the representor has indicated a desire to be heard in support of a representation.

PUBLIC NOTIFICATION

The application is a Category Two form of development pursuant to Section 38 and Schedule 9 of the *Development Act 1993* and Regulations 2008 and the Procedural Matters of the District Centre Zone.

Representations: One (1) representation was received.

Location of the representations are shown in *Figure 1*

Persons wishing to be heard: One (1) representor identified that they wish to address the Panel:

- Graeme Macfarlan

Applicant/s Michael Richardson from Masterplan on behalf of The Community Co-Operative Store (the Applicant) wishes to appear to respond to representations.

Summary of Representations: The representor raised concern regarding the following matters:

- Concern for the health and wellbeing of tenants and clients.
- The sound report from Sonus does not provide any details of the generator unit operated at full load.
- There has been no Building Engineers report regarding the vibration effects to the buildings structure ie footings, walls and sewer pipe that runs next to this generator unit.
- Uncertainty of hours of operation

- No consideration has been taken into account with the positioning of this generator unit to minimise the negative impacts of noise on the property.

Applicant
Response:

The applicant's response to the representation is summarised below:

- The representor has indicated that the State and Federal Government have stated that they are unable to guarantee our power supply with electricity networks failures to become more frequent in the coming decade. Reference to the frequency of future blackouts is conjecture and no evidence to support such a claim has been provided in the representation.

We addressed this claim in detail in our correspondence provided with the application at lodgement, and would reiterate the following:

"Data from the Essential Services Commission of South Australia (ESCOSA) indicates annual targets for normalised outages in the Short Rural category in which Nuriootpa is located of 1.85 outages and 220 minutes of total outage. This target represents 0.04 percent of the time occurring over less than two outage events per year."

Based on the relevant ESCOSA data, the time in which the generator will be used at full load is very infrequent. On this basis, the anticipated impacts associated with the generator are considered minimal given the minimal proportion of the time at which it will operate at load.

We acknowledge that the Sonus report does not assess the levels of noise at the generators full load times, however, based on the ESCOSA data, the anticipated time in which the generator will be used at full load is minimal. This is reaffirmed in the noise assessment undertaken by Sonus, which states:

"...given that the generator is expected to operate approximately two times per year when the office is occupied, it is considered that a noise level well in excess of the goal noise level would still achieve the objectives of the Noise Policy. This approach is similar to the approach taken for activities such as mowing lawn, blowing leaves or construction, which are generally accepted because of the short term and occasional nature."

- Given the commentary provided by Sonus, we are of the view that the infrequent use of the generator will not create unreasonable impacts on the representors land, buildings or infrastructure, nor is the proposal at odds with the requirements of the Environmental Protection (Noise) Policy, 2007.
- It should be noted that the adjacent site in which the representor has an interest is not classified as a sensitive

receptor for the purposes of assessments under the *Environment Protection Act, 1993* and its associated policies.

- We further note that the subject site and adjacent allotment are located within the District Town Centre Zone in which uses requiring noise generating equipment and servicing by large commercial vehicles are specifically envisaged.
- In regard to potential pollutant exposure from exhaust emissions, the specifications provided in the original application for the generator provide for appropriate setbacks from buildings and other structures. Given the generator has been installed in a consistent manner with these specifications, we do not anticipate that the exhaust would cause adverse environmental or amenity impacts.
- Having regard to the proposal, we do not agree that additional technical reports are necessary for the assessment of the proposal. The infrequent use of the generator, particularly its extremely infrequent use at full load times during power failure events, and its location within a loading bay where there will be other noise sources including the frequent movement of commercial vehicles, clearly indicates that the impacts on the representor's property should be reasonable.

An aerial view showing the representations properties is shown in *Figure 1*.



Figure 1: Aerial of Representations Properties

A copy of the representor concerns and the applicant's response is contained in *Attachment 2*.

SITE AND LOCALITY

The site is known as 1-15 Murray Street, Nuriootpa accommodates a redeveloped shopping centre.

The redeveloped shopping centre features a loading area, which services the Foodland supermarket, located in the north-eastern corner of the site, with access from and egress to Murray Street.

The loading area contains manoeuvring areas for commercial vehicles servicing the supermarket, waste storage receptacles, including a bailer for cardboard packaging, a transformer and electrical switchgear.

The loading area is typical of loading areas associated with supermarkets of this scale.

The location of the loading area encloses around a separate land holding, not in the ownership of the Coop, located on the south-western corner of the intersection of Murray Street and Gawler Street. This property contains a building located slightly to the west of the intersection that is currently used as offices.

The site is located within the District Centre and Residential Zone, as shown in *Figure 2*.

The site is located within the Nuriootpa Concept Plan, as shown in *Figure 3*.

An aerial view of the locality and site are shown in *Figure 4* and *Figure 5*.

Site photos are provided in *Figure 6* to *Figure 8*.

