LAND UNITS OF THE
TIMBER CREEK TOWNSHIP AREA

by

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1976.
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The authors wish to thank Mr. A. Czachorowski for his work on vegetation and Mr. I. Hall for his technical assistance. Constructive criticism during the preparation of this report by Mr. K.J. Day was also appreciated.
1. INTRODUCTION

This description of the land in the Timber Creek district arose from a request in 1975 by the Urban Development and Town Planning Branch, Department of the Northern Territory. The objective of the survey was to provide information on land use limitations which may assist in the future planning and development of the Timber Creek township area. Such information could only be assessed by closely examining the various associations of landform, soils and vegetation which occur in the area.

To obtain the desired information, the following steps were taken:

(i) Preliminary air photo interpretation.

Aerial photographs covering the area to be surveyed were examined under a stereoscope. This enabled a separation of broad geomorphological patterns within the area and the drawing of tentative boundaries of land units.

A land unit is described as a reasonably homogeneous part of the land surface, distinct from surrounding terrain with consistent properties in landform, soils and vegetation (Laity 1971). As such, a land unit becomes an area of land which exhibits an essentially uniform pattern on aerial photographs (Aldrick & Robinson 1970).

(ii) Field Survey.

Following the preliminary photo interpretation, sites were selected within the tentatively defined units for field examination by a survey party. Details on soil, vegetation and topography at each of these sites were recorded.
(iii) Final photo interpretation and production of maps.

Using the information gained by field survey, the preliminary interpretation of aerial photograph patterns was reassessed and land unit boundaries fixed ready for map production. The extent of, and the relationships between the land units are shown on Map 1 "Land Units Timber Creek". Map 2, "Potential Land Use - Timber Creek Area" presents the general conclusions of this report based upon an interpretation of the developmental limitations of all land units.
2. LOCATION AND AREA.

The present Timber Creek township is located on the Victoria Highway approximately 277 km from Katherine and 203 km from Kununurra. (See Fig. 1). Timber Creek itself flows immediately east of the township until it meets with the Victoria River a further 2.5 km due north.

The total survey area of approximately 23 km², extends 2 km west of, and 1.2 km east of the existing Timber Creek Police Station. The northern survey boundary is marked by the Victoria River and the southern boundary, formed by the limit of aerial photo coverage, is located perpendicular to the highway, 4.6 km south of the Police Station. (See Fig. 2).
Figure 1  Location Map.
Figure 2. Timber Creek Survey Area.

--- Boundary of aerial photo coverage.
3. PHYSIOGRAPHY

The area concerned is part of the Pinkerton Land System as defined by Stewart et al. (1970). The survey area forms a broad, flat bottomed alluvial valley within a dissected structural plateau of the Newcastle Range. The area is flanked to the east and west by the edges of this plateau. Steep denudation slopes rise at a constant 28.5° to a height of approximately 200 m where a scarp of resistant sandstone forms the base of the plateau surface. Gently sloping footslopes occur beneath the denudation slopes and these give way to alluvial backplains and levees associated with Timber Creek in the centre of the valley floor. Timber Creek is a small perennial stream which meanders northwards until it flows into a bend of the tidally affected Victoria River. The northern section of the survey area is occupied by alluvial floodplains and levees associated with this river.

Four major physiographic units can thus be identified within the survey area. They are:

i. Structured Plateau
ii. Footslopes
iii. Timber Creek and its deposits
iv. Victoria River and its deposits.

The relationship between these units is shown in Figure 3.
4. DEVELOPMENTAL LIMITATIONS AND POTENTIAL LAND USE SUMMARY.

The Timber Creek area can be sectioned into six potential land use divisions based on the data given in the land unit descriptions and the land unit map (1). These regions are shown on the potential land use map (2) and are summarized below:

(i) MOST FAVOURABLE AREAS FOR URBAN AND AGRICULTURAL DEVELOPMENT.

These areas are included in the land units 3b, 3c1 and 3c2. The soils are moderately deep (60-100 cm), well drained and generally appear quite stable. A possible exception is the lower lying areas of unit 3c2 which have already suffered minor erosion. The total area of such units is quite extensive (approximately 250 ha), although approximately 25% of the area is situated on the eastern side of Timber Creek. The majority of the area on the western side is readily accessible from the highway.

Evidence of recent flooding suggests that this factor may be the greatest limitation for urban development in this area. However, due to the elevation of this area above the Victoria River, flooding from this source occurs very infrequently. Damage is more likely to occur from local flooding of the creek itself as a result of high rainfall and subsequent run-off in upland catchment areas. Data obtained from the Hydrographic Section of Water Resources Branch, Department of the Northern Territory, indicate that flooding of this area has occurred only twice in the past 20 years, the first major flood being associated with a record flooding of the Victoria River, and the later being a rare example of flooding of Timber Creek alone. The inherent stability of these soils and the effect of vegetative cover was illustrated by the fact that neither of the two major floods caused any
significant damage to land in this area.

