Water Resources Survey of the Western Victoria River District: Waterloo Station - A Report for the Station Manager
WATER RESOURCES SURVEY OF THE WESTERN VICTORIA RIVER DISTRICT

WATERLOO STATION
A Report for the Station Manager

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POWER AND WATER AUTHORITY

NATIONAL LANDCARE PROGRAM
A REPORT FOR THE MANAGER
ON THE WATER RESOURCES OF WATERLOO STATION

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PLATE 1: Typical undulating basalt country on Waterloo Station. This aerial photograph is in the Waterloo Creek area looking south over the homestead. Late wet season, March 1993.

LIST OF CONVERSIONS

1 mm = .04 inches (4 points)
1 m = 3.3 feet
1 km = 0.6 miles
1 L = 0.22 gallons
1 kL = 220 gallons
1 ML = 220,000 gallons
1 L/s = 800 gallons per hour
1. INTRODUCTION

Waterloo Station (PL 998) covers an area of 3072 square kilometres of mainly basalt country in the western Victoria River District (Fig.1). The existing pastoral lease is based on an estimated safe stock carrying capacity of about 15,000 head. Its westernmost boundary is the Western Australia border, and the closest town is Kununurra in Western Australia.

The homestead is located approximately 45 km south of the Victoria Highway along the Duncan Road, and then about 40 km east along the station access road. The Duncan Road and the station access road are affected by wet season rainfall and are sometimes impassable during wet season flooding of the numerous streams, including Stockade and Collins Creeks, which cross it.

The landform types within Waterloo Station are shown in Figure 2, and the relationship of the various rock units are shown in Figure 3. The Waterloo lease ranges from rugged hill country in the south east with deeply dissected gorges, plateaux and hogsbacks (composed of what geologists call Angalarri Siltstone and Jasper Gorge Sandstone) with very poor, mostly spinifex pastures drained by Horse Creek, to gently undulating basalt country (Antrim Plateau Volcanics) in the north (Plate 1). This basalt country, with some cracking clay soil cover, supports Mitchell, Ribbon and Blue Grass pasture, and much is covered by low woodland consisting of bloodwood and other eucalyptus species. It is drained by Cattle Creek, Waterloo Creek and the West Baines River. The West Baines in turn is a major tributary of the Victoria River and forms useful floodplain country where it is underlain by Angalarri Siltstone inside and downstream of Baines No. 1 Paddock.

The Brumby Plain area of the south and west is principally hill country with gently undulating and useful lowlands comprising stony basalt outcrops (Plate 2), and with soils ranging from grey and brown cracking clays to brown loams, red clays and red earths. Vegetation is mainly arid short grasses and spinifex, with areas of Mitchell, Flinders, Ribbon and Blue Grass. Drainage is provided by Pompey, Bauhinia, Mistake and Bareback Creeks, all of which flow southwards into the Negri River which in turn feeds the Ord River.

The availability of stock water is a major influence on stock management since virtually all of the annual rainfall, which averages 644 mm (median 610 mm), occurs in the short hot monsoonal wet season between December and March. For the remainder of the year, known as the Dry, temperatures are warm and very little rainfall is experienced and stockwater is maintained by bores and depleting waterholes and springs. During the Wet, when the streams flow, much low lying country is inundated by water. Recharge to shallow groundwater aquifers occurs at this time (water levels at two monitoring bores near Datuk Bore on Rosewood Station rose 3 m over the 1993/94 Wet).
During the Dry evaporation rates of about 7 mm per day (2.5 m per year) ensure that water levels in creeks, dams and tanks, and shallow bores decline rapidly.

Air temperatures are high throughout the year. At nearby Auvergne Station the mean monthly maxima range from about 30 to 31 degrees in June and July to 37 to 39 degrees in October and November. The corresponding mean monthly minima at Auvergne are 12 to 14 degrees and 24 to 26 degrees. Similar temperatures are experienced at Waterloo.

The rivers and creeks of the station flow for a limited time after the Wet, eventually forming unconnected waterholes. However, by the end of the Dry only a few major pools and spring fed streams still hold water. Springs are common in the basalt country, but usually decline in flow as the Dry progresses. They are often found where impermeable basalt or siltstone beds underly more permeable cracked or weathered basalt.

Existing waterholes and bores enable most of the basalt country to be within grazing range of relatively permanent water. The station is currently credited with 11 production bores, 1 equipped soak (Dura Soak), 1 pipeline supplied water point, and numerous semi permanent waterholes, the principal ones being Florrie, Dingo and Shovel Springs. However an increased number of reliable watering points in areas of good pasture would provide for more even grazing with decreased land degradation around existing water supplies.

The accompanying map entitled "Water Resources Development Map of Waterloo Station" summarises the findings of a survey undertaken by the Water Resources Division of the Power and Water Authority. It aims to provide information to enable the station manager to select the best type of water supply development, ie. bores or surface water impoundments, for an improved distribution of water supply points throughout Waterloo Station.

