APPLICATION TO CLEAR PASTORAL LAND

(s.38(1)(h) *Pastoral Land Act)*

1. APPLICANT'S DETAILS

Full Name	Cleveland Agriculture on behalf of Ucha Pty Ltd
Position (eg. Lessee / Manager)	Partner of Cleveland Agriculture/ Director of Ucha Pty Ltd
Telephone	0267565004
Mobile	0428659168
Email	jennifer@clevelandag.com.au
Postal Address	PO Box 135 Mungindi NSW 2406

2. DETAILS OF LEASE ON WHICH CLEARING IS PROPOSED

Lease Name	Ucharonidge Station
Pastoral Lease Number	Pastoral Lease 1072
NT Portion Number	NT Portion 307
Location / Pastoral District	Barkly
Total Area of Lease (km^2)	2455 sq km
Size of Proposed Clearing Area	48.89 sq km (4889 hectares)
Total areas previously cleared on the property (km2)	Pastoral land clearing permit PLC19/03 = 317.81 ha Pastoral land clearing permit PLC20/01 = 4916.1 ha Historical clearing circa 2013 (unmaintained) identified via Google Earth imagery = approx. 245ha Total = 5478.91 ha

3. APPLICATION FEE

An application fee is charged for clearing applications and payment is required at the time the application is lodged. Please contact the Pastoral Land Board Executive Officer on 8999 4667 or email pastorallandboard@nt.gov.au to confirm the current fee.

4. CLEARING DETAILS

4.1 How much land are you proposing to clear and what is (are) the proposed uses(s)?

Site ID (paddock or nominated number ID)	**Proposed Use** Specify crops or pasture species to be planted. Will the area be grazed of used for hay production? Provide details of non-pastoral use or other purpose.	**Area** (ha or km^2)
Florence East	Mix of grain and forage crops (predominately sorghum for cattle grazing and hay productions: and cotton seed for on-farm stock use)	1535.65 Ha
Micks East		1961.78 Ha
Rita Holding		1401.09 Ha
	Total Area	4898.52 Ha

The application is proposed to expand on previous permits to achieve a viable commercial operation. The cotton to be planted will be Australian CSIRO varieties currently marketed through Cotton Seed Distributors. These varieties sold as Bollgard III and Roundup Ready Flex cotton which contain insect resistance genes for the control of Helicoverpa Larvae and are also Glyphosate tolerant plants. The Bollgard III technology has decreased insecticide usage in the Australian cotton industry by 86% compared to non Bollgard III cotton. Due to the high protein content of cotton seed and its value as cattle feed, this crop will benefit the current cattle production system.

One of the main varieties of forage sorghum that may be planted at Ucharonidge is Graze-N- Sile, recommended by the NT Governments Ag Notes or a new variety from the same company, Pioneer called Mega Sweet. This new variety has the same excellent qualities as Graze-N-Sile though has improved beef grazing palatability. Cleveland Agriculture has had experience with silage pits of forage sorghum at "Cleveland" Mungindi for drought feed and as part of the ration used in the feedlot.

The proposed cropping system is part of an overall drought management strategy that will capitalize on the good season to better manage the dry years.

4.2 Have any of **these areas** been previously cleared?

☒ Yes (complete table below)

☐ No (go to part 4.3)

Site ID (paddock or nominated number ID)	**Details of Previous Clearing** Year cleared, purpose of original clearing, estimated age / height of regrowth, last known date of maintenance etc.	**Area Previously Cleared** (ha or km^2)
Florence East	Historical imargery on Google earths shows possible clearing, circa 2013, by previous owners. The clearing is not maintained and no longer evident to the eye or in recent imagery.	Approx 245ha

4.3 Have any **other areas** on the property been previously cleared?

☐ Yes (complete table below and show location on a copy of the Clearing Plan)

☐ No (go to part 4.4)

Site ID (paddock or nominated number ID)	**Area previously cleared** (ha or km^2)	**Clearing Purpose / Land Use**	**Approval Date and/or Permit Details**	**Year Cleared**	**Is the clearing currently maintained?**
Dry Paddock	320 ha	Pastoral	PLC19/03	2019	Yes
Pauls Paddock	2252 ha	Pastoral/ Agriculture	PLC 20/01	2020	Yes
Micks Paddock	2664 ha	Pastoral/ Agriculture	PLC 20/01	2020	Yes
Florence East	245 ha	Unknown – possibly cut for hay	Unknown – previous owners	Circa 2013	No

4.4 Attach a Clearing Plan

The Clearing Plan is a drawing made to scale showing the geo-referenced location of the proposed clearing sites(s) numbered or identified as shown in the above tables.

The clearing plan must contain:

- the map datum (eg. GDA94) used to locate the clearing areas;
- the map projection or zone;
- a north arrow;
- a suitable background (eg. cadastre showing property boundaries, satellite/aerial imagery or topographic map);
- corners of clearing areas must be labelled with coordinates, or numbered to identify coordinates contained in an attached table.

For assistance, contact the relevant regional officer, Rangelands Division, Department of Environment and Natural Resources.

Ucharonidge **GDA 1994 UTM Zone 53 – See clearing plan attached**			
Paddock	**Corner**	**E**	**N**
Florence East	A	418051.0404	8064406.8628
Florence East	B	419131.0404	8064406.8628
Florence East	C	419131.0404	8063356.8628
Florence East	D	421435.0404	8063356.8628
Florence East	E	421435.0404	8059156.8628
Florence East	F	418051.0404	8059156.8628
Micks	G	425165.6250	8058130.0425
Micks	H	425885.6250	8058130.0425
Micks	I	425885.6250	8057180.0425
Micks	J	426605.6250	8057180.0425
Micks	K	426605.6250	8054820.0425
Micks	L	427325.6250	8054820.0425
Micks	M	427325.6250	8047640.0425
Micks	N	425165.6250	8047640.0425
Rita Holding	O	421853.6250	8047340.0425
Rita Holding	P	427325.6250	8047340.0425
Rita Holding	Q	427325.6250	8044790.0425
Rita Holding	R	421853.9716	8044776.6568

4.5 Attach any relevant information on proposed pasture or crop requirements: Preferred soils, fertiliser and/or insecticide requirements and management advice. Contact the Department of Primary Industry and Resources for more information on (08) 8999 5511.

Soils:

The cropping system Cleveland Agriculture plans to develop requires a self-mulching black soil clay with a high moisture holding capacity. The soil type in the proposed application area at Ucharonidge has been assessed and classified as Vertosols. This soil type is the same classification given to the soils on the property Cleveland, at Mungindi, New South Wales. Cleveland Agriculture has been successfully producing high yielding irrigated and dryland crops on this soil type for the past 22 years. The high moisture capacity soils will allow a crop to develop during the wet season and continue utilising moisture once the wet season has finished.

Soil tests from Ucharonidge and Cleveland show similarities in both their physical structure and chemical characteristics. Cleveland Agriculture sees the potential to produce crops on this soil type at Ucharonidge. The soil type will allow a crop to develop during the wet season and continue to utilise moisture once the wet season has finished due to the higher PAWC.

The soil tests taken at Ucharonidge last year indicate that these soils currently have very low levels of Nitrogen (N), Phosphorus (P), Potassium (K) and Zinc (Zn). As with all dryland crops the achievable yields in both the cotton and sorghum will be dictated by the PAWC of the soil and the amount of rainfall received during the wet season. However, the next major yield limiting factor is nutrition especially when an average or higher rainfall wet season eventuates, where moisture may not be the largest yield restricting factor. To ensure the highest yield possible is generated from both the cotton and sorghum crops, we will be applying fertiliser to the fields pre-plant. This will likely be a blend of Urea combined with Starter Z & Sulphate of Potash. The urea will provide Nitrogen, whilst the Starter Z / Sulphate of Potash blend will provide Phosphorus, Potassium, Sulphur & Zinc.

Cleveland Agriculture has applied manure from the Cleveland feedlot onto the irrigation fields for the last four years, and more recently onto the broad acre dryland area. Since the practice of spreading manure has been implemented there has been a large increase in Phosphorus, Potassium and smaller increases in Nitrogen and Zinc. This has led to a reduction in the amount of nitrogen being applied whilst removing the need to apply P & K fertilisers. The feedlot manures have been generated from the cotton seed, corn and barley produced on the irrigated fields. This has increased the sustainability of Cleveland Agriculture's farming system by generating nutrients on farm and decreasing carbon emissions by reducing the transportation requirements of fertilisers. It is anticipated that a similar sustainable approach will be replicated at Ucharonidge.

Herbicides & Insecticides:

Sorghum:

Product	***Use***	***Control***
Glyphosate	Pre-emergent	Broad spectrum weed control
Atrazine	Pre/Post emergent	Grass & Broad leaf weed control
Fluroxypyr	Pre/Post emergent	Broad leaf weed control
Metolachlor	Pre/Post emergent	Grass & Broad leaf weed control
Dimethoate	Insecticide	Control of sucking insects
NPV / Vivus	Insecticide	Control of Helicoverpa
Fipronil	Insecticide	Control of grasshoppers / locusts

Pigeon Peas:

Product	***Use***	***Control***
Glyphosate	Pre-emergent	Broad spectrum weed control
Pendimethalin	Pre-emergent	Selected grass & broadleaf weed control
Prometryn	Pre-emergent	Broadleaf weed control

Cotton:

Product	***Use***	***Control***
Glyphosate	Pre-emergent	Broad spectrum weed control
Metolachlor	Post emergent	Selected grass & broadleaf weed control
Thiamethoxam	Seed Treatment	Sucking insects & False Wireworm
Dimethoate	Insecticide	Control of sucking pests
Sulfoxaflor	Insecticide	Control of Mirids, Aphids & Whitefly
Cyantraniliprole	Insecticide	Control of Helicoverpa & Whitefly
Rynaxypyr	Insecticide	Control of Helicoverpa & Spodoptera
Diafenthiuron	Insecticide	Control of Mites, Aphids & whitefly
Thidiazuron	Defoliant	Leaf defoliant & harvest aid
Ethephon	Growth Regulator	Cotton boll conditioner & defoliant
Mepiquat	Growth Regulator	Growth regulator of vegetative growth
Adjuvants	Wetting Agent	Bio-degradable wetting & spreading agent
Paraffinic Oil	Defoliant Aid	Carrier of Defoliant products

Insect Integrated Pest Management:

Once enough rainfall has been received to ensure successful germination of the intended crops, the fields will be assessed for weeds and soil insects by the Cleveland Agriculture agronomist. Recommendations will be made on these assessments and once the crop has germinated, weekly crop checks / assessments will be conducted.

Cleveland Agricultures' current approach for pest control is an Integrated Pest Management (IPM) system based on the best management practices developed by researchers for both the Cotton and Grains Research Development Corporations (CRDC &

GRDC). Using this approach Cleveland Agriculture has been able to minimise the use of insecticides.
During the 2020 cotton season at Ucharonidge the dryland Bollgard III varieties only required two insecticide application for mirids using a low impact insecticide called Transform (Sulfoxaflor). This product has little to no impact on beneficial insects such as spiders, lady beetles, red & blue beetles, predatory shield bugs, damsel bugs, lacewings etc. This product also suppress' Silverleaf Whitefly. By using a low impact product like this it has enabled the beneficial insects to help control pests such as mites, mealybug whilst keeping whitefly in check. Due to our soft IPM approach we have not had to treat for any other pests such as aphids or mites.

Due to this being the first decent wet season in the past three summers we did observe extremely high populations of heliothis, armyworm, pink bollworm and looper caterpillars. The Bollgard III cotton withstood this high insect pressure with no impact on yield. The unsprayed cotton refuge clearly showed the huge benefits offered by Bollgard III cotton with no fruit/cotton being produced in the refuge field.

Having inspected some other Northern Territory cotton crops and talking to the managers and agronomists of those crops along with the researchers at the Katherine Research Centre we are confident that a low impact integrated pest management plan will work well at Ucharonidge. Due to this being a new cropping area it may take a few seasons to see what insect pests will affect the crops. For this reason, we have included the insecticides that may be required in the table above. However, our main goal and preference would be to maintain a low impact IPM approach.

Integrated Weed Management Plan:

This year during the crop checks for insect pest also conducted assessments on the efficacy of the herbicides used before and during the cropping phase. Due to the resistance grass weeds that are becoming established across, the majority of Australian states, we will be using a number of integrated weed management tactics in order to limit the potential for resistant weeds to develop. We also have a biosecurity plan in place to reduce the risk of weed seeds or soil diseases being bought onto Ucharonidge.

To ensure the effectiveness of herbicides on weeds and to reduce the likelihood of resistant weeds becoming an issue, a number of herbicides with different modes of action will be used. This will also include a broad mix of alternated groups of herbicides such as Group A, L, G and M for knockdown of weeds and combining these with Group C, D, G and K residual herbicides for broadleaf weed and grass control. This combined with cultivation in order to incorporate fertiliser or manures makes for a robust integrated weed management program.

4.6 Outline an Establishment Plan in the table below.

Activity	**Timing** (month/year)	**Methods / Details** (Prompts are included to assist but other information can be included where relevant)
Clearing of grassland	Depending on approval but ideally in time to allow planting to occur during the 20/21 wet season.	Mulching of grasslands using tractor drawn offset disc plough will be the first stage. The disc plough has a slicing action that will break down and bury vegetation. Each set of offsets will cover approximately 100 hectares in a 12-hour shift. We anticipate that this operation will take approximately 30 days. A second pass will involve the use of tractor drawn Kelly chains. The Kelly chains will assist in further mulching down of the vegetation and smoothing the soil surface for more uniform planting depths and planting control. The Kelly chains can follow immediately behind the offsets. We anticipate this operation to be completed within a few days of the pass with the offsets.
Removal of vegetation	As above	The vegetation is mulched down and incorporated into the soil by the plough and Kelly chains.
Site Preparation	As above	Full cultivation, outlined above, to prepare a fine tilth which will improve the capture and preservation of soil moisture, followed by post-cultivation control of grass and weed species using herbicide application for weed control prior to planting.
Planting	Jan/Feb 2021 The proposed cropping system is part of an overall drought management strategy which ideally would commence in the coming wet season.	Planting will occur when there is sufficient soil moisture and the land is able to support machinery. It is anticipated that planting would take approximately two weeks following the soil preparation outlined above. The clearing outlined above would achieve the best planting conditions. However, if there are time or weather constraints the soil and land type does provide the potential for the crop to be planted directly into grasslands, but this would not be the preferred option. The planting window will vary according to each season but based on long term averages (See Graph 1 -data obtained from the Bureau of Meteorology's Elliott weather station) the optimal planting time will be January to ensure the crop benefits from the higher rainfall months to achieve maximum vegetative growth and yield potential.

Weed and Sucker Management	On-going	In addition, to the weed and sucker management outlined in the site preparation a controlled herbicide management approach will be undertaken as necessary to target the natural seed bank. Aim to move towards a minimum till approach using selective and targeted herbicides to control specific species. This approach minimizes soil compaction and the use of more biodegradable and softer chemical and avoids the potential for dispersion of non-specific herbicides onto adjoining buffer zones.
Crop Management (if applicable)		Crops will be managed by Cleveland Agriculture with the consultation of agronomist and other specialists as appropriate. Best management practices will be adopted aiming for a minimum till approach along with integrated pest management program. Farm hygiene will also be of high priority in order to avoid issues such as the introduction of foreign or unwanted plant or insect species through machinery or staff.
Crop Management (if applicable)		Outline how crops will be tilled and/or rotated and whether any additional crops or pastures are likely to be added in the future

Note – Permit issue date

If the permit for the new fields is not approved until during or after the NT wet season, then the area would not be ploughed until the dry season (June / July) in order to avoid unnecessary compaction of the new farming fields.