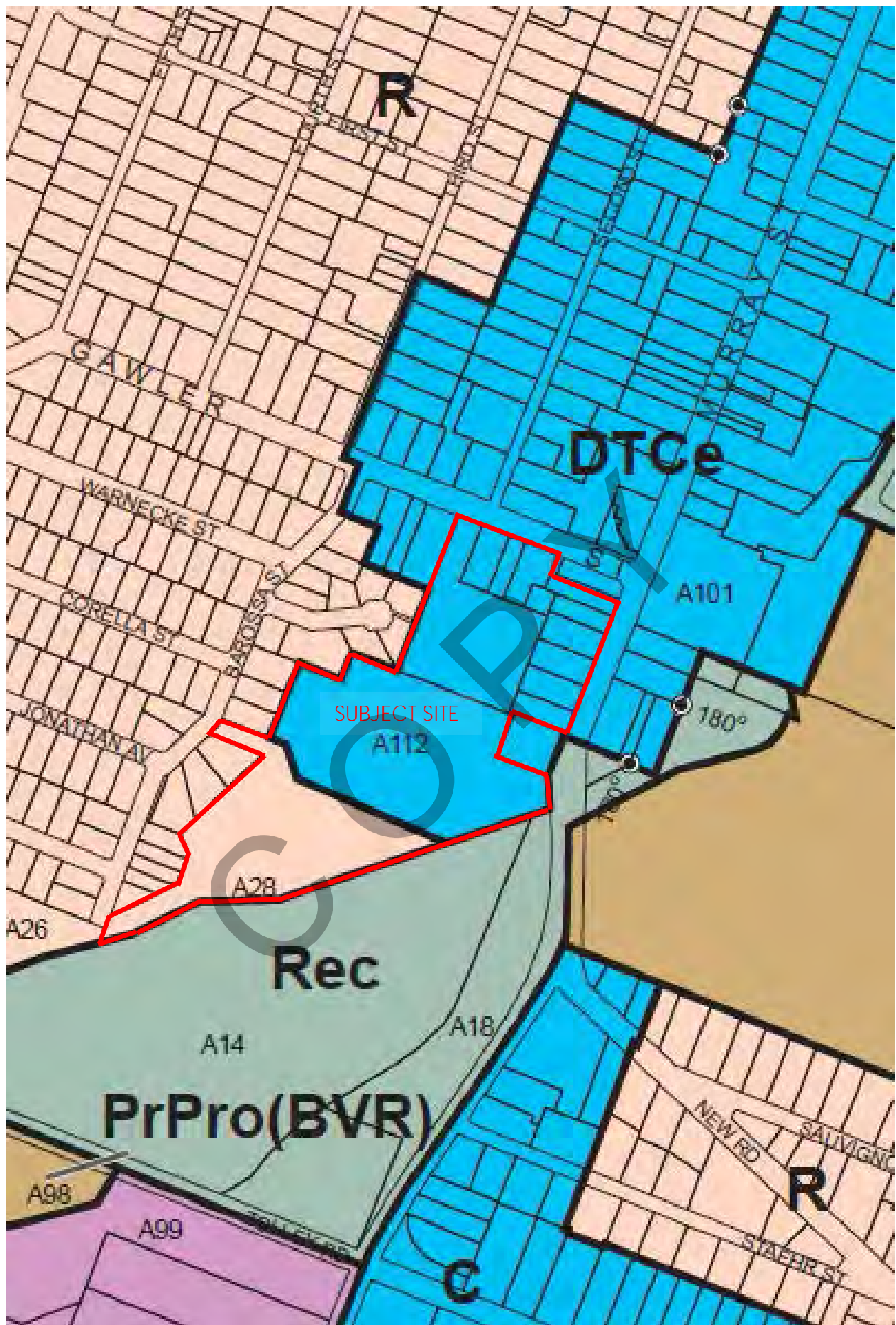


Figure 2: Zone Map

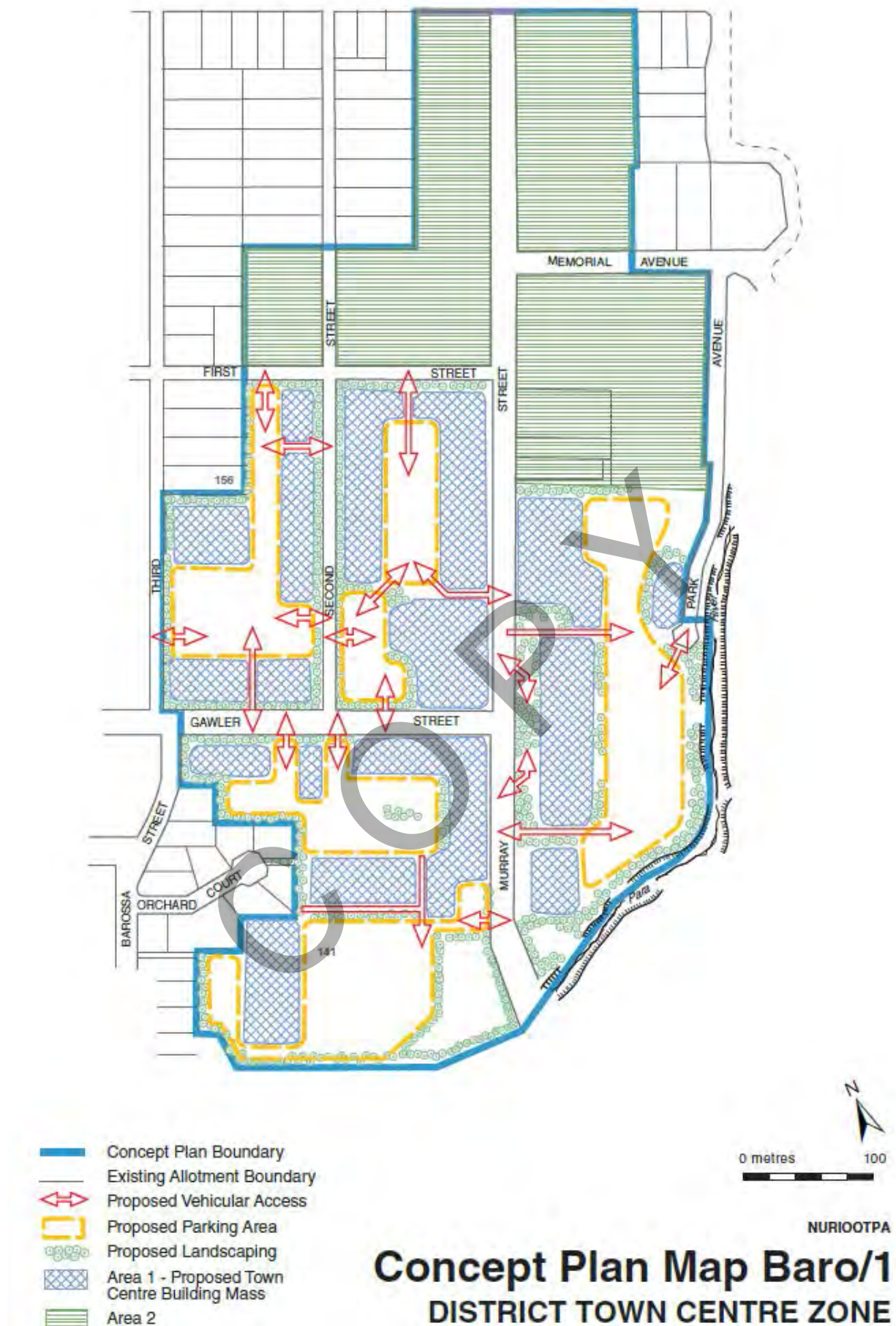


Figure 3: Concept Map



Figure 4: Aerial – Locality



Figure 5: Aerial – Site



Figure 6: Site Photo



Figure 7: Site Photo



Figure 8: Site Photo

REFERRALS

No referrals are required under Schedule 8 of the Development Regulations 2008.

Internal

No internal referrals are required.

ASSESSMENT

Quantitative Criteria

The proposal has no quantitative assessment requirements detailed in the Development Plan.

Qualitative Criteria

The proposal is assessed for consistency with the qualitative requirements of the Development Plan as outlined below:

Overlay Section

Character Preservation District

Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the assessing officer has had regard to the objects of the Act and, in determining this application, whether it seeks to further the objects of the Act

Objective 1 states a district where:

- scenic and rural landscapes are highly valued, retained and protected.
- development near entrances to towns and settlements does not diminish the rural setting, character and heritage values associated with those towns and settlements.
- activities positively contribute to tourism.
- the heritage aspects of the district are preserved.
- buildings and structures complement the landscape.

Principle of Development Control 1 states that development should be consistent with the Objectives for the district.

Where the Objectives and/or Principles of Development Control, that apply in relation to the Character Preservation District are in conflict with the relevant General Section Objectives and/or Principles of Development Control in the Development Plan, the Overlay will prevail.

The Objects of the Character Preservation (Barossa Valley) Act 2012 include:

- (e) to recognise, protect and enhance the special character of the district while at the same time providing for the economic, social and physical wellbeing of the community; and
- (f) to ensure that activities that are unacceptable in view of their adverse effects on the special character of the district are prevented from proceeding; and

	<p>(g) to ensure that future development does not detract from the special character of the district; and</p> <p>(h) otherwise to ensure the preservation of the special character of the district.</p>
Bushfire Protection Area	The subject site is in an area excluded from Bushfire Protection Plan.
Design and Appearance	<p>Objectives 1 PDCs 4</p> <p>The generator is most likely colorbond "classic cream" colour and is unobtrusive in colour and placement in its setting within a service and loading area of a supermarket.</p> <p>The generator is not visible from the adjoining property (17 Murray Street, Nuriootpa) nor from Gawler Street as the generator, while sitting on an elevated slab, is positioned below the top of fence and building line.</p> <p>All other Objectives and PDCs are deemed to comply.</p>