It is therefore concluded that if clearing of vegetation within these areas and in the upland catchment areas (units 1a, 1b), is minimized the flooding problem should be alleviated.

(ii) POSSIBLE, ALTHOUGH LESS FAVOURABLE, AREAS FOR AGRICULTURAL AND URBAN DEVELOPMENT.

This division is represented by two areas of widely differing land units, 3c3 and 4c. Both units have some potential for improved pasture development and limited urban development, but suffer important limitations.

The deep calcareous red clays of unit 3c3 have sufficient depth, structure and drainage to be suitable for some urban or agricultural uses but are limited in their extent. Lower lying areas of heavier textured, dark brown clays which are subject to seasonal waterlogging, are interlaced with the higher elevated, more suitable areas. Local relief is 1.5 - 2 m and access is limited during the wet season.

The area encompassed by the land unit 4c, contains a large cleared section previously used as an airstrip. The land here has been compacted and contains large amounts of introduced stone and gravel, making it relatively stable and well drained for building purposes. However, due to the lack of vegetative cover the perimeter and immediate surroundings to this area are eroded and further development should be approached with caution.

Limited vegetated areas of alluvial sandy red earths with desirable depth and drainage characteristics are also present in this unit and provide some potential for the development of improved pastures or urban development. However, the highly erodible nature of the soils in the surrounding land units would
mean that strict stock management would be essential and that access roads would require frequent maintenance and suitable drainage facilities.

(iii) VERY MARGINAL AREAS FOR URBAN OR AGRICULTURAL DEVELOPMENT.

This division is represented by the gently undulating gilgaid backplains of the Victoria River, land units 4b1, 4b2 and 4b3. These units are considered to have very limited potential for agricultural or urban development because of the physical limitations associated with the strongly gilgaid cracking brown clays.

The microrelief due to the gilgai formation consists of a succession of microbasins and microknolls approximately 1 to 3 m in diameter in an essentially level area. The nature of the clays is such that marked expansion and contraction of the soil occurs during alternate wet and dry periods. The characteristic morphology is thought to be formed by the upward movement of large blocks of soils that have been released by a horizontal fracture in the subsoil caused by a swelling in a wet period of soil that has fallen down cracks when the soil was dried out. (Stace et al. 1968). The soil surface is self mulching, crumbling in dry weather into small subical aggregates which lie loosely on the surface. This means that there is remarkably little soil per unit volume and the soil is inherently unstable. Extensive crumbling and cracking of this soil in the dry season limits the agricultural potential of this land. The slow semi continuous upward heaving of soil blocks and marked change in soil volume during wet and dry seasons, make these areas largely undesirable as building sites. Digging of foundation trenches through the entire solum would be unfeasible due to the required depth of up to 15 m. Urban development on these areas is consequently not recommended.
12.

(iv) AREAS SUITABLE FOR LIMITED ROUGH GRAZING.

These areas include the footslope land units 2b1, 2b2 and 2c. They are considered generally unsuitable for urban development due to their limited extent and their erodible, imperfectly drained soils. Vegetation on such footslope areas should be preserved to minimize the erosion caused by run-off from the higher slopes. The erodibility of the soils is indicated by gullies along the drainage lines. These areas could only support limited rough grazing of native pastures with minimal soil disturbance. If possible the land is best left undisturbed.

(v) AREAS FOR POSSIBLE ROUGH GRAZING ALTHOUGH NOT SUITED TO GRAVEL STRIPPING OPERATIONS.

These areas are encompassed by the land unit 2a. The slope of this land generally eliminates any potential for agricultural or urban development. However the shallow gravelly skeletal soils are suitable for gravel stripping providing measures are taken to ensure run-off from the higher denudation slope is intercepted and does not cause scouring and erosion of the exposed subsoil. There were, at the time of this survey, four gravel stripped areas located within this land unit. The high probability of erosion along tracks to these, and any subsequent gravel stripping areas is a problem associated with this form of land use. These areas may also be able to support some limited rough grazing of native pastures.

(vi) AREAS UNSUITABLE FOR AGRICULTURAL OR URBAN DEVELOPMENT.