For more detail on bore siting and excavated tank design the report entitled "A Guide for Water Resources Management of Waterloo Station" (hereafter called the guidelines report) should be consulted.

2. EXISTING PROPERTY MANAGEMENT PRACTICES

Current stock management is based on the fencing of Waterloo into paddocks to allow the control of movement dependent on pasture and water availability. Internal fencing has mainly been undertaken in the basalt country north of the West Baines River and in the Brumby Plains - Shovel Springs areas. These paddocks vary greatly in size (commonly carrying between 200 and 1200 head) but will on average accommodate 600 head of cattle.
All paddocks are dependent to some extent on surface water from wet season rainfall. The majority are also serviced by at least one stock bore. Reliable bores often service more than one paddock. For instance, Dingo Bore is at the junction of three paddocks, with stock often congregating at this junction. Severe overgrazing has occurred in this area.

The piping of water away from bores to give an improved distribution of watering points is not common due to the difficulty of burying pipeline in the hard basalt country.

At the start of the Dry cattle are dispersed throughout the musterable areas of the station to take advantage of full waterholes and good pasture. At this stage the maximum recommended distance of 3 to 4 km between grazing and watering areas is easily maintained. As the surface water depletes throughout the Dry cattle are moved to paddocks where more reliable water is available, until by about September when large numbers are concentrated on the most reliable watering points (mainly the bores). Pasture adjacent to these water supplies is usually overgrazed while more remote pasture remains relatively untouched.

Attempts to improve the dry season utilisation of pasture have included the successful drilling of bores in the Brumby Plains area, and the unsuccessful drilling of two bores in the shale and siltstone of the floodplain country north east of Baines No. 1 Paddock. The highly productive country to the west and north east of Baines No. 1 Paddock will be of particular interest for stockwater development in the future.

3. WATER REQUIREMENT

Cattle require, on average, 50 litres per day per head. Therefore a surface water impoundment servicing 600 head of cattle for 11 months of the year will require a volume of about 10 megalitres (ML) plus an extra 2.4 m depth of water to make up for evaporation losses. Design dimensions for offstream excavated tanks with this capacity are included in the guidelines report.

Similarly a paddock of 600 head that is totally dependent on a single bore for water supply will require that bore to be capable of pumping for 24 hours a day at 0.4 L/s. Thus a bore reliably yielding 1.6 to 2 L/s could potentially service four paddocks by utilising pipelines.

Bores with capacities in this range are common in the Antrim Plateau Volcanics basalt or the Jasper Gorge Sandstone, but not in the Angalarri Siltstone. Bores in the Angalarri Siltstone do not yield more than 0.3 L/s on a long term basis even when larger supplies are struck during drilling. Details on the aquifers of Waterloo are included in the guidelines report.
These demand figures do not take into account that for some of the Dry bore and tank supplies will be supplemented by waterholes remaining from the Wet. Thus the figures should provide a safety factor.

4. FUTURE WATER SUPPLY DEVELOPMENT

The improved utilisation of pasture on Waterloo Station, together with decreased land degradation, is dependent to a large extent on upgrading of the present distribution of reliable water supplies (bores and waterholes).

The recommended type of development for a specific area is summarised in the accompanying map entitled "Water Resources Development Map of Waterloo Station". This map is supported by two others available with the guidelines report. The map entitled "The Hydrogeology of Waterloo Station" is to assist in the selection of bore sites, while "The Land System and Land Unit Map of Waterloo Station" provides a general indication of what surface materials to expect if constructing an excavated tank. These maps are held in GIS format and in future the information, including land unit data being compiled by the Conservation Commission of the Northern Territory, could be combined onto other maps at the request of the pastoralist.

Briefly the recommendations for future development of water supplies at Waterloo are:

- the provision of reliable water supplies with a maximum grazing radius of 3 to 4 km throughout the good pasture country of Waterloo (mainly the basalt and the West Baines floodplains areas) should be a priority in future management plans for the station;

- the water resources development map should be used to determine the type of water supply most appropriate to a specific area on Waterloo Station. In areas where alternative options are available, economics will normally determine the final development type selected;

- most of the grazing country in the basalt areas has good groundwater potential, and stock water supply development in these areas should focus on the drilling of well sited bores (generally near faultlines or "T" junctions in creeks). Similarly good bores should be available in the Jasper Gorge Sandstone country of Horse Creek, although the grazing potential is not high;

- the piping of water from proven springs, or the construction of excavated tanks, situated away from the main flow channels and harvesting sheet flow runoff, should be considered in the lower floodplains of the West Baines River, where groundwater is generally not available because of the poor aquifer potential of the underlying Angalarri
Siltstone. Likely springs should be observed over at least one dry season to ensure reliability;

- gully dams require a high standard of design and construction in hard rock areas such as Waterloo. The cost of doing this for stockwater is excessive when compared with bore supplies, but may be reasonable for irrigation water. The specialist advice of a geotechnical or civil engineer should be sought if this method of surface water containment is to be used;

- advice should be sought from groundwater consultants or Water Resources Division for detailed bore siting information, or from geotechnical engineering consultants if considering the construction of excavated tanks.