Infrastructure	<p>Objectives 1 and 4 PDCs 1, 8 and 11</p> <p>The proposed generator is designed and located to minimise its visual impact on the immediate locality.</p> <p>All other Objectives and PDCs are deemed to comply.</p>
Interface between Land Uses	<p>Objectives 1 and 2 PDCs 1, 2, 3, 4, 5, 6 and 7</p> <p>The proposed generator will emit a flume, noise and vibration when in operation. Given the engine specifications, the proposed generator's emissions during testing are not dissimilar to those of an idling delivery vehicle that are regularly encountered and envisaged on the subject site.</p> <p>The generator is proposed to act as an auxiliary and independent electrical generation source to provide backup power in the event of a power failure to maintain refrigerated and frozen stock held by the supermarket.</p> <p>The acoustic report does not test the generator under full load. It is anticipated that if there was a loss of power to the immediate locality, that properties, including the adjoining office building, without back-up power generation will not be able to operate or be open for business during this time and will not be compromised by potential noise or odour.</p> <p>The operation of the loading area currently causes some adverse amenity impacts on the locality, including noise (vehicles movements, reversing beepers, forklift operations, movement of stock and waste operations, including lifting</p>

and lowering of bins), vehicle movements to and from public roads and the emission of exhaust from vehicles.

The acoustic report describes the noise level as “well in excess of the goal noise level” and acceptable given the short term and occasional nature of the noise source and likens the noise to using a lawn mower, blowing leaves or construction.

In the absence of evidence of the generator tested under full load and its vibration impact on adjoining buildings, a condition is proposed for a dilapidation report to monitor any potential adjoining building impacts.

At all times the generator will have to comply with the Environmental Protection Authority's Environment Protection (Noise) Policy.

All other Objectives and PDCs are deemed to comply.

Orderly and Sustainable Development

Objectives 1, 3, 4 and 6
PDCs 1,

The proposed generator does not jeopardise the continuance of adjoining authorised land uses.

The out of hours testing and hypothetical, spasmodic and unpredictable use of the proposed generator under full load during a power failure event, is balanced by the need to protect food and health for the public good.