If the permit is issued in January, the method of clearing may be altered from mulching the grassland to applying Glyphosate to the new area at the end of the wet season – approximately March/April. In doing so this would preserve as much of the water in the profile as possible for the following wet season which could allow for the earlier planting of suitable crops – cotton or sorghum. Although the grasses would die, they would provide ground cover during the remaining wet season reducing erosion. This would then allow the permit area to be offsetted / disced in June or July and then have fertiliser applied in August.

4.7 Will the clearing development be staged? ie will different sites be cleared in different years?

☐ Yes (complete table below)

☒ No (go to part 4.8)

Year	**Site ID** (paddock or nominated area)

5. WATER REQUIREMENTS

5.1 Does the proposal require irrigation?

☐ Yes (complete table below)

☒ No (go to part 6)

5.1.1	What will be the total annual water requirements for the property following establishment of the proposed development? *Contact Water Resources on 8999 4613 for advice on water use requirements*
5.1.2	Where will water be sourced and is there adequate supply? For example, 860 ML/yr will be sourced from the Tindall Limestone Aquifer from bore RN32140 at 20L/sec.

Note: Licensing provisions apply to Water Control Districts and Water Allocation Plan areas. Contact Water Resources on 8999 4613 for advice on whether this applies to you.

5.2 Do you need a water license?

☐ Yes (see 5.2.2)

☐ No (go to part 6)

5.2.2 Please advise the current status of the water license:

☐ Approved (please attach copy of license)

☐ Pending approval

☐ Application to be lodged

6. ENVIRONMENT PROTECTION

Has the proposal been referred for assessment under the *Environmental Assessment Act*?
To determine whether your proposal will trigger referral, read the Environmental Assessment Guidelines "When a Notice of Intent is not required for development proposal submitted under the Pastoral Land Act".
See www.ntepa.nt.gov.au/environmental-assessments/factsheets-and-guidelines.

☐ Referred – assessment not required (attach advice from NT EPA)

☐ Referred – assessment required (attach advice from NT EPA)

☒ Not referred to NT EPA

7. LAND RESOURCES

7.1 Describe the physical characteristics of the land:

The proposed site is located in Mick's, Florence East and Rita's holding paddocks. The land type is described level to gently undulating, undifferentiated colluvial/alluvial plain, moderately well-drained, gray cracking clay (Vertosol). See attached land and soil report prepared by soil consultant Nicholas McGrath (B.Env Sc).

7.2 Attach a copy of any land resource mapping that extends over the proposed clearing areas with a description of the mapping units and map scale.

See attached land soil report prepared by Nicholas McGrath following on-ground site survey.

7.3 Verify and/or refine the land resource mapping. Describe the various land types using the pro-forma at Appendix A. Take a representative photo of the land type.

See attached land soil report prepared by Nicholas McGrath following on-ground site survey.

Attach the descriptions (Appendix A pro-forma) and photos of each land type to your application. Delineate the location of each land type on a copy of the clearing plan.
For further assistance, see: www.lrm.nt.gov.au/soil and www.lrm.nt.gov.au/natveg/vegmapping

8. WEEDS

8.1 Are there any weeds declared under the Weeds Management Act on the property?
For assistance see: http://www.lrm.nt.gov.au/weeds2/legislation/declared

☒ Yes (complete table below)

☐ No (go to part 8.2)

Weed species and declared class	**Weed Locations** (eg. tracks, previously cleared areas, proposed clearing areas)	**Describe how common the weed is**
Parkinsonia aculaeta	Isolated plants recorded in adjacent paddocks	Isolated individual plants
Calotropis procera	Isolated plants recorded in adjacent paddocks	Isolated individual plants

Class A: to be eradicated
Class B: growth and spread to be controlled
Class C: not to be introduced to the Northern Territory

8.2 Do you have a weed management plan?

☒ Yes (complete table below)

☐ No (go to part 9)

Target Weed	**Aims** (contain spread, reduce extent, eliminate)	**Methods** (ie. monitor and spray)
All weeds that become apparent	Eliminate	Monitoring and using a controlled herbicide management approach, using biodegradable and softer chemicals when practical. In some instances, cultivation may be necessary.
Other areas - Parkinsonia aculaeta	Reduce extent	Use of basal-bark Access and diesel and/or Grasslan on annual basis as well as opportunistically
Other areas – Calotropis procera	Reduce extent	Use of basal-bark Access and diesel and/or Grasslan on annual basis as well as opportunistically

9. POTENTIAL IMPACTS

9.1 Are there any coastal/marine areas on the property?

☐ Yes (provide description below)

☒ No

9.2 Are there any public facilities, utilities or infrastructure in the locality?

☐ Yes (provide description below)

☒ No

9.3 Are there any records of threatened flora and/or fauna species listed under the *Commonwealth Environment Protection and Biodiversity Conservation* (EPBC) *Act* or the *Territory Parks and Wildlife Conservation Act* within 5km of the proposed clearing sites?

Note: Further information and search tools on the EPBC Act are available from the Commonwealth Department of the Environment and Energy at: http://www.environment.gov.au/epbc/protected-matters-search-tool.

Access threatened species information at: www.nt.gov.au/environment/animals/classification-of-wildlife or http://nrmaps.nt.gov.au/. The Department of Environment and Natural Resources, Fauna and Flora Division can be contacted on 08 8995 5000 for advice.

☐ Yes (complete table below)

☒ No (go to part 9.4)

Common Name	Species Name	EPBC Act Listing	TPWC Act Listing	Location

Listing Codes: Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Data Deficient (DD)

9.3.1 Assess the risks posed to each species from the proposed development and describe in the table below how any risk will be mitigated.

Identify any associations that the species may have with landforms, vegetation structure or dominant plant species proposed for clearing.

Download species information at: www.lrm.nt.gov.au/plants-and-animals/home/specieslist or contact the Department of Environment and Natural Resources Fauna and Flora Division on 8995 5000.

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)

9.4 Are there any "significant" vegetation communities such as rainforest; closed forest; riparian vegetation; communities containing large trees with hollows; sand-sheet heath; or mangroves within 200m of the proposed clearing area(s)?

Note: See the NT Planning Scheme Land Clearing Guidelines for definitions of significant vegetation communities.

☐ Yes (complete table below)

☒ No (go to part 9.5)

Description of significant vegetation community	**Distance to proposed clearing**

Attach copy of the clearing plan with location of significant vegetation communities.

9.4.1 Identify and assess the risks to significant vegetation communities associated with the proposed development and use of the land and describe how risk will be mitigated. Potential impacts include weed incursion, fertiliser/chemical inputs, erosion and/or sedimentation, and reduced wildlife movement to or from community. Consider any benefits from fire management.

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)

9.5 Are native vegetation buffers and/or wildlife corridors proposed to be retained?

☒ Yes (complete table below)

☐ No (explain why)

If yes, describe the proposed width and length of corridors, reason for inclusion in that location and width chosen. See the NT Planning Scheme Land Clearing Guidelines for recommended buffers and wildlife corridors.

Purpose of buffer / corridor	Width, length and reason chosen
Property Boundary Buffer	The proposed clearing footprint is approximately 2% of the pastoral lease or 4% if combined with existing permits. The area (96% of lease) external to these areas is retained native vegetation. The distance from the proposed clearing area to the property boundary is greater than the land clearing guidelines recommendation of 200m.
Landscape buffer	A thorough on- ground site inspection was undertaken when determining the location of the proposed area to be cleared. As can be seen in the photos and field site notes, in the attached land and soil report, the area to be cleared and surrounding paddocks is predominately open grasslands. There has been no sensitive or significant vegetation observed on the pastoral lease. Similarly, the site chosen is not located near any significant landscape features such as sinkholes or riparian vegetation. The area is not coastal, or sand based arid zone landscape where wind erosion is likely to be high. Therefore, the necessity for wind break/buffers is minimal. The proposed cropping system is likely to be structurally similar to the existing native vegetation. The structure of the proposed cropping system and the proposed land management practices outlined in section 11 should provide similar outcomes, to what that the recommended buffers in the Land Clearing Guidelines seek to achieve.

Wildlife corridor	There has been no evidence or observations of threatened, range restricted or otherwise significant species within the area or surrounding area. On ground site observations revealed minimal wildlife activity in the proposed area. The existing area is currently used for grazing cattle. It is acknowledged that the default guidelines recommend that corridor should be at a rate of approximately one corridor per linear kilometer of clearing. It is also recognized in the guidelines that" such a prescriptive arrangement is not necessarily pragmatic or conducive to the most beneficial land management or biodiversity outcomes" Given the area is predominately open grasslands and the proposed cropping system will be structurally similar it is highly unlikely the clearing will negatively impact on wildlife. It is proposed that 300m corridor/buffer will be retained between cleared areas rather than multiple corridors.

Note: the location and size of all native vegetation buffers and wildlife corridors are to be shown on the Clearing Plan.

9.5.1 Identify and assess the risks to corridors and wildlife movement. Potential risks include reduced habitat availability and movement of wildlife between larger patches of vegetation and impact on edges of corridors (weeds, wind exposure, fertiliser or sediment).

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)
Minimal	The crops should not restrict the movement of wildlife as expect the fodder crops to be structurally similar to native grassland.

9.6 Potential Impacts to Soils, Surface Water and Ground Water

9.6.1 Are there any permanent or seasonal water features or sinkholes adjacent to proposed clearing sites?

Note: See the NT Planning Scheme Land Clearing Guidelines for assistance.

☒ Yes (complete table below)

☐ No (go to 9.6.2)

Describe feature (eg. drainage line, wetland, waterway / stream order, sinkhole (open or closed)	**Width of buffer to be retained**	**If buffer width is smaller than recommended in Land Clearing Guidelines, explain why**
Itermittent draining line west of Rita Holding Paddock	450 metres	Not applicable

9.6.2 Assess the risk of chemical sprays or aerial application of fertiliser associated with the proposed land use drifting into and polluting surface water or sinkholes and describe how risk will be mitigated.

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)

10. SITES OF CONSERVATION SIGNIFICANCE

Are there any sites of conservation significance located within the proposed area for clearing?

☐ Yes ☒ No

If yes, please show the location of sites of conservation significance on a map and describe how risk will be mitigated in the table below.

Sites of Conservation Significance Search

NT Sites of Conservation Significance: www.lrm.nt.gov.au/plants-and-animals/conservation-for-land-managers/sites-of-conservation-significance/map

Register of the National Estate: www.environment.gov.au/cgi-bin/ahdb/search.pl

NT Parks and Reserves: www.ntlis.nt.gov.au/imfPublic/imf.jsp?site=nreta
(check box for "Parks and Wildlife", refresh map, click and drag over area of interest)

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)

11. EROSION & SEDIMENT CONTROL

11.1 Attach a copy of the Clearing Plan showing:

- delineated land types described in Part 7.1;
- the direction of overland flow;
- adjacent property boundaries (within 200m); and
- adjacent water features and sinkholes described in 9.6.1 above.

11.2 Assess the potential for water and wind erosion during both the establishment and operational phases of the development.

Consider:

- the % and length of slope in the proposed clearing area;
- the vulnerability of the soil type to overland flow (vulnerable soils include: loose sands; poorly drained soils; sodic or dispersive soils; and shallow soils);
- the risk of receiving erosive floodwater from adjacent streams or run-off from the surrounding landscaped (eg. rises and hills);
- the proposed land use, including projected minimum groundcover (%), tillage practices, and potential loss of soil structure from trafficking; and
- the vulnerability of soil type to wind erosion (e.g. sandy soils).

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)
There is minimal risk of either wind or water erosion occurring during the clearing / establishment phase. The risk of overland flow is low on these paddocks due to their lack of slope.	**Erosion mitigation during clearing & establishment**: As noted in the attached land and soil report the country in the application area is level to very gently undulating. Slope mostly≤ 0.5% (occasionally up to 2%) As such the slope and location of the proposed area does not present a risk. The soil is a coarse, self-mulching, cracking clay with a large water holding capacity, with minimal erosion characteristic due to it's soil composition. The paddocks will be cleared/ploughed by Grizzly offsets. The effect from the offsets will leave the country in a "rough" nature with a high infiltration profile which will enable the soil to fully absorb any rainfall. The soils being a coarse, self-mulching, cracking clay are less likely to be susceptible to wind erosion.
There is minimal risk of either wind or water erosion occurring during the operational / cropping phase.	The forage and grain sorghum to be planted will provide very similar ground cover to the current Mitchell grass vegetation which will minimize the potential risk of wind or soil erosion. The height of both the sorghum and cotton once established will further minimise the risk of wind erosion for these paddocks.

11.3 Assess the risk of erosion or sedimentation of adjacent infrastructure, water features and sinkholes during both the establishment and operational phases of the development.

Consider:

- The adequacy of retained buffers (described above in 9.5 and 9.6.1) to filter runoff and promote infiltration before run-off reaches streams or infrastructure.
- Potential for chemical pollution of surface water or sinkholes from herbicides, insecticides or fertilisers attached to sediment (i.e. intensity of chemical use).

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)
There is a low likelihood of soil erosion or sedimentation to adjacent features due to the deliberate placement of these paddocks away from any existing infrastructure, water features or sinkholes.	The location of the proposed paddocks has been deliberately chosen due to its lack of slope, to avoid and mitigate any risk of soil erosion or runoff. The retention of large areas of native vegetation around these two paddocks plus the internal buffers will minimise runoff. This native vegetation will filter any potential runoff whilst promoting infiltration.
There is a low risk of Fertiliser pollution of surface water. The land type has been assessed as very slow to slow runoff. (See attached land and soil report)	The majority of the fertiliser to be used will be MAP, a phosphorus based fertiliser. This will be drilled into the soil profile prior to planting and is an immobile nutrient. A small amount of Nitrogen fertiliser will also be applied prior to planting and will be drilled into the soil profile at a depth of 15-20cm, thus reducing potential runoff. The lack of slope on these paddocks further minimise the risk of nutrient runoff. The large buffer of surrounding native vegetation isolates the paddocks from neighboring properties and water features.

There is a low risk of Pesticide pollution of surface water.	The lack of slope on these two paddocks further minimise the risk of nutrient runoff. Integrated Pest Management (IPM) will be utilised on all crops reducing the amount of insecticides required. When needed the softest insecticide options will be used to maintain and use beneficial insects whilst reducing impacts on these beneficials. The crop canopy of the sorghum and cotton will further reduce the potential of pesticide runoff. Bollgard III cotton reduces the need for pest control. Naturally occurring virus (Gemstar) will be first option for control of Helicoverpa in grain sorghum. The placement of these paddocks maintains a large native vegetation buffer from neighboring properties or water features. Application of pesticides will be conducted by Chemcert or AAAA accredited contractors.

Based on considerations above, outline temporary and/or permanent controls that you will put in place to minimise the risk of erosion and avoid the potential impacts of sedimentation and pollution. The amount of detail and controls provided should be proportionate to the degree of risk. Show the location of controls on a copy of the Clearing Plan.