The water resources development map is divided into 7 zones.

Zone 1

Inland plains country and alluvial channels with moderate to good pasture. Moderate surface runoff in areas of loamy, skeletal or sandy soils. High runoff rates in areas of cracking clays and shale or siltstone. Water supply development could include investigation into the presence of springs (particularly in the basalt escarpments) for piping to areas of good pasture. If no springs are present the construction of surface water impoundments, with excavated tanks away from clearly defined drainages being the preferred type, could be examined. Excavated hillside storages with bunds on three sides are possible where the ground surface shows some slope, or natural waterholes may be modified. Viability is highly dependent on local site conditions. Shallow siltstone - shale will or the requirement of sealing with a clay liner would add significantly to costs. Piping of water from reliable natural waterholes or bores may be a cost effective alternative where these are present. High intensity flood damage and silting of tanks is likely where structures are constructed too close to major creeks and rivers.

Zone 2

Plains adjacent to the West Baines River, and undulating hill country, with variable access and pasture. Moderate surface runoff. Preferred options as for Zone 1, but will usually involve the excavation of Angalarri Siltstone.

Zone 3

Gently undulating or hilly basalt country. High runoff and variable pasture. Up to 80% probability of obtaining groundwater supplies of between 1 and 2 L/s in bores at selected sites in Antrim Plateau Volcanics basalt and
sandstone. Drilling should not be undertaken closer than about 2 km from the escarpments that form the eastern edge of the basalt country. Aquifers usually struck before 80 - 100 m. Blacksoil areas suitable for turkeys' nest construction and piping to remote watering points. Gully dams possible but require expensive design and construction work.

Zone 4

Rocky and sandy gently dipping country in the headwaters of Horse Creek. Poor pasture. High runoff. Although this is poor grazing country with difficult access there is up to an 80% probability of encountering groundwater supplies of between 0.5 and 5 L/s at selected sites in outcropping Jasper Gorge Sandstone. Aquifers usually struck before 80 m. These supplies could be useful for pumping to areas of good pasture.

Zone 5

Plains and alluvial channel country with variable pasture and runoff rates. Up to 50% probability of obtaining groundwater supplies of between 0.5 and 5 L/s in bores targeting Jasper Gorge Sandstone at depths up to 150 m. Bore site selection is very important and the area should not be drilled before seeking specialist advice (eg. groundwater consultants or Rural Advisory Section, Water Resources Division). If bore sites are available then bores of 1.6 L/s or more have potential to supply up to 4 paddocks with piping, thus being an economical alternative to excavated tanks. If bore sites are not available then there is potential for surface water alternatives as in Zone 1.

Zone 6

Undulating hill country and plains adjacent to major drainages including West Baines River. Groundwater as for Zone 5, surface water options as for Zone 2.

Zone 7

Rugged and rocky ridge country with high runoff rates. Because of very poor access and stocking rates, combined with poor aquifer potential, this area is economically and physically unsuitable for water supply development. Natural springs and waterholes may provide limited supplies, especially in the basalt escarpment country.

As a last resort aquifers in the Angalarri Siltstone within zones 1, 2, 5 and 6 could be investigated, but drilling in this formation on Amanbidji has shown only a 20% success rate for bores yielding 0.3 L/s, and individual paddocks may require more than one bore.
5. CONCLUSIONS

The improved utilisation of pasture on Waterloo Station, together with decreased land degradation, is dependent to a large extent on upgrading of the present distribution of reliable water supplies (bores and natural waterholes). Most of the good grazing country in the basalt areas has good groundwater potential, and in these areas the improvements will probably be due to the drilling of more bores. The good groundwater potential precludes surface water development, except in areas such as the lower floodplains of the West Baines River, which are underlain by siltstones with very limited aquifer potential. In these areas springs should be used where present, or if not, excavated tanks situated away from the main flow channels and harvesting sheet flow runoff show potential. Bores should be available in the sandstone country of the Horse Creek area, although the grazing potential is not high.

The accompanying map is a key tool in planning future water supply development at Waterloo. The required distribution of water supply points should be marked on a pastoral map and the type of development then determined from this water resources development map. The final decision on how to proceed with development should be based on consultation with the guidelines report and specialists (eg. Water Resources Division, consultants) and site investigations.

6. ACKNOWLEDGEMENTS

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7. REFERENCES


Fig. 2

LANDFORM DIVISIONS OF WATERLOO STATION
SCHEMATIC CROSS SECTION SHOWING THE GEOLOGY OF WATERLOO STATION
PLATE 1: Typical undulating basalt country on Waterloo Station. This aerial photograph is in the Waterloo Creek area looking south over the homestead. Late wet season, March 1993.