All other Objectives and PDCs are deemed to comply.

Zone Section

District Town Centre Zone

Objectives 1

The District Town Centre Zone seeks a centre that accommodates a full range of retail facilities including the provision of major retail development. The proposed generator is ancillary to the existing, lawful and envisaged use on site and is consistent with the Objectives of the zone.

All other Objectives are deemed to comply.

Desired Character

It is expected that each of the townships of Nuriootpa, Angaston and Tanunda will serve as the principal service centres for the surrounding district, providing both the services and facilities for the day-to-day needs of residents, as well as cater for visiting tourists to the district. Development will reinforce the perception of small-scale development that characterises each town centre.

Development will maintain the integrity and prominence of the original street facades and enhance the historic, low profile character and townscape of the zone. Any contemporary improvements will be integrated without compromising the character of

original buildings by having regard to the siting, scale, set-backs, architectural style and form, materials and external appearance of existing buildings in the locality. It is anticipated that development will not exceed two storeys in height.

Nuriootpa

It is expected that development located within the zone within Nuriootpa will be in accordance with Concept Plan Map Baro/1 - District Town Centre (Nuriootpa). Provision of major retail development, including alfresco dining facilities and associated car parking with functionally linked commercial activities will be focussed within 'Area 1'. Provision of small-scale retail developments, tourist and community services and a mixture of commercial and business activities which are compatible with adjoining living areas and provide a supporting role to the land uses and development in 'Area 1' will be focussed within 'Area 2'.

The historic townscapes and buildings especially along Murray Street, Gawler Street and Old Kapunda Road will be conserved and enhanced. In particular, development in Murray Street will provide for continuity and retention of building facades incorporating hip and gable roof forms or masonry parapets, together with small-scale, discrete ground floor retail frontages on the Murray Street alignment. The boundaries of the zone will be visually defined through the siting of new development, associated landscaping and road treatments.

Car parking areas associated with development will be located to the rear of retail and commercial frontages to Murray Street and linked to existing parking areas with a limited number of access and egress points.

Desired Character	The proposed generator is not a form of development that is at variance with the Desired Character of the District Town Centre Zone and is ancillary to the existing, lawful and envisaged use on site and is consistent with the Desired Character of the zone.
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Land Use	<p>PDCs 1 and 5</p> <p>The existing supermarket and its supplementary and ancillary functions and structures are an envisaged use within the District Centre Zone. Accordingly, the proposed generator is not inconsistent with the desired character for the zone.</p>
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All other Objectives and PDCs are deemed to comply.

CONCLUSION

Not seriously at variance

The proposed development is not seriously at variance with the Development Plan.

Development Plan Consent should be granted

When assessed against the relevant provisions of the Development Plan it is considered that the proposed development, on balance, warrants Development Plan Consent subject to conditions recommended below.

RECOMMENDATION

The Barossa Assessment Panel, having considered the application for consent to carry out development of land and pursuant to the provisions of the *Development Act 1993* resolves:

- (a) Pursuant to Section 6(2) of the *Character Preservation (Barossa Valley) Act 2012*, the Barossa Assessment Panel has had regard to the objects of that Act and, in determining this application, seeks to further the objects of that Act.
- (b) That the proposed development is not seriously at variance with The Barossa Council Development Plan.
- (c) To GRANT Development Plan Consent for Application No. 960/425/2018 by The Community Co-Operative Store to undertake Installation of generator (retrospective) at 1-15 Murray Street, Nuriootpa (CT 6191/67) subject to the following conditions and advisory notes:

Council Conditions

- (1) The development shall be undertaken in accordance with the endorsed plans and documentation (as amended) accompanying Application No. 960/425/2018 except where varied by any condition(s) listed below.

Reason: To ensure that the proposal is constructed in accordance with the plans stamped as approved by the Planning Authority.

- (2) Maintenance and testing of the generator shall only occur between 6 .00 pm and 10.00 pm and the occupiers of 17 Murray Street, Nuriootpa shall be **given 24 hours' notice of such maintenance and testing.**

Reason: To ensure the amenity of the immediate locality.

- (3) Other than for maintenance and testing, the generator shall only be used as an auxiliary power source when power supply from the electricity network is unavailable, unless with the prior consent of Council.

Reason: To ensure the amenity of the immediate locality.

- (4) The generator shall be maintained in good working order at all times, particularly in respect of exhaust and vibration mitigation, and shall be maintained in accordance with the manufacturers recommended schedule.

Reason: To ensure that the development complies with best engineering practice and is adequately maintained.

- (5) A dilapidation report shall be prepared including photographs and/or video footage to document the pre-development structural condition of all buildings on adjoining land at 17 Murray Street, Nuriootpa. The dilapidation report shall be prepared within six (6) months of Development Approval, with copies provided to the affected adjoining landowner and Council.

Reason: To ensure the condition of buildings within the immediate locality.

Advisory Notes

- (1) The development shall in accordance with the *Environment Protection Act 1993* (the EP Act), and by the *Environment Protection (Noise) Policy 2007* (Noise Policy).

COPY

8.1 Attachment 3

Traffic Vibrations in Buildings

by Osama Hunaidi

This Update describes the nature and causes of traffic-induced vibrations in buildings, and discusses possible remedial and preventive measures. The focus is on houses.

Vibration is a frequent problem in buildings. Common internal sources are machinery, HVAC systems, elevators and the activities of occupants. External sources include earthquakes, wind, blasting and construction operations, and road and rail traffic. This Update addresses vibrations caused by road traffic.