Temporary Controls	Permanent Controls
Once the paddocks have been worked with offsets this will leave the soil in a rough state which will capture water and restrict this from moving across the landscape.	These paddocks will be farmed using minimum tillage practices whereby the crop stubble will be retained from year to year increasing water infiltration whilst reducing potential runoff.
Vigorous crop growth of the sorghum or cotton during the wet season will continue to extract moisture from the profile further reducing potential runoff.	Large native vegetation buffer areas are being retained which surround both paddocks. This area will continue to reduce run off whilst filtering any water that does move across these paddocks.

11.5 Are acid sulphate soils present in or within 200m of the proposed clearing areas? (usually found on tidal areas including mangroves and coastal floodplains)

☐ Yes

☒ No

If Yes ensure that these areas are shown on a copy of the Clearing Plan. Assess the risk of disturbance to acid sulphate soils and release of sulphuric acid, and describe how the potential impact will be avoided.

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)

12. Potential Impacts Across Property Boundaries

12.1 Is there a public road or public area within 200m of the proposed clearing?

☐ Yes (complete table below)

☒ No (go to part 12.2)

Distance from public road or corridor	Width of retaining boundary buffer
1.5 km to Beebe Road – no through access road to Ucharonidge	
18.5 km to western boundary Tandyigee	
8 km to eastern boundary Mungabroom	
32 km to northern boundary Beetaloo	
19 km to southern boundary Helen Springs	

Note: the location and size of all buffers are to be shown on the clearing plan.

12.2 Assess the risk of reduced visual amenity (any quality that makes the locality harmonious, pleasant or enjoyable), recreation or tourism value associated with the proposed development and describe how risk will be mitigated.

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)
Minimal	Proposed location is within pastoral lease. The access road would be a station road rather than a public road. Distance to neighbours and public road outlined above

12.3 Assess the risk of chemical spray drift or dust pollution associated with the proposed development affecting neighbours/community and describe how risk will be mitigated.

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)
Minimal	Proposed location presents little or no risk to neighbours or community. See distance to neighbours outlined in 12.1. Best management practices will be adhered to with the application of fertilizer and chemical.

12.4 Are introduced species proposed to be planted less than 100m from the property boundary?

☐ Yes (complete table below)

☒ No (go to part 12.5)

Species to be planted	**Distance from boundary**	**Width of buffer**

Note: the location and size of all buffers are to be shown on the clearing plan.

12.4.1 Assess the risk of species spreading across the boundary and describe how potential spread will be mitigated.

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)
Minimal	Proposed location presents little or no risk to neighbours or community. See distance to neighbours outlined in 12.1. Best management practices will be adhered to with the application of fertilizer and chemical.

13. HERITAGE & SACRED SITES

13.1 Are there any declared heritage places or archaeological sites within the meaning of the Heritage Conservation Act on the property?

Attach results of a Heritage search from the Heritage Branch, Department of Tourism and Culture (phone (08) 8999 5051) or an archaeological survey report if a survey has been conducted.

☒ Yes

☐ No (go to part 12.5)

If yes, attach the advice, show the sites on the clearing plan and complete the risk assessment table below.

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)
Minimal impact to the heritage site - Ucharonidge Station Number 1 Bore and 1949 Comet Windmill	The farming activity presents no risk to the site as the heritage site is already enclosed.

13.2 Are there any sacred sites or significant sites protected under the *Aboriginal Sacred Sites Act* on the property?

Attach a report from the Aboriginal Areas Protection Authority outlining the results of a register inspection. http://www.aapant.org.au Phone (08) 8999 5511.

☒ Yes ☐ No

If yes, attach the advice, show the sites on the clearing plan and complete the risk assessment table below.

Risk Assessment (the likelihood of impacts occurring and possible consequences)	**Risk Mitigation** (how will the risks identified be minimised)
Minimal	All Sacred sites outside clearing area. See attached letter and map that was provided to accompany application lodged by Consolidated Pastoral Company.

SIGNED:_____ **DATED:** 9 November 2020

Please forward your application to:

The Executive Officer
Pastoral Land Board
PO Box 496
PALMERSTON NT 0831
Email: pastorallandboard@nt.gov.au

APPENDIX A: LAND TYPES IN THE PROPOSED CLEARING

In your own words describe **EACH** land type on a separate sheet

See attached land and soil report prepared by soil consultant Nicholas MacGrath (B. Env Sc)

Checklist of Attachments

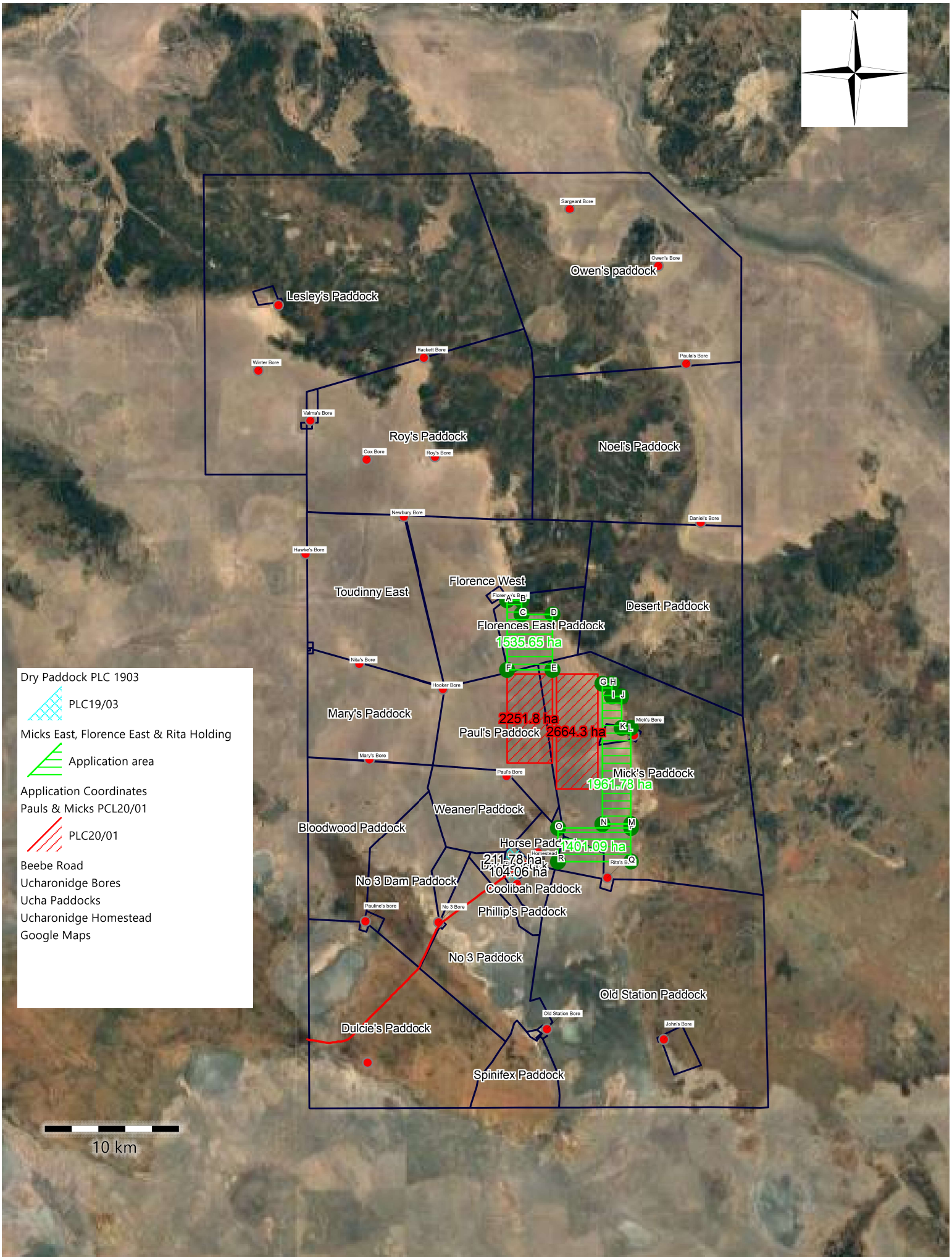
Note: You can show more than one feature on a plan to reduce the total number of plans required.

A Clearing Plan showing the geo-referenced location of each proposed clearing site and numbered to identify the proposed land use at each site.

Copies of the Clearing Plan showing one or more of the following:

- Location of any other areas on the property previously cleared
- Location of land types proposed for clearing
- Location of significant vegetation types or sites of conservation significance within 200m of proposed clearing sites
- Location and size of all native vegetation buffers and wildlife corridors
- Location of drainage lines or depressions, waterways (label stream order), wetlands, springs or sinkholes adjacent to proposed clearing sites
- Direction of potential overland flow
- Location of proposed erosion and sediment controls
- Location of acid sulphate soils within 200m of proposed clearing sites
- Location of heritage places, archaeological sites, sacred and significant sites and restricted works area
- Land resource mapping over the proposed clearing area with a description of mapping units. Representative photos of land types proposed for clearing
- Advice regarding threatened species
- Advice from DLPE Heritage Branch regarding the presence of declared heritage places or archaeological sites
- Results/advice from a Register of Sacred and Significant Sites search from the Aboriginal Areas Protection Authority (AAPA)
- Information on crops or pastures to be planted

Ucharonidge



Dry Paddock PLC 1903

PLC19/03

Micks East, Florence East & Rita Holding

Application area

Application Coordinates

Pauls & Micks PCL20/01

PLC20/01

Beebe Road

Ucharonidge Bores

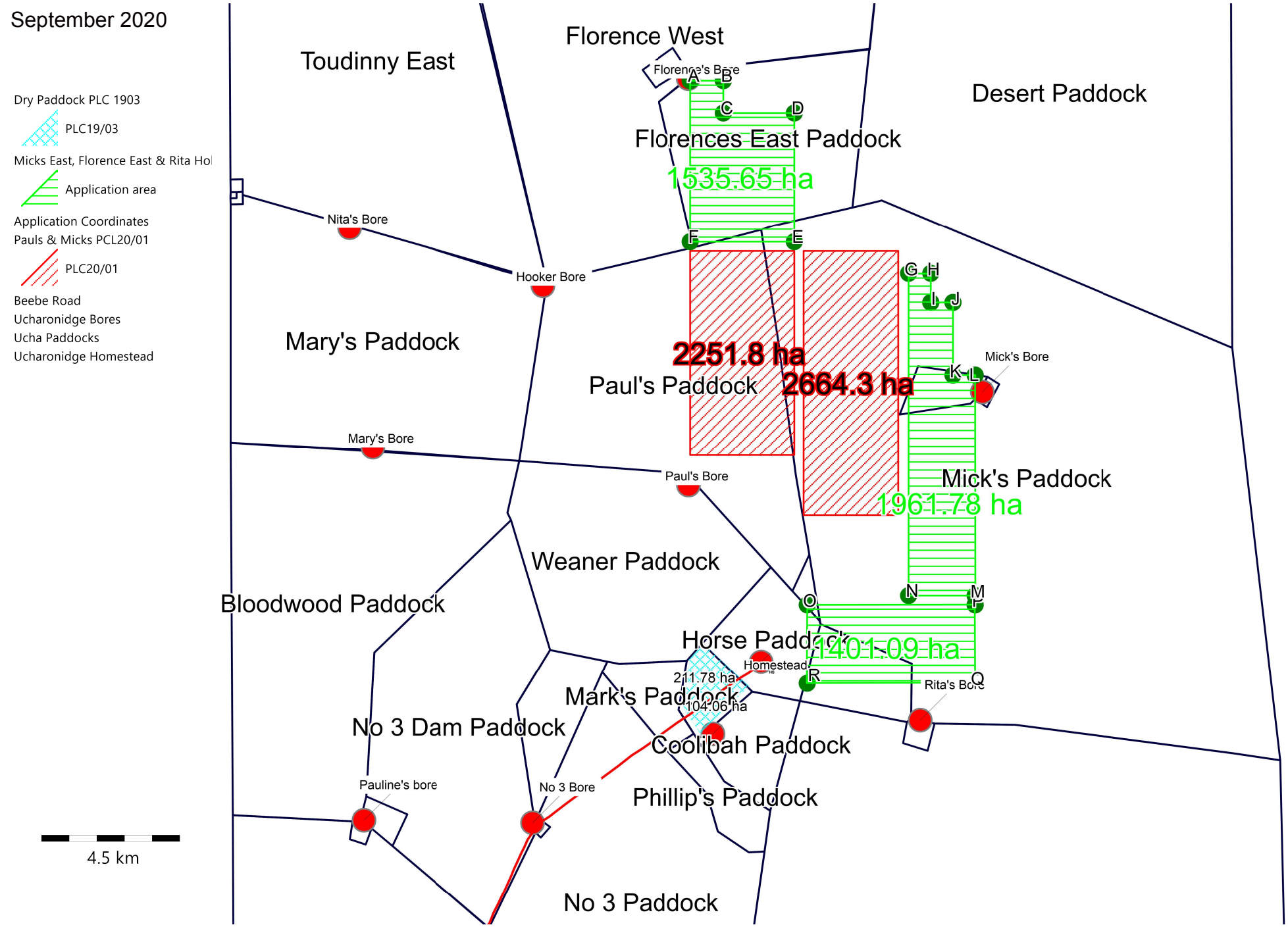
Ucha Paddocks

Ucharonidge Homestead

Google Maps

Ucharonidge

September 2020



Nicholas McGrath
B.Env.Sc
ABN: 30 391 624 635

109 Newton Rd, Mullengandra NSW 2644
Mob: 0488 155 101
Email: nmcgrath26@gmail.com

LAND TYPES AND LAND CAPABILITY ON PARTS OF RITA'S HOLDING, MICK'S EAST AND FLORENCE'S EAST PADDOCKS, UCHARONIDGE STATION

August 2020

Prepared for: Cleveland Agriculture

Prepared by: Nicholas McGrath

Table of Contents

1. Introduction

1.1 Background

Cleveland Agriculture manage Ucharonidge Station in the Barkly Tableland region of the Northern Territory on behalf of the owner, Ucha Pty Ltd. They propose to clear approximately 4 889 ha of native vegetation for diversification into broadscale dryland cropping on the property. As lessee of the pastoral lease, Ucha Pty Ltd are required to lodge an 'application to clear native vegetation' for consideration and approval by the Pastoral Land Board. Cleveland Agriculture, on behalf of Ucha Pty Ltd, are lodging the application. Nicholas McGrath (ABN 30 391 624 635) has been tasked by Cleveland Agriculture to assess the landform, soil and vegetation properties of the proposed clearing area to reliably inform and assist in the completion of the Land Resources (Section 7) and Erosion and Sediment Control (Section 11) sections of the application. The following report describes findings of the land resource assessment and land capability assessment of the proposed clearing area.

1.2 Survey area

The proposed clearing area, referred to as the survey area, is located east and north of the Ucharonidge station homestead and covers a total area of 4 889 ha (Figure 1). The survey area is divided into three sections. 'Rita's Holding' (1 401 ha) is the southern most section, 'Mick's East' (1 962 ha) is the middle section and 'Florence's East' (1 536 ha) is the northern most section. For simplicity, the survey area is referred to as a whole throughout this report.

The location and extent of the survey area was adjusted during field assessment after preliminary field observations of the original survey area (further to the south and east of the current survey area) identified drainage features and riparian vegetation (*Eucalyptus microtheca*). Adjustment of the boundary was made to avoid such areas and enabled the proposed clearing area to include a single uniform land type, namely a non-gravelly, level to gently undulating Mitchell grass clay plain (Land Type 1).

Figure 2 illustrates the level to gently undulating landform associated with Land Type 1.