Vibrations induced by road traffic are a common concern in cities in Canada and worldwide. House owners may complain about annoyance and building damage. There may be concern about the possibility of adverse long-term effects of vibrations on historic buildings, especially those in a weak condition. Vibrations may also interfere with sensitive processes, such as those in hospital operating theatres, scientific research laboratories and high-tech industries.

How Traffic Generates Vibration

Like most vibration problems, traffic vibrations can be characterized by a source-path-receiver scenario (Figure 1). Vehicle contact with irregularities in the road surface (e.g., potholes, cracks and uneven manhole covers) induces dynamic loads on the pavement (Figure 2). These loads generate stress

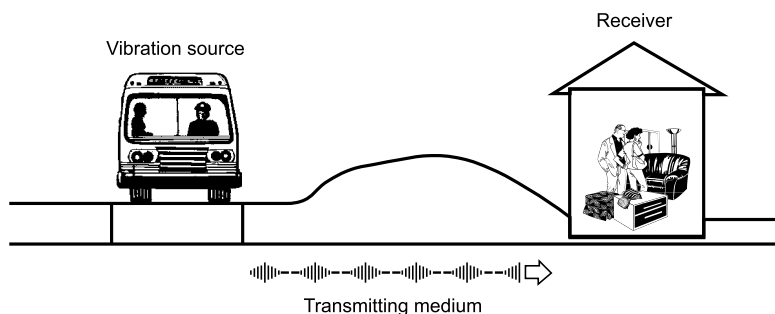


Figure 1. Traffic vibrations can be characterized by a source-path-receiver scenario.



Figure 2. Vibrations are generated when a bus or truck strikes an irregularity in the road surface.

Table 1. Comparison of vibration levels (mm/sec², rms) induced by a bus and a truck, to demonstrate the effect of different suspension systems at different speeds*

Location	25 km/h		50 km/h	
	Bus	Truck	Bus	Truck
Ground in front of house	20.5	19.9	64.5	33.2
External foundation wall	11.2	10.1	30.9	15.7
Mid-point of floor in 1 st storey	20.3	20.8	62.9	30.1
Mid-point of floor in 2 nd storey	35.0	37.3	96.2	46.7
* Bus had air-bag suspension system; truck had multi-leaf steel spring suspension system.				

waves, which propagate in the soil, eventually reaching the foundations of adjacent buildings and causing them to vibrate. Traffic vibrations are mainly caused by heavy vehicles such as buses and trucks. Passenger cars and light trucks rarely induce vibrations that are perceptible in buildings.

When a bus or a truck strikes an irregularity in the road surface, it generates an impact load and an oscillating load due to the subsequent “axle hop” of the vehicle. The impact load generates ground vibrations that are predominant at the natural vibration frequencies of the soil whereas the axle hop generates vibrations at the hop frequency (a characteristic of the vehicle’s suspension system). If the natural frequencies of the soil coincide with any of the natural frequencies of the building structure or its components, resonance occurs and vibrations will be amplified.

In contrast to irregularities such as manhole covers or potholes, normal road surface roughness induces continuous dynamic loads on the road. If the road surface roughness includes a harmonic component that, at the posted speed, leads to a forcing frequency that coincides with any of the natural frequencies of the vehicle and/or those of the soil, substantial vibration may be induced. This effect is familiar to car drivers travelling over dirt or gravel roads with ripples (termed “the washboard effect”). At a certain speed, the vehicle shudders excessively but the vibration subsides at higher or lower speeds.

Factors Influencing Vibration Level and Frequency

Road traffic tends to produce vibrations with frequencies predominantly in the range from 5 to 25 Hz (oscillations per second). The amplitude of the vibrations ranges between 0.005 and 2 m/s² (0.0005 and 0.2 g) measured as acceleration, or 0.05 and 25 mm/s measured as velocity. The predominant frequencies and amplitude of the vibration depend on many factors including the condition of the road; vehicle weight, speed and suspension system; soil type and stratification; season of the year; distance from the road; and type of building. The effects of these factors are interdependent

and it is difficult to specify simple relationships between them.

The effect of vehicle speed, for instance, depends on the roughness of the road. Generally, the rougher the road, the more speed affects the vibration amplitude. The effect of the suspension system type also depends on vehicle speed and road roughness. For low speed and smooth road conditions, the effect of the type of suspension system is not significant. But for high speeds and rough roads, the type of suspension system becomes important (Figure 3). This interdependence can be seen in Table 1, which presents vibration levels recorded for a transit bus and a truck of the same weight category, travelling on a rough road. Vibration levels induced by the two vehicles were similar at 25 km/h. At 50 km/h, however, vibration levels induced by the bus were about twice those induced by the truck.¹

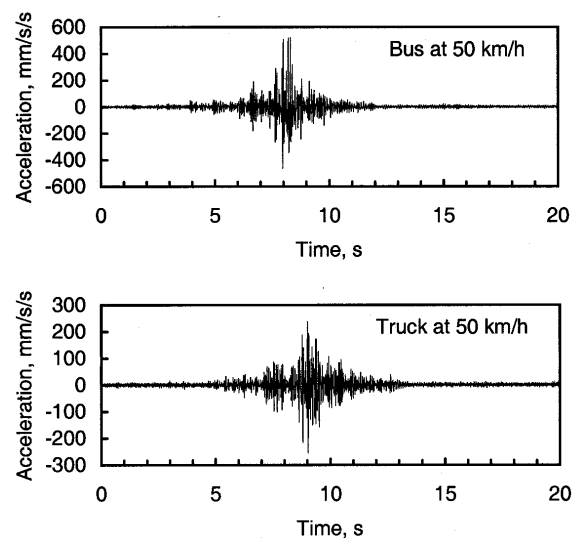


Figure 3. Comparison between vibration levels induced by a transit bus and a truck. Vibration levels are significantly different because of differences in suspension systems.

Vibration amplitudes and the predominant frequencies are influenced significantly by the soil type and stratification. The lower the stiffness and damping of the soil, the higher the vibration. For impact loads, ground vibrations are highest at the natural frequencies of the site. At these frequencies, the soil, like any structural system, offers the least resistance and hence the greatest response to loads. For soils, the natural frequencies depend on stiffness and stratification. Typically, traffic vibrations are worst in areas underlain by a soft clay soil layer that is between 7 and 15 m deep. In these areas, the natural frequencies of the soil can coincide with those of houses and their floors, leading to resonance or amplified vibration.

In Canada and other northern countries where the topsoil is normally frozen in winter, vibration levels in winter can be less than half the levels occurring in other seasons. Generally there are fewer complaints about vibrations in winter. The number of complaints is usually highest during the spring thaw period. It is commonly believed that the high ground water table at this time increases vibration levels; evidence based on experiments, however, shows that vibration levels in the spring are only slightly higher than those in the fall and summer. The higher number of complaints in the spring may be due to the lower vibration levels during winter. The 'quiet' winter period may cause a loss of familiarity with vibration and consequently a decrease in tolerance as vibration levels increase again in spring.

Vibration levels decrease with distance from the road as a result of "geometrical spreading" of the vibration energy and its dissipation by soil viscosity and/or friction. By way of example, geometrical spreading is the effect by which ripples induced by throwing a stone into a pond become flatter as they spread out. For homogeneous soil sites, vibration propagation patterns are simple, and general simple relationships can be found between vibration levels and distance. In general, however, soils are rarely homogeneous and are usually stratified. Propagation patterns are, therefore, very complex, and attenuation relationships are site-specific.

Airborne Vibration

The noise of passing buses and trucks can also induce vibrations, especially if buildings are close to the road. These airborne vibrations occur at higher frequencies than soil-borne vibrations and mostly cause rattling of windows and loose objects in front-facing rooms of affected buildings.

Measurement and Analysis of Vibrations

For proper evaluation of the effect of building vibrations induced by road traffic, measured vibrations must be undistorted and data processing and analysis must follow established procedures.² Instrumentation for the measurement of vibration signals, which usually includes vibration sensors, signal conditioners and recording equipment, should have sufficient resolution and sensitivity. Measurements should be made at locations where the vibration levels reflect the purpose of the evaluation. To evaluate the effect of vibrations with respect to human annoyance, measurements should be taken at locations where the vibration level is greatest, normally at the midpoints of floors. On wood floors, the measurement points should be located near joists to avoid local resonance of individual floor panels.

To evaluate the effect of vibrations on a building, measurements should normally be made on the foundation or on the ground close to the building on the side facing the road. Vibration sensors should be mounted using methods that can faithfully transmit to the transducer the actual motion of the ground or building components over the frequency range of interest. If the mounting method is suspected of distorting the motion, alternative methods should be tested.

The degree of detail required in the analysis of the vibration signals depends on the nature and purpose of the investigation. For a preliminary evaluation, it might be sufficient to find the peak of the vibration signal and to determine the predominant frequency of vibration by counting the number of negative and positive peaks in a given time interval. For an in-depth evaluation, advanced analysis methods are necessary, such as one-third-octave frequency band analysis, frequency-weighting according to established human response curves, and spectral analysis.

Effect of Vibrations on People

Building vibrations caused by road traffic are not a health and safety concern; they are more a problem of annoyance. Vibrations may be unacceptable to occupants because of annoying physical sensations produced in the human body, interference with activities such as sleep and conversation, rattling of window panes and loose objects, and fear of damage to the building and its contents. Experience has shown that people living in houses are likely to complain if vibration levels are only slightly above the perception threshold, the major concern being fear of damage to the building or its contents. The tolerance level varies widely from person to person and from area to area.

The International Organization for Standardization and several countries (not including Canada) have published standards that provide guidance for evaluating human response to building vibration. The standards deal mainly with continuous and intermittent vibration such as that induced by machinery and pile driving, and impulsive vibration such as that induced by blasting. The standards are not clear about how to evaluate bus and truck vibrations, which have relatively short duration and complex amplitude characteristics. Alternative evaluation methods have been developed recently by IRC researchers based on their extensive measurements of traffic vibrations at several complaint sites.³

Potential for Building Damage

House owners may complain about damage induced by traffic vibrations, such as cracks in walls and ceilings, separation of masonry blocks, and cracks in the foundation.

However, vibration levels are rarely high enough to be the direct cause of this damage, though they could contribute to the process of deterioration from other causes.

Building components usually have residual strains as a result of uneven soil movement, moisture and temperature cycles, poor maintenance or past renovations and repairs. Therefore small vibration levels induced by road traffic could trigger damage by “topping up” residual strains. Consequently it is difficult to establish a vibration level that may cause building damage and, therefore, controversy continues to surround the issue. In some cases, when a building is subjected to vibration for many years,

fatigue damage (i.e., that caused by repeated loading) may occur if the induced stresses in the building are high enough. In addition to damage caused directly by vibration, indirect damage may result from differential movements caused by soil settlement due to densification. Loose sandy soils are particularly susceptible to densification when subjected to vibration.