1.3 Previous land resource mapping

Previous land resource studies that intersect the survey area are limited to the 1:1 000 000 land systems mapping – *Survey of the Barkly Region, Northern Territory and Queensland, 1947-48* (Christian *et al*. 1954). Two land systems from this mapping intersect the survey area. The Creswell land system covers the majority of survey area. This land system is characterised as very gently undulating to nearly flat Tertiary swamps with heavy grey pedocal soils and dominant vegetation of *Eulalia fulva* and *Dicanthium fecundum* grassland (Christian *et al*. 1954). A small portion of the survey area in the south is mapped as the Sylvester land system. This land system is characterised as very gently undulating seasonally flooded swamps with heavy grey pedocal soils and a dominant vegetation of *Chenopodium auricomum* shrubland with *Eucalyptus microtheca* on the fringes (Christian *et al*. 1954).

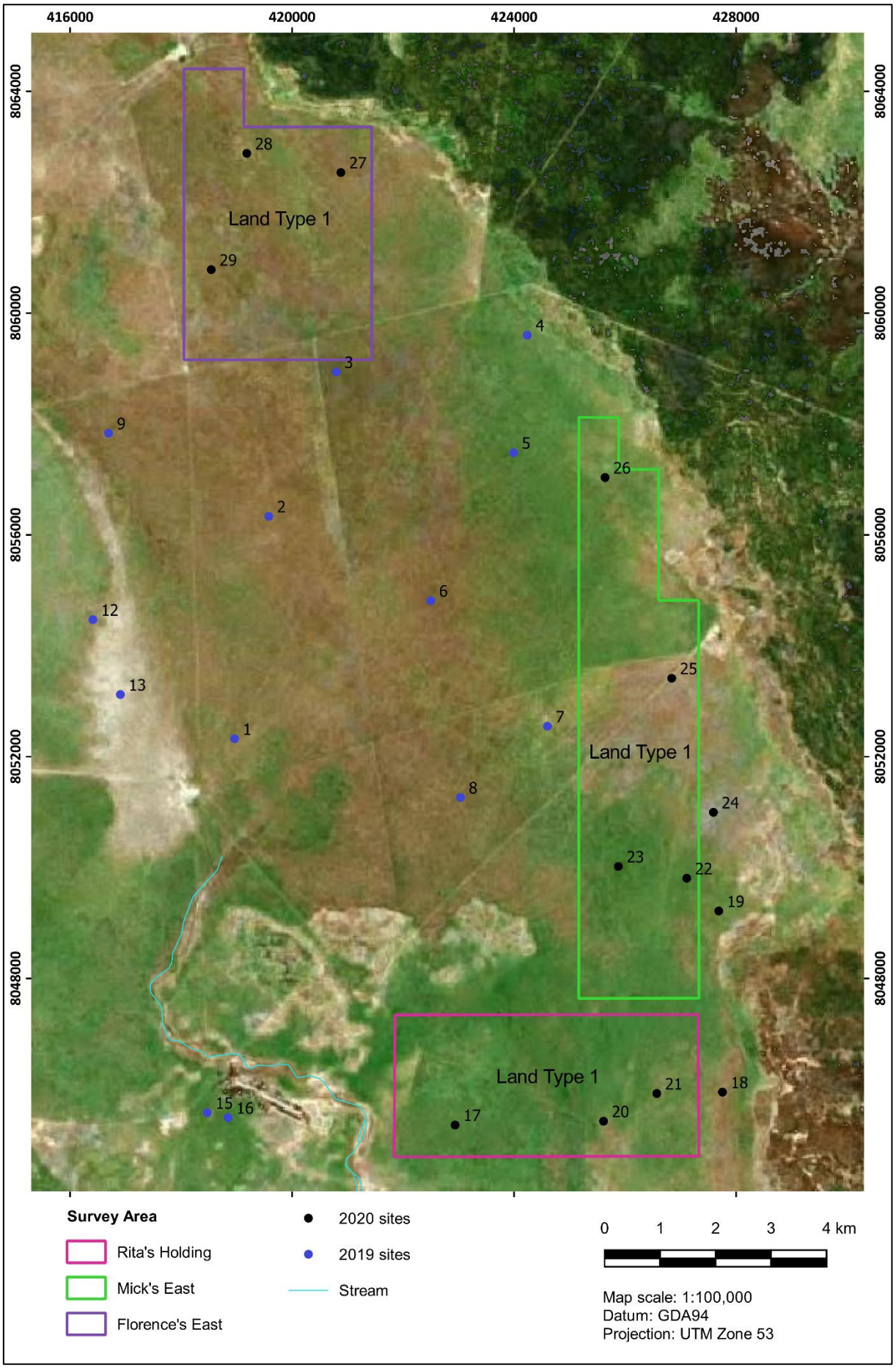


Figure 1 The location and extent of the survey area, including field sites and land types (image source: Bing).

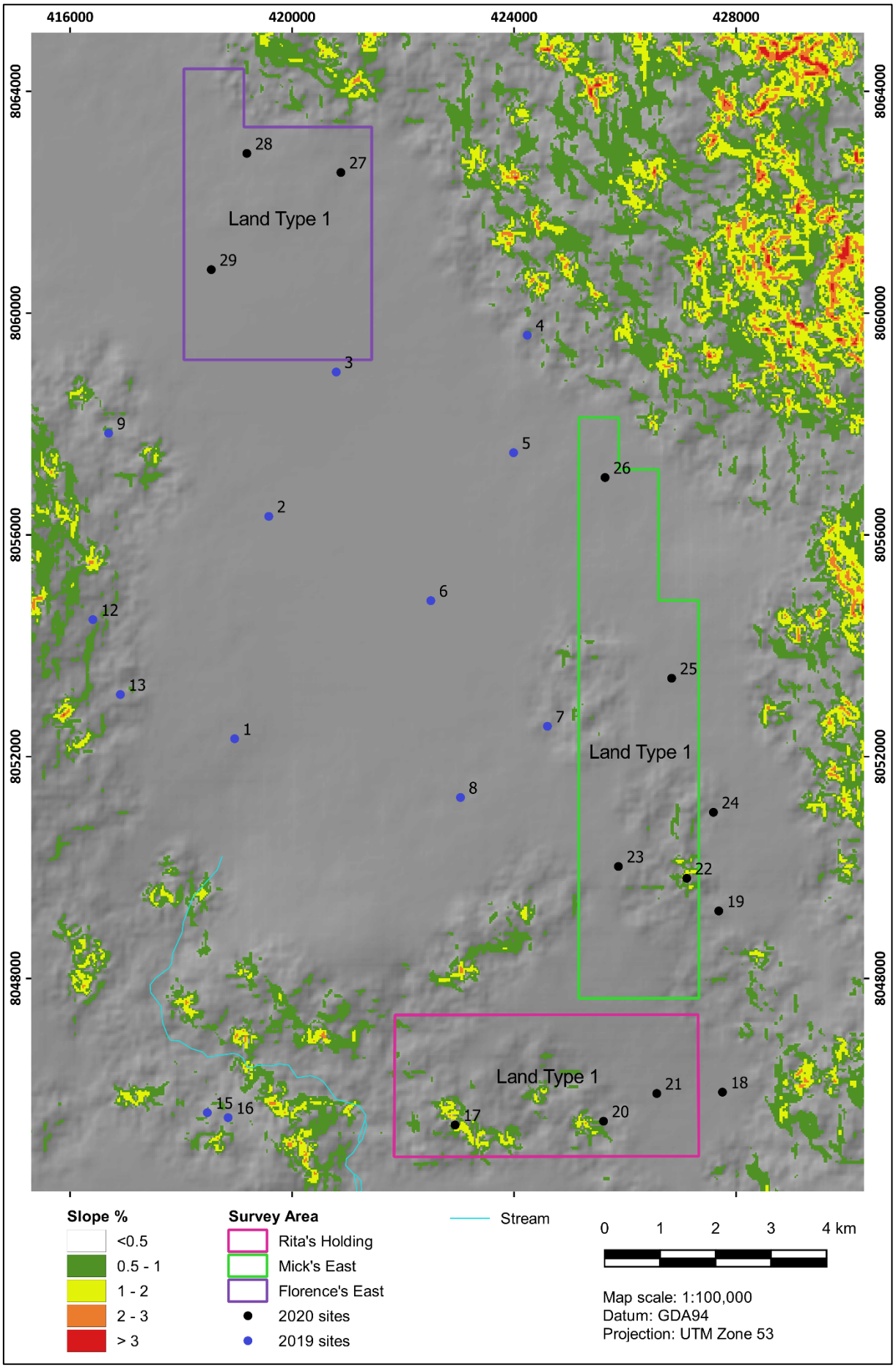


Figure 2 Hillshade and percentage slope of the the survey area, from the SRTM-derived 1 second (30 m) Digital Elevation Model (source: Geoscience Australia).

2. Investigation methods

2.1 Land type mapping

The Northern Territory *Land Clearing Guidelines* (DENR 2020) define a land type as a simplified land unit that incorporates "a reasonably homogenous part of a land surface, distinct from surrounding terrain with consistent properties in landform, soil or vegetation" (Hooper 1970). As such, mapped land types typically exhibit a uniform pattern on aerial photography or satellite imagery, and present as a repeatable and recognisable combination of landscape terrain, soil type and associated vegetation community.

Preliminary landscape interpretation incorporating geological mapping, digital elevation model (DEM) analysis, satellite imagery patterns and observable landscape features was used to delineate potential landform, soil and vegetation changes within the survey area. Proposed field sampling locations were selected during this process and preliminary land type boundaries were verified and adjusted during fieldwork.

2.2 Mapping scale

Due to the uniformity of landform, soil and vegetation characteristics within the survey area, and the low to medium intensity (see McKenzie *et al.* 2008) broadscale nature of the proposed land use (broadscale dryland cropping), a mapping scale of 1:50,000 was deemed appropriate. Field site densities and data collection conform with minimum acceptable requirements for this scale (McKenzie *et al.* 2008).

2.3 Field survey

The field program was undertaken in late July 2020. In total, 11 detailed field sites were described for landform, soil and vegetation characteristics. A further two field sites were described for landform, surface soil and vegetation characteristics. In addition to the 13 field sites described in July 2020, another 4 field sites described in September 2019 and located near the survey area were used to assist site selection and mapping in this investigation. All field site locations are shown in Figure 1 and Figure 2.

Detailed field sites comprise fully described soil pits to a depth of between 1.1 m and 1.5 m. Soil pits were excavated by a backhoe, and have been comprehensively photographed, described and sampled. Landform, soil and vegetation descriptions were collected in accordance with national standards outlined by NCST (2009), Hnatiuk *et al*. (2009) and Isbell and NCST (2016). Sampling of the surface soil and subsoil horizons was undertaken at standard depth intervals; 0-0.05 m (or depth of A11 horizon), 0.2-0.3 m, 0.5-0.6 m, 0.8-0.9 m, 1.1-1.2 m and 1.4-1.5 m (if exposed) at all detailed field sites. Salinity analyses were completed for all sites (Field sites – 17, 18, 19, 21, 22, 23, 24, 25, 26, 27 and 29), while cation chemistry and potential sodicity characteristics were undertaken at selected representative sites (Field sites – 21, 22 and 27).

2.4 Laboratory analysis

All laboratory analyses were undertaken by Agricultural Chemistry Pty Ltd. in Queensland. This is an Australasian Soil and Plant Analysis Council (ASPAC) accredited laboratory and methodologies used follow the procedures described by Rayment and Lyons (2011) and McKenzie *et al.* (2002).

2.4.1 Salinity assessment

Analyses undertaken at each sample depth included $pH_{1:5}$, electrical conductivity ($EC_{1:5}$), soluble chloride ($Cl_{1:5}$). EC_e is a measure of the electrical conductivity of a saturated soil-water extract, and is the preferred method for assessing soil salinity within the broader landscape. Standard $EC_{1:5}$ measurements can be converted to EC_e however the dissolution of crystalline gypsum ($CaSO_4$) during dilution (1:5 soil-water) inflates measured values and makes $EC_{1:5}$ data inconsistent and difficult to interpret. Soluble chloride ($Cl_{1:5}$) data, in contrast, is unaffected by the presence of gypsum and provides a reliable measure by which to quantify salinity characteristics. Due to the presence of crystalline gypsum in the soil in the survey area, EC_e values have been calculated from soluble chloride (Cl) data and not $EC_{1:5}$ measurement. Soluble chloride (Cl) data from the survey area were converted to EC_{Cl} values and then EC_e values using the following equations:

Equation 1 $\%Cl = Cl\ (mg/kg) \times 10^{-4}$

Equation 2 $EC_{Cl}\ (dS/m) = 6.64 \times \%Cl$ (per weight of soil)

Equation 3 $EC_e\ (dS/m) = EC_{Cl}\ (dS/m) \times$ multiplier factor (fromTable 1 below)

Table 1 Multiplier factors for converting $EC_{1:5}$ (dS/m) to an approximate value of EC_e (dS/m) (Hazelton and Murphy 2016)

Soil texture	Multiplier factor
Light medium clay	8.6
Medium clay	7.5
Medium heavy clay, heavy clay	5.8

Salinity data (including the conversion of Cl data to EC_{Cl} and then to EC_e) for the survey area is presented in Appendix 3.

2.4.2 Sodicity assessment

Sodicity is measured as the exchangeable sodium percentage (ESP) and is calculated as exchangeable sodium over cation exchange capacity (Na/CEC). Analyses were undertaken at 0-0.05 m (or depth of A11 horizon), 0.2-0.3 m, 0.5-0.6 m and 0.8-0.9 m, at 3 detailed field sites for cation chemistry and potential sodicity characteristics. The 3 representative sites were selected to ensure adequate spatial distribution across the survey area (Site 21 is located in the southern section ('Rita's Holding'), Site 22 is located in the middle section ('Mick's East') and Site 27 is in the north section ('Florence's East'). Analyses undertaken included cation exchange capacity (CEC/ECEC), exchangeable cations (Ca, Mg, Na and K), ESP and Ca/Mg ratio.

Sodicity data (including CEC/ECEC, exchangeable cations, ESP and Ca/Mg ratio) for the survey area are presented in Appendix 3.

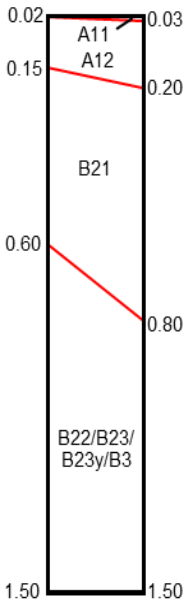
3. Land types

Land Type 1	Mitchell grass plains with grey cracking clays
Geological landscape:	Undifferentiated Cainozoic clay sheets derived from reworked terrestrial, alluvial and lacustrine deposits (unconsolidated clay, minor chert/chalcedony gravel) (Czb).
Landform:	Level to gently undulating, undifferentiated colluvial/alluvial plain, slopes mostly ≤0.5%, occasionally up to 2%
Soil concept:	Very deep (>1.5 m), hardsetting, firm pedal to weakly or moderately self-mulching, grey cracking clay (MHC subsoil); with an inconsistent, moderately thick (0.02-0.03 m), coarse granular (2-5 mm) to blocky (10-20 mm) A11 surface horizon (LMC-MC), over a moderately friable, blocky (mostly 5-30 mm) A12 subsurface horizon (MHC).
Aust. Soil Classification:	Epipedal or Self-mulching Grey Vertosol.
Runoff, perm., & drainage:	Very slow runoff; slowly permeable; moderately well-drained.
Surface features:	Hardsetting, firm pedal to weakly or moderately self-mulching; cracking; crabhole or normal gilgai (VI 0.15-0.3 m HI 2-5 m); non-gravelly; no outcrop; no termitaria.
Dominant vegetation community:	*Astrebla sp. +/- Paspalidium retiglume +/- Iseilema vaginiflorum* low tussock grassland.
Sub-dominant vegetation communities:	*Sorghum timorense +/- Astrebla sp.* mid tussock grassland. (Vegetation characteristics (height, cover etc.) are described on field sheets (Appendix 4))

Astrebla sp. +/- Paspalidium retiglume +/- Iseilema vaginiflorum low tussock grassland (Site 22).

Firm pedal to weakly self-mulching, grey cracking clay.

Modal Soil Profile Description

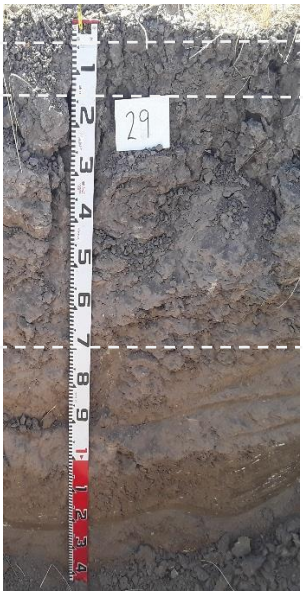


The **upper surface soil** (A11) is a grey (10YR, 2.5Y 4/1-2, 5/2), light medium clay to medium clay, with weak to moderate granular (2-5 mm) to subangular blocky (10-20 mm) structure; field pH 6.0-6.5.

The **lower surface soil** (A12) is a grey (2.5Y 4/2, 5/1), medium heavy clay, with moderate subangular blocky (10-40 mm) structure; field pH 6.5.

The **upper subsoil** (B21) is a grey (2.5Y 4/2, 5/1), medium heavy clay, with moderate to strong lenticular or angular blocky (10-50 mm) structure; field pH 7.0-7.5.

The **lower subsoil** (B22/B23/B23y/B3) is a grey (2.5Y 4/2), mottled (2-70% 5-10 mm distinct orange substrate mottles increasing with depth), medium heavy clay, with weak to moderate lenticular or angular blocky (10-40 mm) structure; 1-10% 5-10 mm gypsum crystals with occasional 1-2% 2 mm calcareous nodules; field pH 7.5-8.5.



4. Land capability

4.1 Land capability assessment

Land capability has been assessed in accordance with the *Land Clearing Guidelines* (DENR 2020). Four land capability classes are recognised within the Northern Territory (Table 2). Class 1 generally defines the most versatile soil and land resources, while Class 4 identifies the most constrained land. Increasing class values signal an escalating degree of limiting constraint.

Table 2 Land capability classes from Table 6 and Table 8 of the *Land Clearing Guidelines* (DENR 2020).

Class	Land capability	Description
1	High	**Land with negligible constraints** and requires only simple management practices. (ASS not present; flood-free; gilgai microrelief absent, EC_e <2 dS/m; ESP <6%; 0-1% slope; >1.0 m soil depth; rapid to well-drained soil; no surface rock; low wind erosion hazard)
2	Moderate	**Land with minor or moderate constraints** but requires more than the simple management practices of Class 1. (ASS not present; and/or flooding extremely rare (<1 in 30 years); and/or gilgai microrelief vertical interval <0.3 m; and/or EC_e 2-4 dS/m; and/or ESP 6-15%; and/or 1-2% slope; and/or soil depth 0.5-1.0 m; and/or moderately drained soil; and/or 0-2% surface rock; and/or moderate wind erosion hazard)
3	Marginal	**Land with severe constraints** and requires considerable management practices. (ASS not present; and/or flooding rare (1 in 10 to 30 years); and/or gilgai microrelief vertical interval 0.3-0.6 m; and/or EC_e 4-8 dS/m; and/or ESP 15-20%; and/or 2-3% slope; and/or 0.25-0.5 m soil depth; and/or imperfectly drained soil; and/or 2-10% surface rock; and/or high wind erosion hazard)
4	Not recommended	**Land with extreme constraints** too severe to develop. Can only be overcome with major management and/or engineered solutions. (ASS present; and/or regular to permanent flooding (>1 in 10 years); and/or gilgai microrelief vertical interval >0.6 m; and/or EC_e >8 dS/m; and/or ESP >20%; and/or >3% slope; and/or <0.25 m soil depth; and/or poor to very poorly drained soil; and/or >10% surface rock; and/or very high wind to extreme erosion hazard)

Eight soil and land resource attributes from Table 2 are considered important in the northern Barkly region. These include flooding, microrelief, salinity, slope (as a surrogate for water erosion), sodicity, soil depth, soil drainage and surface rock. Acid sulfate soil (ASS) presence was not assessed because of the elevation of the site above sea level and absence of coastal landscapes in the area. Similarly, wind erosion was not assessed as it is only applicable in sandy, arid zone landscapes or where coastal sand masses are involved. Each key characteristic was assessed against the defined land capability criteria, and a criteria sub-class from 1 to 4 was assigned to each land type. A final land capability class was determined by the most limiting characteristic recorded for each land type (i.e. the highest assigned criteria sub-class).

4.2 Land capability assessment outcomes

Land capability outcomes for the survey area are summarised in Tables 3 and 4. Land Type 1 is considered to have moderate capability (Land Capability Class 2) with only minor or moderate constraints. The land type comprises a level to gently undulating, undifferentiated colluvial/alluvial plain with a very deep (>1.5 m), uniform, gravel-free, grey cracking clay (Epipedal or Self-mulching Grey Vertosol).

Minor or moderate constraints are limited to rare, very shallow, low velocity local inundation following very large, short duration 'Wet season' rainfall events (1 in 10 to 30 years) on the colluvial/alluvial plain, the presence of shallow gilgai microrelief (VI <0.3 m), moderate ESP levels (6 to 15%), areas with slope between 1 and 2%, and slightly impeded drainage (moderately well-drained profiles).

4.2.1 Salinity and sodicity assessment findings

Laboratory analysis of Chloride (Cl) levels at each site identified low salinity levels (<2 ECe (dS/m)) from 0 to 1 m. Advice from representatives of the Land Assessment Branch, DENR, based on existing soil knowledge from the northern Barkly region, suggests sodicity constraints are closely linked with the development of salinity loads within the soil profile. Analysis of salinity data within the survey area shows an increase of salt loads with depth down the profile but low salt loads (<2 ECe (dS/m)) within the top 1 m of all field sites. Based on this information, it is likely sodicity characteristics also match these trends and that ESP values are also likely to be low in the top 0.6 m of the soil profile.

Laboratory analysis of ESP values for the 3 representative sites (Sites 21, 22 and 27) identified low levels (<6% ESP) from 0 to 0.6 m at Sites 21 and 27 and a moderate level (6% ESP) between 0.5 and 0.6 m at Site 22. This data indicates that clay dispersion is unlikely to be significant from 0 to 0.6 m. Analysis of exchangeable cations (at Sites 21, 22 and 27) identified the soil is calcium dominant (relative to magnesium and sodium) at depth 0.5 and 0.6 m, with a Ca/Mg ratio >1, indicating that the soil is likely to have good physical properties (Baker and Eldershaw 1993). In addition, the relatively level landscape (slopes <2%) and lack of erosive surface flows over the survey area means that soil erosion risk is likely to be low to very low.

4.2.2 Avoidance of flooding/inundation constraints

The proposed clearing areas have been positioned to avoid recognised drainage features in the area. Local drainage systems are subject to short duration, low energy, low velocity, low gradient, back-up water inundation. Field observations and satellite imagery analysis of a large rainfall event in the 2015/16 'Wet season' identified drainage features to the south, west and east of the southern section ('Rita's Holding'). The identified drainage depression to the east of the southern section appears to receive flow coming off Creataceous landscapes immediately to the east. The drainage depression starts south-east of Site 19 and extends south to the Coolibah swamp. Vegetation within the depression is not considered riparian, indicating that flooding is only rare or extremely rare. All proposed clearing areas, particularly the southern section, have been carefully located to ensure they are segregated and appropriately buffered with natural Mitchell grassland from recognised areas of back-up inundation. Any inundation that may enter the proposed clearing areas is likely to be short duration, very shallow, low energy and low velocity, and would be similar to an irrigation event.

4.2.3 Slope characteristics

Field observations indicate the majority of the survey area has <0.5% slope with minor areas of 0.5 to 1% and 1 to 2% slope. This is consistent with the DEM generated slope map (Figure 2). Areas indicated as having slopes >2% according to the slope map were navigated to in the field and measured using a clinometer. GPS coordinates, measured slope and a photo of each of the locations are presented in Appendix 2. A total of 3 locations, consisting of a singular 30 x 30 m pixel of between 2 and 3% slope are located within the survey area. Two of the locations are presented in Appendix 2 and the third location is at Site 17. Measured slope at all 3 locations was <2% and is appropriate for arable agriculture.

Table 3 Land capability assessment for the land types in the Ucharonidge survey area.

Land Type	Land Capability	Flooding	Microrelief	Salinity (0 to 1 m)	Sodicity (0 to 0.6 m)	Slope	Soil Depth	Soil Drainage	Surface Rock	Overall Land Capability Class
1	Initial assessment	Rare (1 in 10 to 30 years)	Vertical interval <0.3m	<2 ECe (dS/m)	ESP 6 to 15%	1 to 2%	>1 m	Moderately well-drained	0%	-
	Initial land capability sub-class	3	2	1	2	2	1	2	1	3
	Amended land capability sub-class	2[1]	2	1	2	2	1	2	1	2

Note 1: The flooding sub-class has been amended in accordance with Section 4.2.7 of the *Land Clearing Guidelines* (DENR 2020). Frequency of inundation of the proposed clearing areas is unknown and could potentially be extremely rare (<1 in 30 years). Inundation of the proposed clearing areas is likely to be short duration, very shallow, low energy, low velocity, back-up inundation, similar to an irrigation event. Therefore, the amended land type is considered Class 2 for the proposed land use of broadscale dryland cropping.

Table 4 Overall land capability assessment for the land types in the Ucharonidge survey area.

Land Type	Description	Overall land capability
1	Level to gently undulating, undifferentiated colluvial/alluvial plain; slopes mostly ≤0.5% (occasionally up to 2%); very deep (>1.5 m), moderately well-drained, grey cracking clay (Vertosol); *Astrebla sp.* +/- *Paspalidium retiglume* +/- *Iseilema vaginiflorum* low tussock grassland.	**Class 2**

5. References

Baker, DE & Eldershaw, VJ 1993, *Interpreting soil analyses for agricultural land use in Queensland.* Project Report QO93014, Department of Primary Industries, Queensland Government, Brisbane.

Christian, CS, Noakes, LC, Perry, RA, Slatyer, RO, Stewart, GA & Traves, DM 1954, *Survey of the Barkly Region, Northern Territory and Queensland, 1947-48*. Land Research Series No. 3, Commonwealth Scientific and Industrial Research Organization, Melbourne.

Department of Environment and Natural Resources 2020, *Land Clearing Guidelines*. Northern Territory Government DENR, Darwin.

Hazelton, PA & Murphy, BW 2016, *Interpreting soil test results: what do all the numbers mean?* Third Edition. CSIRO publishing, Melbourne.

Hnatiuk, RJ, Thackway, R & Walker, J 2009, 'Vegetation'. In National Committee on Soil and Terrain, *Australian Soil and Land Survey Field Handbook*. Third Edition. Australian Soil and Land Survey Handbook Series, CSIRO Publishing, Melbourne.

Hooper, AD 1970, *Mapping Land Resources*. Turnoff, 2(2), 1-6.

Isbell, RF & the National Committee on Soil and Terrain 2016, *The Australian Soil Classification*. Australian Soil and Land Survey Handbook Series, Second edition, CSIRO Publishing, Melbourne.

McKenzie, NJ, Coughlan, KJ, & Cresswell, HP (ed.) 2002, *Soil Physical Measurement and Interpretation for Land Evaluation.* Australian Soil and Land Survey Handbook Series, CSIRO Publishing, Melbourne.

McKenzie, NJ, Grundy, MJ, Webster, R & Ringrose-Voase, AJ 2008, *Guidelines for Surveying Soil and Land Resources*. Second Edition. Australian Soil and Land Survey Handbook Series, CSIRO Publishing, Melbourne.

National Committee on Soil and Terrain 2009, *Australian Soil and Land Survey Field Handbook.* Third Edition. Australian Soil and Land Survey Handbook Series, CSIRO Publishing, Melbourne.

Rayment, GE & Lyons, D 2011, *Soil Chemical Methods – Australasia.* Australian Soil and Land Survey Handbook Series, CSIRO Publishing, Melbourne.

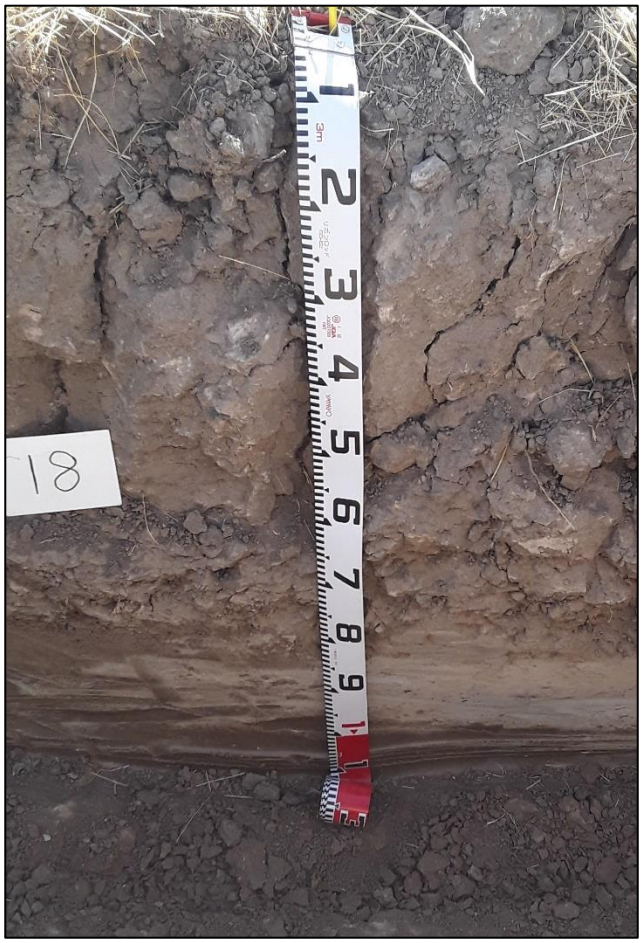
6. Limitations

The interpretations of data and recommendations presented in this report are based on the physical and chemical conditions only at the locations where sampling occurred. The conditions of the site are considered representative, however due to natural variability, actual conditions across the site may be different from those described, especially between sampling locations. Therefore, the findings in this report should only be used within the limitations and methodology specified and those acting on information provided in this report do so entirely at their own risk. Specific circumstances in the future may also influence the accuracy of the data and recommendations within the report. Nicholas McGrath accepts no liability or responsibility for any losses, damages, cost or other consequences for any action taken or not taken on the basis of any part of the contents of this report.