Several countries have adopted standards for evaluating the effect of vibration on buildings. No such national standards exist in Canada, but some provinces have adopted guide values for vibration induced by blasting. The most stringent vibration guide value specified in published standards for damage to houses is more than 30 times the human perception level. Occupants would therefore find potentially damaging vibrations to be extremely annoying because of their very high level. In a recent IRC study of vibrations induced by buses in houses at complaint sites in Montreal, vibration levels were found to be significantly lower than the most stringent guide value.¹

Standards for evaluating human response to vibration levels

- ISO 2631/2 (1989), International Organization for Standardization
- ISO 8041 (1990), International Organization for Standardization
- BS 6472 (1984), British Standards Institution
- ANSI S3.29 (1983), American National Standards Institute

Standards for evaluating the potential for building damage

- DIN 4150 (1984), Deutsches Institut fuer Normung
- SN 640 312 (1978), Association of Swiss Highway Engineers
- BD 7385 (1993), British Standards Institution
- Report No. 8507 (1980), U.S. Bureau of Mines (blasting-induced vibration)
- Publication No. NPC-119 (1978), Ontario Ministry of the Environment (blasting-induced vibration)
- ISO 4866 (1990), International Organization for Standardization

Suggested Solutions and Preventive Strategies

Solutions and preventive strategies that have been suggested to reduce vibration to an acceptable level include periodic maintenance of road surfaces, control of traffic flow and speed, improvement of the road structure, soil improvement, sufficient distance between roads and buildings, screening of vibration using in-ground barriers, and building isolation systems. Some of these measures have proven to be effective.

Maintenance of the road surface (for example, levelling manhole covers, patching potholes and applying a new pavement overlay) is the most economical and effective remedial method. However, it is usually a short-term measure; for example, cracks and defects in the original pavement reappear in the overlay. Therefore, roads may have to be maintained more frequently than normally required for good rider comfort, safety and appearance. This will not always be feasible because of the high cost. Reducing speed limits and restricting heavy vehicles, while effective remedial measures, are usually difficult to enforce.

Experimental and theoretical evidence indicates that improving the structure of the road by increasing its thickness and stiffness is not effective for reducing vibration levels in the predominant frequency range of traffic-induced vibration (Figure 4). On the other hand, improvement of the soil structure under roads using deep mixing techniques could reduce vibration levels.

Increasing the distance between roads and houses might be a practical strategy for planned developments. Where vibrations result from impacts with a pothole or crack in the road, and considering geometrical damping only, vibration levels could decrease by at least one-third for each doubling of the distance if the soil is homogeneous. Attenuation relationships are in most cases site-specific and therefore must be measured on-site to determine the necessary distance.

In-ground barriers are trenches that are either left open or filled with a material (such as bentonite or concrete) that has stiffness or density significantly different from that of the surrounding soil (Figure 5). These barriers could be effective since traffic vibrations are mainly transmitted by the soil in the form of Rayleigh waves, which propagate near the ground surface.

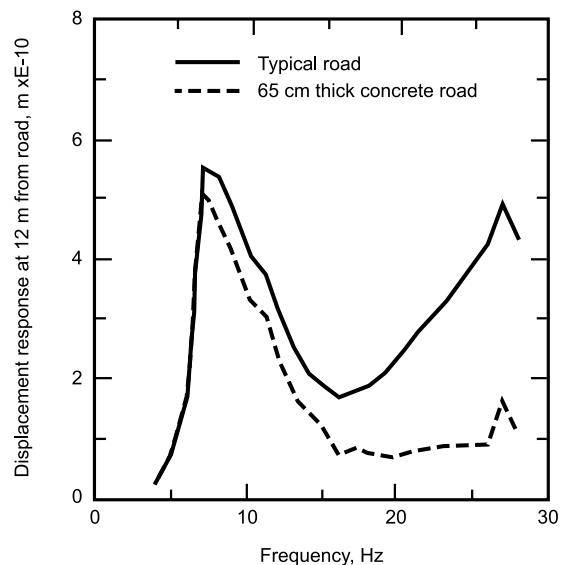


Figure 4. Effect of varying pavement stiffness on vibration levels. Stiffer road structures do not significantly decrease vibration levels at the frequencies that affect houses most (8 to 15 Hz).

In-Ground Vibration Barriers

Studies show that the depth of an in-ground vibration barrier has to be at least equal to one Rayleigh wavelength to achieve a significant reduction in vibration levels (a reduction factor of 0.25 is usually considered significant). In the case of traffic vibrations, very deep barriers would be needed (in excess of 10 m) because of the low-frequency nature of these vibrations.

Rayleigh waves

Rayleigh waves, which are the main carrier of traffic vibrations, are confined to a region near the surface of the ground that is roughly one wavelength deep. The ground motion induced by these waves has both horizontal and vertical components, which diminish with depth. Rayleigh waves that are induced by a point-like source on the ground surface, e.g., a vehicle striking a pothole, have cylindrical wave-fronts and are therefore attenuated much more slowly than shear and compression waves, which have hemispherical wave-fronts.

Attenuation mechanisms for ground vibrations

- Geometrical spreading:
 $A_2 = A_1 (r_1 / r_2)^n$
 $n = 1/2$ for surface waves
 $n = 1$ for body waves
- Material damping (soil friction)
 $A_2 = A_1 \exp [\alpha (r_2 - r_1)]$

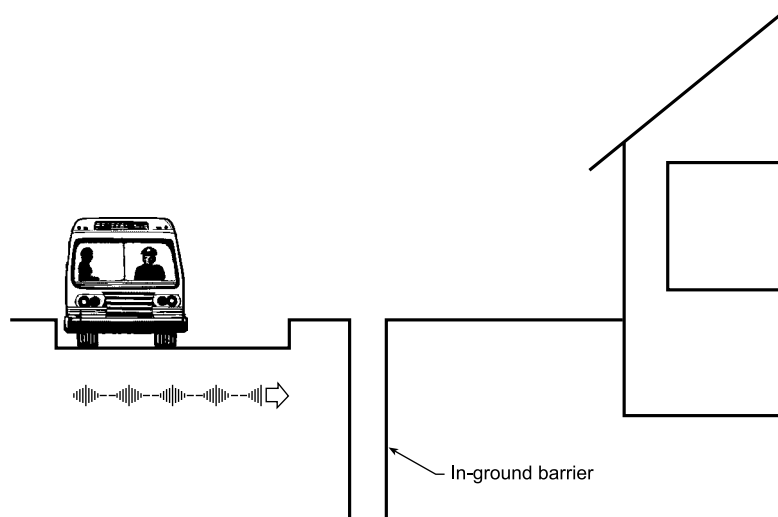


Figure 5. Schematic illustration of an in-ground vibration barrier

However, trenches may be too costly for situations involving houses. They could perhaps be justified for larger buildings with strict vibration limits, such as operating theatres of hospitals or high-tech factories with sensitive processes.