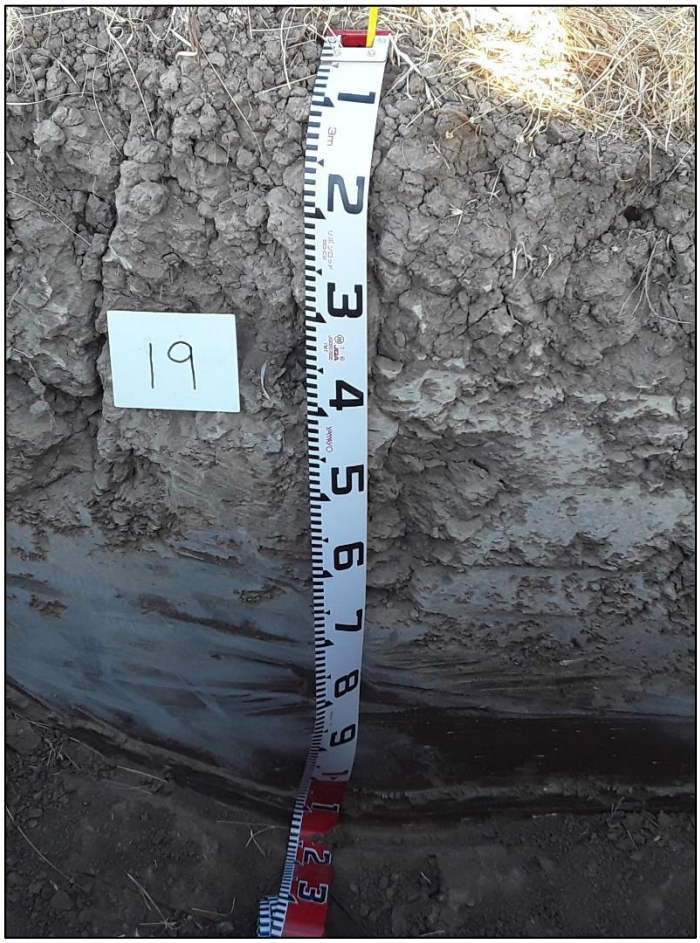
Appendix 1 Field site photos and location

Site 17 Location: 422937 E 8045355 N ASC: Self-mulching Grey Vertosol Slope: 1%

Site 18 Location: 427756 E 8045948 N ASC: Self-mulching Grey Vertosol Slope: 0.5%



Site 19	Location: 427689 E	8049217 N	ASC: Epipedal Grey Vertosol	Slope: 0.5%

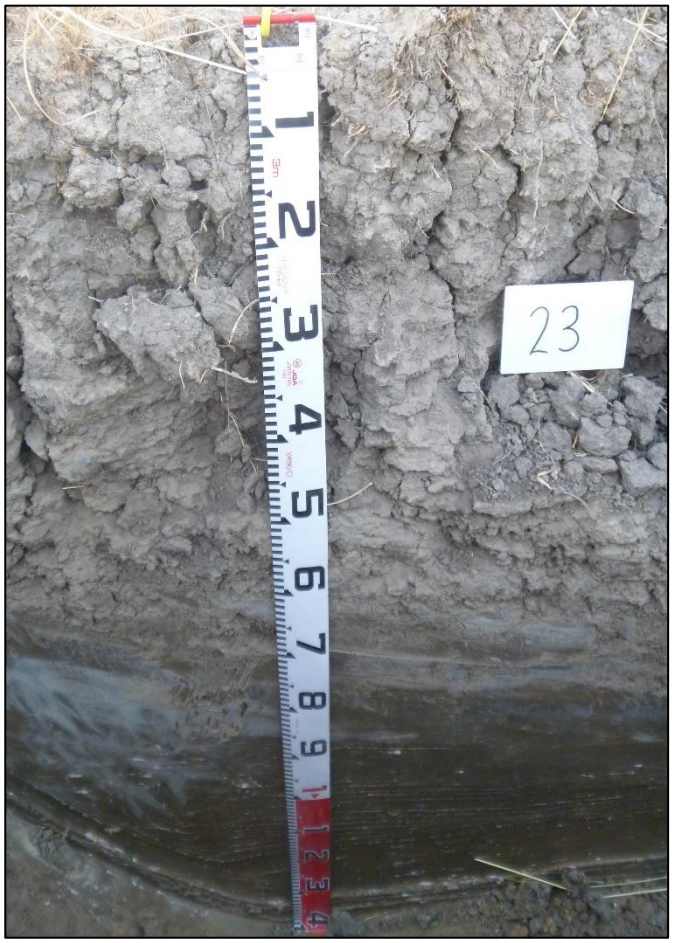


Site 20 Location: 425612 E 8045424 N ASC: - Slope: 1.0%

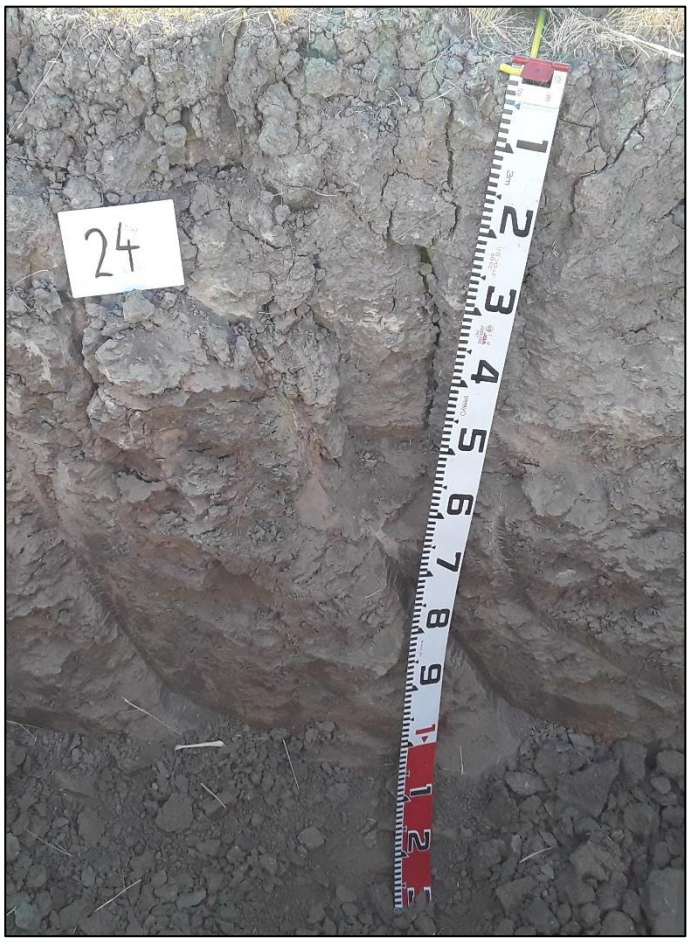
Site 21 Location: 426572 E 8045924 N ASC: Epipedal Grey Vertosol Slope: <0.5%

Site 22	Location: 427113 E	8049807 N	ASC: Epipedal Grey Vertosol	Slope: 0.5%

Site 23 Location: 425880 E 8050019 N ASC: Epipedal Grey Vertosol Slope: <0.5%



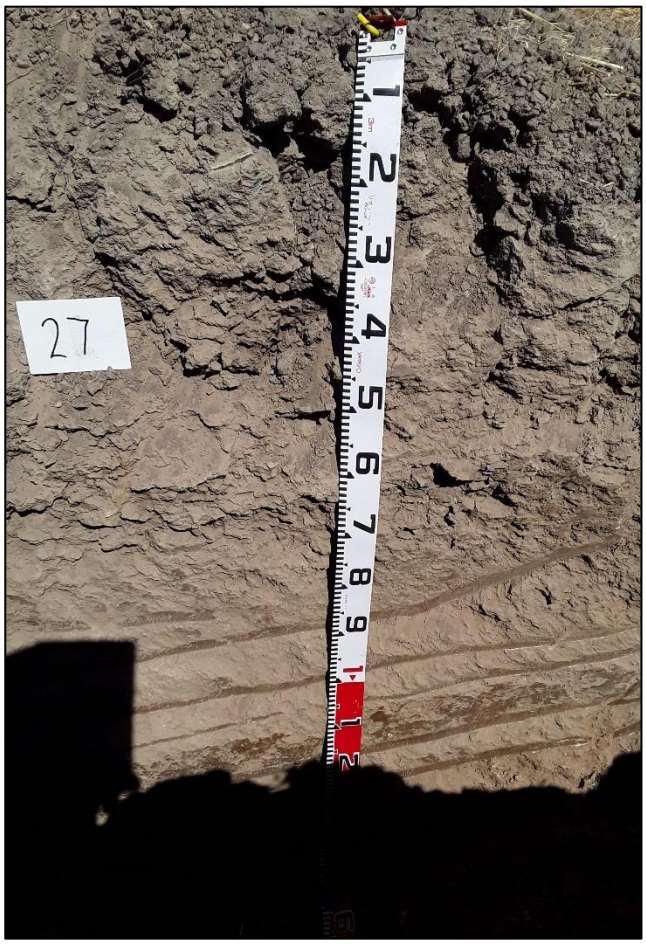
Site 24	Location: 427594 E	8050996 N	ASC: Epipedal Grey Vertosol	Slope: 0.5%



Site 25	Location: 426840 E	8053414 N	ASC: Epipedal Grey Vertosol	Slope: <0.5%

Site 26 Location: 425640 E 8057035 N ASC: Self-mulching Grey Vertosol Slope: <0.5%

Site 27 Location: 420879 E 8062537 N ASC: Epipedal Grey Vertosol Slope: <0.5%



Site 28 Location: 419186 E 8062881 N ASC: - Slope: <0.5%

Site 29	Location: 418544 E	8060784 N	ASC Self-mulching Grey Vertosol	Slope: <0.5%

Appendix 2 Slope check site photos and location

Areas indicated as having slopes >2% according to the slope map (Figure 2) were measured in the field using a clinometer. GPS coordinates, measured slope and a photo of each of the locations are presented below.

Location: 422840 E 8045520 N DEM Slope: 2.3% Measured Field Slope: 0 – 1%

Location: 425290 E 8045390 N DEM Slope: 2.1% Measured Field Slope: 0.5 – 1.5%

Appendix 3 Analytical data for field sites

Agricultural Chemistry Pty Ltd
Soil Analysis Report
Batch Number: 20/57

Date Received: 5/8/2020
Date Completed: 15/8/2020

Client Cleveland Ag

Lab No	Site	Depth	pH	EC	Cl	%Cl	ECCl	ECe	Ca	Mg	K	Na	ECEC	ESP	Ca/Mg
		cm		mS/cm	mg/kg		dS/m	dS/m	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	%	ratio
952	17	0 - 3	7.1	0.118	95	0.01	0.06	0.47							
953		20 - 30	7.6	0.028	4.6	0.00	0.00	0.02							
954		50 - 60	8.3	0.035	4.3	0.00	0.00	0.02							
955		80 - 90	9.0	0.111	24	0.00	0.02	0.09							
956		110 - 120	7.7	2.830	119	0.01	0.08	0.46							
957	18	0 - 2	6.7	0.042	27	0.00	0.02	0.13							
958		20 - 30	7.5	0.020	4.9	0.00	0.00	0.02							
959		50 - 60	8.0	0.028	8.7	0.00	0.01	0.03							
960		80 - 90	8.4	0.142	124	0.01	0.08	0.48							
961		110 - 120	8.4	0.390	369	0.04	0.24	1.42							
962	19	0 - 2	6.6	0.025	17	0.00	0.01	0.10							
963		20 - 30	7.3	0.017	4.7	0.00	0.00	0.02							
964		50 - 60	8.0	0.027	4.5	0.00	0.00	0.02							
965		80 - 90	8.6	0.206	173	0.02	0.11	0.66							
966		110 - 120	8.4	0.497	444	0.04	0.29	1.71							
967	21	0 - 2	6.5	0.115	99	0.01	0.07	0.57	8.2	9.9	1.19	0.122	19	1	0.8
968		20 - 30	7.6	0.019	11	0.00	0.01	0.04	12.3	11.1	0.40	0.583	24	2	1.1
969		50 - 60	8.1	0.042	16	0.00	0.01	0.06	12.1	10.8	0.40	1.302	25	5	1.1
970		80 - 90	8.4	0.198	115	0.01	0.08	0.44	12.9	10.8	0.37	1.891	26	7	1.2
971		110 - 120	7.7	2.640	256	0.03	0.17	0.98							
972	22	0 - 2	6.2	0.099	69	0.01	0.05	0.34	6.2	6.4	1.21	0.090	14	1	1.0
973		20 - 30	7.3	0.019	5.4	0.00	0.00	0.02	10.5	8.6	0.33	0.366	20	2	1.2
974		50 - 60	8.2	0.071	47	0.00	0.03	0.18	12.2	8.4	0.18	1.430	22	6	1.5
975		80 - 90	8.1	0.600	425	0.04	0.28	1.64	12.7	9.1	0.24	2.281	24	9	1.4
976		110 - 120	7.7	2.450	679	0.07	0.45	2.62							
977	23	0 - 2	6.5	0.055	44	0.00	0.03	0.22							
978		20 - 30	7.3	0.019	6.2	0.00	0.00	0.02							
979		50 - 60	8.0	0.060	30	0.00	0.02	0.12							
980		80 - 90	8.1	0.303	150	0.02	0.10	0.58							
981		110 - 120	7.4	2.440	440	0.04	0.29	1.70							
982		140 - 150	7.4	3.030	512	0.05	0.34	1.97							
983	24	0 - 2	6.8	0.030	18	0.00	0.01	0.09							
984		20 - 30	7.7	0.022	5.3	0.00	0.00	0.02							
985		50 - 60	8.4	0.077	42	0.00	0.03	0.16							
986		80 - 90	8.2	0.590	485	0.05	0.32	1.87							
987		110 - 120	7.7	3.060	378	0.04	0.25	1.46							
988	25	0 - 2	7.1	0.030	17	0.00	0.01	0.10							
989		20 - 30	7.5	0.027	5.9	0.00	0.00	0.02							
990		50 - 60	8.0	0.112	63	0.01	0.04	0.24							
991		80 - 90	7.3	2.350	135	0.01	0.09	0.52							
992		110 - 120	7.3	2.880	308	0.03	0.20	1.18							
993		140 - 150	7.4	3.040	355	0.04	0.24	1.37							
994	26	0 - 3	6.6	0.038	15	0.00	0.01	0.08							
995		20 - 30	6.6	0.098	5.9	0.00	0.00	0.02							
996		50 - 60	7.9	0.061	11	0.00	0.01	0.04							
997		80 - 90	8.4	0.052	9.4	0.00	0.01	0.04							
998		110 - 120	8.7	0.192	14	0.00	0.01	0.06							
999		140 - 150	7.7	2.770	26	0.00	0.02	0.10							

Lab No	Site	Depth	pH	EC	Cl	%Cl	ECCl	ECe	Ca	Mg	K	Na	ECEC	ESP	Ca/Mg
		cm		mS/cm	mg/kg		dS/m	dS/m	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	%	ratio
1000	27	0 - 3	6.5	0.034	21	0.00	0.01	0.12	8.0	6.8	0.46	0.183	15	1	1.2
1001		20 - 30	7.0	0.024	12	0.00	0.01	0.05	10.1	7.4	0.29	0.346	18	2	1.4
1002		50 - 60	7.9	0.051	26	0.00	0.02	0.10	12.7	7.5	0.16	1.182	21	5	1.7
1003		80 - 90	7.9	0.282	252	0.03	0.17	0.97	12.7	7.7	0.15	1.858	22	8	1.7
1004		110 - 120	7.6	2.320	445	0.04	0.30	1.71							
1005		140 - 150	7.6	2.660	504	0.05	0.33	1.94							
1006	29	0 - 3	6.6	0.044	19	0.00	0.01	0.09							
1007		20 - 30	7.4	0.029	6.1	0.00	0.00	0.02							
1008		50 - 60	7.8	0.203	81	0.01	0.05	0.31							
1009		80 - 90	6.9	2.330	342	0.03	0.23	1.32							
1010		110 - 120	7.1	3.240	444	0.04	0.29	1.71							
1011		140 - 150	7.2	3.300	580	0.06	0.39	2.23							

Appendix 4 Field site sheets

Agnote

No: C19

November 2006

Forage Sorghum

A. G. Cameron, Principal Pastures Agronomist, Darwin

INTRODUCTION

Forage sorghums are a group of *Sorghum* species and hybrids which have been bred for forage production and are commonly used as annual forage or hay crops. They are tall (to 3.8 m), leafy, erect, tussock grasses. The stems can grow to 1.5 cm thick in some varieties. The leaves are large, up to 4 cm wide and up to 1 m long. The size and shape of the seed head varies with the variety, as does the colour, shape and size of the seed.

Traditional forage sorghums were not well suited to Northern Territory conditions, but with the release of a number of late-flowering types in recent years, forage yields of up to 20 tonnes dry matter per hectare are possible under good moisture and nutrient conditions.

TYPES OF FORAGE SORGHUM

The main types of forage sorghum available are discussed below.

a) Sudan grass hybrids

- fine stems, therefore good for haymaking;
- a range of varieties with different flowering times; Superdan and Betta Dan are late-flowering varieties.

b) Grain sorghum x Sudan hybrids

- medium stems;
- traditional (intermediate flowering, e.g. Sudax, Speedfeed) and ultra late (short-day) flowering varieties (Jumbo and Cowpow). Ultra late-flowering varieties are capable of very high forage yields in the Top End when well fertilised.

c) Sweet sorghum hybrids

- thick stems with high sugar content;
- less regrowth than other types;
- late flowering.

d) Open-pollinated sweet sorghum

- only one variety, Sugardrip;
- low yield in the Top End;
- thick stems;
- intermediate flowering.

e) Dual purpose grain sorghum hybrids (e.g. Graze-N-Sile)

- grow to 1-2 m high;
- can be grown for grazing, grain production, or silage.

f) Perennial sorghum

- Silk sorghum is a short-lived perennial more suitable as a pioneer or in a short-term pasture rotation. Management of silk sorghum is covered in a separate Agnote (see Agnote E67 “Silk Sorghum”).

CLIMATE AND SOILS

In the Top End of the Northern Territory, forage sorghums are suited to deep, well-drained soils in areas receiving between 900 and 1300 mm annual rainfall. Forage sorghums are quite drought resistant, but less so than Bulrush millet. Waterlogging is detrimental to establishment and growth.

SOWING

Forage sorghum may be sown by no-till, minimum till or conventional till, depending on available machinery and paddock condition. Sowing no-till or minimum till requires a reasonable quantity of surface mulch which provides better access, better moisture retention, less erosion risk and lower soil surface temperature.

Conventional tillage requires a well-prepared seed bed for optimum establishment. Seed should be sown in 35 cm spaced rows at a rate of 15 kg/ha for sorghum hybrids and 10 kg/ha for Sudan types. Higher sowing rates can be used for irrigated crops. If sowing in combination with a legume, the sowing rate of forage sorghum can be halved.

The use of a combine, air-seeder or row crop planter to sow at 2.5–5 cm depth is preferred (use press-wheels if available). Broadcasting and harrowing seed may give unreliable results.

FERTILISER

Forage sorghums have similar nutrient requirements to maize. The past history of the paddock will influence total fertiliser requirement. Soil nutrient analysis will assist in determining fertiliser type and rate. In general, the crop will require at least 20 kg/ha phosphorus and sulphur and 100 kg/ha nitrogen. Potassium, molybdenum or zinc may be required on some soils. Consult your local extension officer if you require more information.

WEED CONTROL

If sown into a weed-free seedbed, the rapid growth rate of forage sorghum usually overcomes any weed problem.

If weed control is required, atrazine at 1.25 – 3 kg/ha active ingredient, depending on weed type, can be applied post-planting pre-emergent. For broadleaf weeds, 2, 4-D can be used with care at the seedling stage – 1.1 L/ha of 50% 2, 4-D Amine when the crop is 7-15 cm high and secondary roots have developed. Fluoxypyr (Starane 200® at 0.75 L/ha) to control broadleaf weeds may be used post-emergent when secondary roots have developed. These herbicides should **not** be used if a companion legume is sown.

High rates of herbicide should be avoided on sandy soils.

UTILISATION/MANAGEMENT

a) Grazing

Short rotational grazing - the ideal grazing height is 1 - 1.5 m, with stock removed once the crop is grazed down to 15 cm if regrowth is required.

Extensive grazing - maximum quality forage will be available if grazing commences when the crop is 1-1.5 m high, but grazing of the late-flowering varieties can be delayed if necessary. Sweet sorghums are favoured for late grazing, as the high sugar content improves feed quality and palatability.

A forage legume such as cowpeas or lablab can be sown with forage sorghum if a higher quality forage mixture is required. Sowing rates should be adjusted if under-sowing with a legume.

Precautions when grazing forage sorghum:

All sorghums contain prussic acid, which in high doses can cause poisoning. Prussic acid content is highest in new or stressed growth and problems are most likely when hungry animals gain access to such crops.

- Feed hungry stock before putting them onto forage sorghum and introduce only a few animals at first.
- Wait until the crop is 80 cm high before grazing.
- Adequate phosphorus nutrition of the crop lowers the risk
- Provide animals with a sulphur supplement. Sulphur is used in detoxification of prussic acid by the animal. Forage sorghums tend to have low sulphur content and animals grazing sorghum as a sole fodder may become sulphur-deficient.

The treatment for prussic acid poisoning is to drench cattle with 55 g photographic hypo (sodium thiosulfate) in 600 mL water. The sodium thiosulfate can also be given intravenously or by intra-ruminal injection.

An alternative is to grow other forage crops such as bulrush millet, cowpeas or lablab.

b) Hay

Palatable hay can be made from forage sorghums. The fine stemmed Sudan grass types make good hay. If sorghum x Sudan hybrids or sweet sorghums are cut for hay, a mower conditioner is essential because of the thicker stems. The optimum cutting time is early flowering, striking a balance between forage quality and the likelihood of rain damage. Up to 20 tonnes/ha dry matter can be harvested from good stands of the later maturing varieties.

c) Forage harvesting

High quality green chop can be obtained from a well fertilised forage sorghum crop. Maximum feed quality and regrowth will be obtained by harvesting the crop when 1 - 1.5 m in height. A variety capable of rapid regrowth should be chosen.

d) Silage

While all forage sorghums can be cut for silage, sweet sorghums with their high sugar content are best. There are also “dual purpose” sorghums available, such as Graze-N-Sile and Feed n Grain. Forage sorghum for silage should be cut at the early dough stage – i.e. 30-40% moisture.

POTENTIAL VARIETIES FOR THE TOP END

This table should be used as a guide only, as new varieties are released regularly.

Intended use	Type of forage sorghum	Varieties
Extensive grazing	Ultra late flowering	Jumbo, Cowpow
Intensive grazing	Good regrowth potential	Jumbo, Superdan, Speedfeed
Hay	Fine stems, late flowering	Betta Dan, Superdan, Sugargraze
Silage	High sugar content	Sugargraze, Graze-N-Sile, Feed n Grain
Green chop	Very rapid regrowth	Speedfeed, Jumbo

Please visit us at our website:

www.nt.gov.au/dpifm

Department of Primary Industry, Fisheries and Mines

ISSN 0157-8243
Serial No. 514
Agdex No. 127/10

Northern Territory Government

DEPARTMENT OF
NATURAL RESOURCES, ENVIRONMENT, THE ARTS AND SPORT

Ucharonidge Station Number 1 Bore and 1949 Comet Windmill

Background Historical Information

Prepared by the Heritage Branch, April 2010

If you require further information about this background historical information, please contact:

Heritage Branch
Department of Natural Resources, Environment, the Arts and Sport
P.O. Box 496
Palmerston NT 0831
Phone: 08 8999 8981

Please cite this report as:
NRETAS (2010). Ucharonidge Station Number 1 Bore and 1949 Comet Windmill: Background Historical Information. Prepared by the Heritage Branch, NT Department of Natural Resources, Environment, the Arts and Sport, Darwin.

Disclaimer:
The material presented in this report is believed to be correct at the time of writing and is provided for information purposes only.

Cover Photo: Ucharonidge No 1. Bore, Comet Windmill and Turkey Nest (Source: Robin Gregory, Heritage Conservation Services, Alice Springs)

Table of Contents

1. Introduction

This background historical information was compiled in January 2007 as part of a heritage assessment report prepared on the number 1 bore and comet windmill located on Ucharonidge Station for the Heritage Advisory Council, as per the requirements under the *Heritage Conservation Act*.

2. Location

The number 1 bore and Comet windmill on Ucharonidge Station are located on NT Portion 307, Perpetual Pastoral Lease 1072. Ucharonidge Station is located on the Barkly Tableland and situated 19 kilometres south of Elliott and 77 kilometres east on the Barkly Stock Route (see map 1).

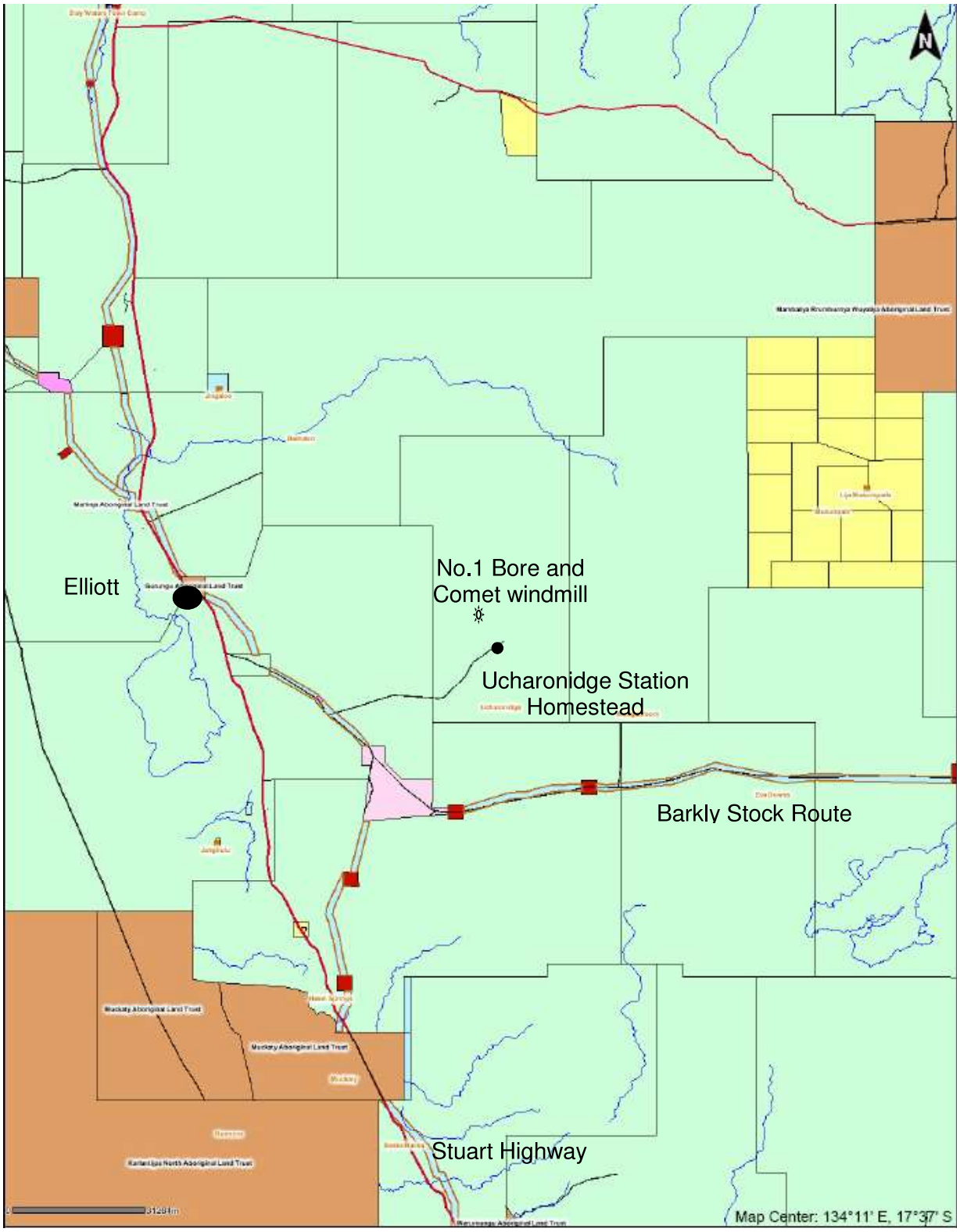
3. Historical Overview

NT Portion 307, Pastoral Lease 468, was created out of a large area of unoccupied vacant land and advertised for leasing in the Commonwealth Gazette on 4 December 1947. The land would be allocated via the ballot system and offered to the first person drawn. Five people applied for the land and the ballot was won by Paul and Florence Ann Beebe, graziers from Woorabinda in Queensland. The annual rental for the 958 square mile (2,481 square kilometre) property was set at three shillings and sixpence per square mile until 13 June 1958 (Department of Planning & Infrastructure).

The agreement, which was signed on 1 July 1948, stated that within the first five years Beebe must stock the property with five head of cattle per square mile and at the end of ten years there must be ten head per square mile. Also within the first five years the owner must make improvements to the property valued at £3 per square mile. By the end of ten years the improvements had to total £6 per square mile and the property had to be securely fenced (DPI Land Information).

The majority of Ucharonidge Station consists of open downs covered with Mitchell and Flinders grass with the remainder being thick Lancewood scrub fringed by desert with Spinifex and Turpentine grass. It was estimated that the country could carry approximately 10,000 head of cattle (CoA Gazette No. 233).

Paul Beebe's family emigrated to Australia from Oregon in the United States early last century and settled near the Burnett River in Queensland. The family also had property in the Dawson Valley near Rockhampton. After securing Ucharonidge Station Paul moved his family to the Northern Territory after the 1949 wet season and started the difficult job of establishing and developing the cattle station. (Parliamentary Record No. 29).



Map 1. Location of Ucharonidge Station, NT Portion 307, Perpetual Pastoral Lease 1072.

According to Abbott, Administrator of the Northern Territory 1937-1946, even new settlers with good financial backing faced a tremendous task:

> *The Northern Territory Administration officers considered that the expenditure over the first two years would be £15,000, and this appears to be close to the minimum* (1950, p: 182).