An economical alternative to trenches in a residential area could be a row of lime or cement piles in the right-of-way adjacent to the road. Such piles are constructed in situ by mechanical mixing of the soil with either quick lime or ordinary cement. The piles could have a diameter of 0.5 to 1 m and a depth of 15 m. However, the effectiveness of such pile-walls in reducing traffic vibrations has not yet been demonstrated.

The use of building isolation systems — for example, mounting the building on springs — is not effective for houses because of the predominantly low-frequency range of vibrations induced by road traffic. Unlike multi-storey buildings for which isolation systems have been successfully used to reduce subway-generated vibrations, typical houses do not have the necessary mass to induce the required deflections in isolation materials. The cost of installing isolation systems under existing buildings is prohibitive.

Summary

House owners are likely to complain about traffic vibrations if the levels are only slightly above the perception threshold, the main concern being fear of damage to their property. Building damage may occur but it is unlikely to be caused solely by the vibrations themselves. Reducing vibrations to an acceptable level could be difficult and expensive. For existing buildings, the most practical remedial measure is road maintenance. For new developments, increasing the distance between buildings and roads, improvement of soil structure, and in-ground pile barriers could prove effective.

References

1. Hunaidi, O. and Tremblay, M. Traffic-induced building vibrations in Montréal. *Canadian Journal of Civil Engineering*, Vol. 24, No. 5, 1997, pp. 736–753.
2. Hunaidi, O. Evaluation of human response to building vibration caused by transit buses. *Journal of Low Frequency Noise and Vibration*, Vol. 15, No. 1, 1996, pp. 25–42.
3. Hunaidi, O., Rainer, J.H. and Pernica, G. Measurement and analysis of traffic-induced vibrations. *Proceedings of 2nd International Symposium on Transport Noise and Vibration*, St. Petersburg, Russia, 1994, pp. 103–108.

Dr. Osama Hunaidi is a senior research officer in the Urban Infrastructure Rehabilitation Program of the National Research Council's Institute for Research in Construction.

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Canada

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For more information, contact Institute for Research in Construction,
National Research Council of Canada, Ottawa K1A 0R6
Telephone: (613) 993-2607; Facsimile: (613) 952-7673; Internet: <http://www.nrc.ca/irc>

9. REPORTS – PANEL UPDATES

9.1 STATE PLANNING COMMISSION CONCURRENCE APPLICATIONS

The following applications have received or are awaiting concurrence from the State Planning Commission.

DA NUMBER	APPLICANT	ADDRESS	NATURE OF DEVELOPMENT	DAC DECISION
960/819/2017	Chateau 1847 Yaldara	159 Herrmann Thumm Drive Lyndoch	Alterations to existing two-storey building, demolition and partial demolition of numerous sheds; Continue use as a Function centre (ground floor), additional use Motel incorporating eleven rooms (first floor)	Concurrence granted 13/2/2019 (4/12/2018 panel meeting)
960/305/2018	Poonawatta Enterprises	1227 Eden Valley Road Flaxman Valley	Cellar Door Sales Outlet, Deck and Advertising Sign	Concurrence granted 25/1/2019 (4/12/2018 panel meeting)
960/568/2018	Angaston Bowling Club	Lot 21 Valley Road Angaston	Construction of Two bowling greens, clubhouse (community centre), shade structures, Six light towers, associated car parking, landscaping and entrance sign	Awaiting SPC Concurrence (5/2/2019 panel meeting)
960/583/2018	Bryce Neyland	Piece 31 Steingarten Road Rowland Flat	Increase size of Existing Dam from 37.4 ML to 150 ML, 6.0 m high dam walls and relocation of associated pump station	Awaiting SPC Concurrence (5/2/2019 panel meeting)

RECOMMENDATION

That the report be received.

10. REPORTS – OTHER BUSINESS

Nil.

11.1 960/152/2018 (Lot 1 Wynns Road Flaxman Valley)

REASON FOR CONFIDENTIALITY

It is recommended that the public be excluded from the meeting, as is necessary, in accordance with Section 13 of the *Planning, Development and Infrastructure (General) Regulations 2017* to receive, discuss or consider in confidence the following information or matters in relation to this item:

- (i) legal advice;

RECOMMENDATION

That:

- (1) Pursuant to Section 13 of the *Planning, Development and Infrastructure (General) Regulations 2017* the Barossa Assessment Panel orders that the public be excluded from the meeting with the exception of the Assessment Manager, Planners and the Minute Secretary, on the basis that it will consider legal advice.
- (2) Accordingly, on this basis, the Barossa Assessment Panel is satisfied that the principle meetings of the assessment panel should be conducted in a place open to the public has been outweighed by the need to keep the information and discussion confidential.

12. NEXT MEETING

Tuesday 2 April 2019 commencing at 5.00 pm.

13. CLOSURE OF MEETING