Abbott was a strong supporter of the recommendations made in the Payne Committee's Report, which had earlier looked into the possibilities of further land development in the Northern Territory. In numerous annual reports Abbott strongly urged the Commonwealth Government to establish a fund to help the Territory's primary producers establish and develop their properties. Abbott suggested that financial assistance should be provided for stockyards, fencing, water supplies and buildings:

> *And also the establishment of at least two fully equipped bores upon each block, the cost to be repaid over a period of twenty years. This last recommendation was approved, though Treasury hoped that I would keep the proportion of "dud" bores as low as possible* (Abbott, 1950, p:185).

Some idea of the costs faced by pastoralists were outlined in a survey compiled in 1952. It suggested that the cost for fencing was £150 per mile, a new bore and pumping equipment £3,000, a stockyard with dipping facilities £2,000 to £3,000 and the construction of an earth dam (turkey nest) £2,000 to £4,000 (Longmans Australian Geographies, 1961).

Phelts suggests that since its commencement, the Territory's pastoral industry had been constrained by water shortages. The constraints included "limiting the carrying capacity of stations, affecting the movement and transportation of stock, contributing to disease, forcing capital and labour into stock agistment and water procurement" (2006, p:91).

Many of the Territory's early pastoral properties relied heavily on natural waterways and hand dug wells for watering stock. Obtaining water from wells was both time consuming and laborious as it had to be raised by either a hand operated windlass or a whip system pulled by a camel or horse and then transferred to troughs. The reliance on well water limited stock numbers and properties were not being used to their full potential. In times of drought any stock strong enough for the journey would be driven to the coastal regions until conditions improved. Some relief came with the introduction of transportable steam engines driving pumps, as they had the capacity to supply large volumes of water to large holding tanks and dams.

Although the steam powered pumps were an improvement the financial outlay and the employment of men (pumpers) to keep them operational could only be met by the larger pastoral companies. Millar states that "if the bores they serviced were heavily loaded with stock, the bore had to pump 24 hours a day and two or three casual pumpers were employed to tend each bore" (1984, p:59-60). The introduction of reliable wind powered pumps soon replaced the

steam engines.

In 1890 the first sub-artesian bore in the Barkly Tableland region was put down on Rocklands Station in Queensland.

> *Graziers welcomed this new development, which offered them freedom from droughts, the capacity to more efficiently stock and graze their properties* (McLaren & Cooper 2001, p:17).

With an average seasonal rainfall of around 400mm, and little surface water, the success of Ucharonidge Station depended on sub-artesian bore water and wind powered pumps. The Beebes could not rely on using the natural Ucharonidge Waterhole as this would become dry in the latter parts of the year.

After the Beebe's arrival they found out that the Department of Works and Housing had already issued a requisition for the installation of two bores and pumping equipment under the twenty year payback scheme. Paul Beebe advised the Administrator of the Northern Territory that he intended to drill his own bores and had already purchased a new truck to transport a boring plant to Ucharonidge Station. Paul Beebe's sons, Owen, Roy and Mick submitted tenders to the government for the drilling of the first two bores on their property but were unsuccessful. There must have been some further negotiations between the two parties as approval was eventually given (Parliamentary Record No. 29 & Pastoral Homestead Lease No. 5).

The boring process relied heavily on water to lubricate the head of the punch and rods, and Paul and his sons had to cart water 96 kilometres to pour down the hole. For some unknown reason they only put down the No. 1 Bore and later agreed to take advantage of the government's assistance scheme for a further two bores.

As they had not yet completed a homestead, and the road to the station became impassable, the family stayed at Elliott during the next wet season. In 1951 they were ready to start stocking the property and purchased 1,500 head of cattle from Tom Quilty. Owen, Roy and Mick overlanded the cattle from Springvale in Western Australia via Flora Valley, Gordon Downs, Wallamunga, Inverway down the Victoria River to Wave Hill, past Top Springs and down the Murranji Track to Ucharonidge. (Parliamentary Record No. 29 & Pastoral Homestead Lease No. 5)

It was well into the dry season when they arrived at Ucharonidge, and as there was no paddock fencing, they had to contain the cattle at No. 1 Bore for several days to settle them at the watering point. From this small beginning, and years of dedicated hard work, the Beebe's herd would grow to 7,000 by 1963.

The family acquired earthmoving equipment and commenced installing earth tanks (turkey nests) adjacent to their bores. Turkey nests were an essential part of the stations infrastructure and are still widely used on many pastoral

properties. They are designed to store large volumes of water ready for use when the pumps are either not operating through the lack of wind or during maintenance procedures.

The Beebes supplemented their income by contracting their services and equipment to other property owners and built dams, drilled bores and erected windmills. All the money made from these ventures went to finance further developments on Ucharonidge. Roy and Mick came to an agreement with their parents and took over ownership of the station, and in 1963 they sold all but 1,500 head of cattle and the proceeds of the sale went to pay out all family interests in the property (Parliamentary Record No. 29 & Pastoral Homestead Lease No. 5).

Plate 1. Erecting the Comet Windmill at No.1 Bore, Ucharonidge Station (Source: Coral Beebe).

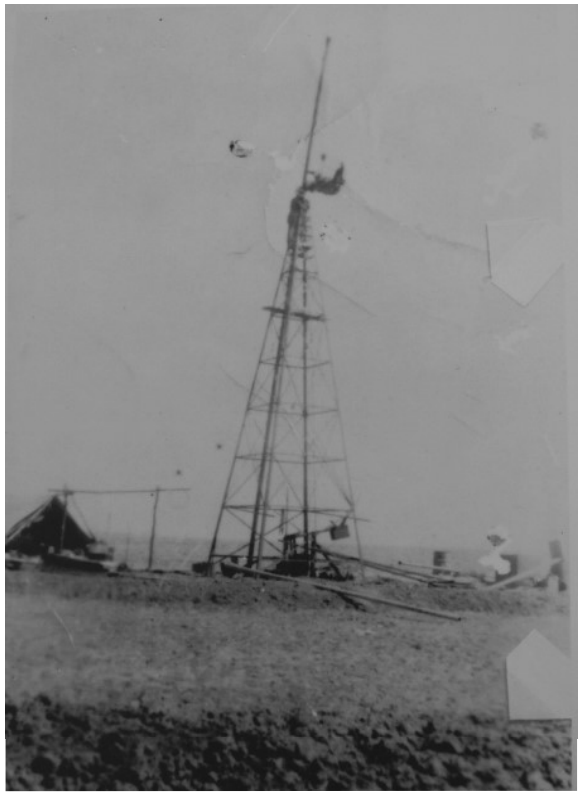


Plate 2. 'D' pattern windmill nearing completion, Ucharonidge Station. (source: Coral Beebe)

In order to upgrade the quality of their stock in 1964 they introduced Droughtmaster bulls and later in 1966 Braham bulls. Roy and Mick Beebe are credited for introducing Braham cattle to the Barkly Tableland and by the mid 1970s their stock numbered 25,000. The Beebe's became successful pastoralists and soon expanded their interests by purchasing the Murranji, Buchanan, Kalala and Tanumbirini Stations, thus controlling 70,000 head of cattle (Parliamentary Record No. 29 & Pastoral Homestead Lease No. 5). Although Roy and Mick Beebe have now passed away, Ucharonidge is still in family hands and is considered a model station with a well designed

homestead precinct, over 300 kilometres of fencing, 19 equipped bores with turkey nests and pumping equipment, 5 sets of steel drafting yards and 3 sets of post and rail yards (Parliamentary Record No. 29).

No.1 Bore and Comet Windmill

No. 1 Bore and Comet Windmill is located approximately 24 kilometres northwest of the station homestead and was the first sub-artesian bore and windmill installed on Ucharonidge. The original bore drilled by the Beebe family in 1949 is no longer in use and a new bore has been developed adjacent to the original. The original bore, registration number 1622, is listed as being 101 metres deep and supplied 1.54 litres per second. In 1949 the Beebs installed a 24 foot (7.3 metre) 'D' pattern Comet Windmill to pump water from the bore to a 1.5 million litre turkey nest holding dam (NTA Water Resources).

The first Comet Windmill was produced by the Sidney Williams and Company in 1910 to meet the ever increasing demand on the sub-artesian water supply. Because a majority of the mills would be located in remote regions the company's aim was to manufacture a mill that could operate efficiently with minimal maintenance and be easily repaired by the owners. The company produced a uniquely designed, direct acting mill, that could have fans ranging from 8 foot (2.4 metres) to 35 foot (10.6 metres) in diameter (Troppo Architects, 1992).

The mill heads were made of cast iron and contained a minimum of working parts and one complete revolution of the fan would produce one stroke of the attached water pump. With no complex gearing, less moving parts and a self contained oiling system, the mills were extremely reliable. The company produced two patterns, 'D' and 'C' models and these could be positioned on variable height, prefabricated galvanised iron towers. The mills remained in production by Sidney Williams until 1988 and according to Troppo Architects the company also made a selection of water handling equipment including "pumps, hoses and valves, jetting equipment, tanks and troughs" (Troppo Architects,1992 : section 5).

Today the windmills are manufactured by Comet Windmills Australia Pty Ltd who still use the original design and model types (Comet Windmill Australia).

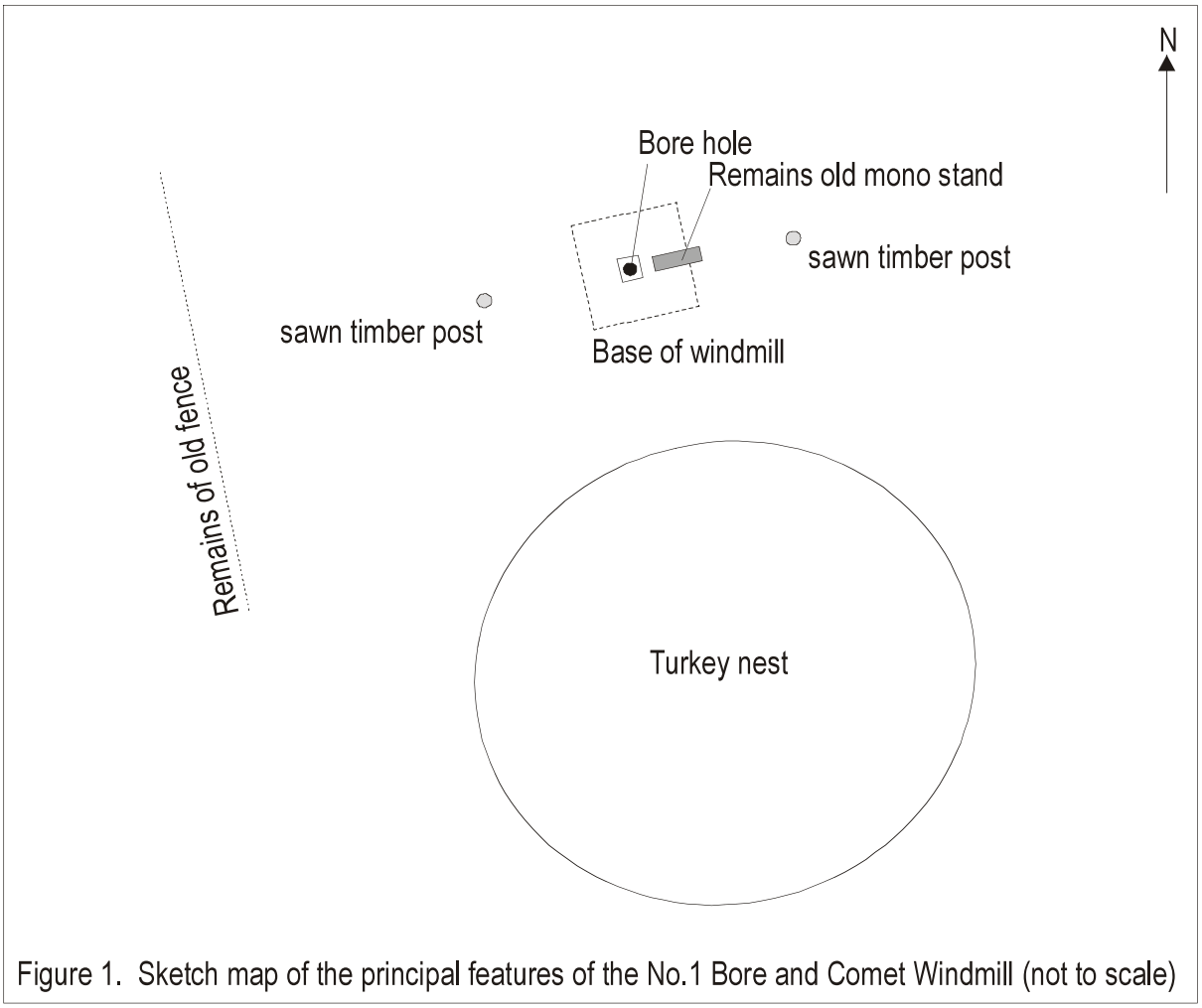


Figure 1. Sketch map of the principal features of the No.1 Bore and Comet Windmill (not to scale)

(Source: Robin Gregory, Heritage Conservation Services, Alice springs)

Plate 3. Upper section of the tower showing the windmill head and fan. Note the tail has been positioned to stop the fan moving into the wind.
(Source: Robin Gregory, Heritage Conservation Services, Alice springs)

Plate 4. Lower section of the tower with bore hole directly in the centre.
(Source: Robin Gregory, Heritage Conservation Services, Alice springs)

Plate 5. Composite photo – turkey nest at No. 1 Bore and Windmill, viewed from the north-north-west.
(Source: Robin Gregory, Heritage Conservation Services, Alice springs)

4. Site Description

Although they are no longer used for their original purpose the No. 1 Bore and 'D' pattern Comet Windmill on Ucharonidge Station are a prominent feature on this part of the Barkly Tableland. For its age the windmill is in a fair condition. The turkey nest (earth dam) is a vital part of the station's water supply infrastructure. The fabric and structure of the No.1 Bore, Comet Windmill and Turkey Nest on Ucharonidge Station have not changed since they were installed in 1949 and the turkey nest is still used for its original purpose.

Bonney Well, located 88km south of Tennant Creek, is the only place listed on the NT Heritage Register to-date that is similar to the No.1 Bore, Comet Windmill and Turkey Nest on Ucharonidge Station. The only difference between them is that Bonney Well has an additional stone dump and well which was later replaced by a bore.

5. References

Abbott, C L A. 1950. *Australia's Frontier Province*. Angus and Robertson, Sydney.

Comet Windmills Australia Pty Ltd, 2006. Retail Catalogue.

Commonwealth of Australia Gazette, No. 233, dated 4 December 1947.

Department of Planning & Infrastructure, Land Tenure Research. Nichols Place Darwin.

Longmans Australian Geographies. 1961. The Barkly Tableland. No 3. Longmans, Green and Co Ltd, Victoria.

McLaren and Cooper, 2001. *Distance, Drought and Dispossession*. NTUniprint, Northern Territory University, Darwin NT.

Millar, L. 1984. *The Border and Beyond*. Lilian Ada Millar, Camooweal, QLD.

NTA Water Resources Branch Bore Data Sheet, No. 1 Bore, Ucharonidge Station. Supplied by Coral Beebe.

NTG Land Information, 2006. Land Tenure Research, Nichols Place Darwin. Pastoral Lease 468.

Pastoral Homestead Lease No. 5. Northern Territory of Australia, The Crown Lands Ordinance 1931 - 1961. Volume 47, Folio 68.

Phelts, B. 2006. Water And Its Role In The Economic Development Of The Northern Territory 1824-2002. A Thesis submitted for Doctor of Philosophy, Charles Darwin University.

Seventh Assembly Session First Session 26/11/96 Parliamentary Record No. 29.