These areas include the land units 1a, 1b, 3a, 4a and 4d. They are deemed unsuitable due to reasons of either inaccessibility, extreme slope, or extreme erosion hazard. The rugged terrain of the structural plateau is best left undisturbed as
this is part of the catchment area for Timber Creek and any disturbance would increase the probability of flooding and erosion in the lower areas. The land units in the immediate vicinity of the Victoria River, Timber Creek or major drainage lines should also be left undisturbed as they are largely unstable areas, often with severe natural erosion taking place.
5. **BREAKDOWN OF LAND UNITS.**

The initial breakdown of land units has been based on physiographic situation. (Fig. 3). This breakdown can be seen to be directly related to parent material. (See Appendix I - Geology).

Further divisions of land units are based on soil and vegetation data. The soils have been divided on the basis of morphological characteristics, colour, texture, consistence, structure, fabric and reaction trend (pH). The soils have been classified into Great Soil Groups (Stace et al. 1968), Principal Profile Forms (Northcote 1971) and into divisions of the Unified Soil Classification*. Table I summarizes the soils of the Timber Creek region and their occurrence in the various land units. Representative soil profiles are described in Appendix II.

The vegetation structure in the survey area ranges from low open shrubland to low woodland and its classification is based on that by Specht (1970) (Table II). A complete list of all botanical species observed in the survey area is given in Appendix III.

* Soil Classification devised for engineering purposes and adopted by Corps of Engineers and Bureau of Reclamation U.S.A.
## TABLE I. SOILS OF THE TIMBER CREEK REGION.

<table>
<thead>
<tr>
<th>Great Soil Group (Stace et al. 1968)</th>
<th>Factual Key Northcote (1971)</th>
<th>Unified Soils Classification</th>
<th>Land Unit Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alluvial Soils</td>
<td>Gn2.11</td>
<td>SM/SC</td>
<td>4c, 4d</td>
</tr>
<tr>
<td>Lithosols</td>
<td>(K-)Uc1.23</td>
<td>GC</td>
<td>1b, 2a</td>
</tr>
<tr>
<td>Earthy Sands (yellow)</td>
<td>Uc5.21</td>
<td>SM/SC</td>
<td>2b1, 2b2</td>
</tr>
<tr>
<td>Brown Clays (non cracking)</td>
<td>Ur6.5</td>
<td>GL</td>
<td>3c3</td>
</tr>
<tr>
<td></td>
<td>Ur6.53</td>
<td>ML</td>
<td>3b, 4a</td>
</tr>
<tr>
<td>Brown Clays (calcareous, cracking)</td>
<td>Ug5.15</td>
<td>CH</td>
<td>4b1, 4b2, 4b3, 4d</td>
</tr>
<tr>
<td>Red Clays (calcareous)</td>
<td>Gc1.22</td>
<td>CL</td>
<td>3c3, 4d</td>
</tr>
<tr>
<td>Calcareous Red Earths</td>
<td>Dr2.63</td>
<td>NL</td>
<td>3c1, 3c2</td>
</tr>
<tr>
<td>Yellow Earths (gravelly, shallow)</td>
<td>-</td>
<td>GC</td>
<td>2c</td>
</tr>
</tbody>
</table>
### TABLE II  STRUCTURAL FORMS OF VEGETATION *

<table>
<thead>
<tr>
<th>Life Form and Height of Tallest Stratum</th>
<th>Projective Foliage Cover of Tallest Stratum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dense (70-100%)</td>
</tr>
<tr>
<td>Trees 30 m</td>
<td>Tall closed-forest</td>
</tr>
<tr>
<td>Trees 10 - 30 m</td>
<td>Closed-forest</td>
</tr>
<tr>
<td>Trees 5 - 10 m</td>
<td>Low closed-forest</td>
</tr>
<tr>
<td>Shrubs 2 - 8 m</td>
<td>Closed-scrub</td>
</tr>
<tr>
<td>Shrubs 0 - 2 m</td>
<td>Closed-heath</td>
</tr>
</tbody>
</table>

* Taken in part from Specht (1970).
### DESCRIPTION OF LAND UNITS.

<table>
<thead>
<tr>
<th>Land Unit</th>
<th>Landform</th>
<th>Soils</th>
<th>Vegetation*</th>
<th>Limitations</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Structural plateau surface, upper slopes, and benches occurring above scarp at top of denudation slope.</td>
<td>Skeletal soils with rock outcrop.</td>
<td>Open woodland; <em>E.</em> <em>tetradonta</em>, <em>E.</em> <em>dichromopliaea</em>, <em>E.</em> <em>ferruginea</em>, <em>E.</em> <em>minista</em>, <em>E.</em> <em>phoenicea</em>; dominant grasses <em>Sorghum stipoides</em>, <em>Electrachne pungens</em>.</td>
<td>Rugged terrain, inaccessibility, severe outcrop.</td>
<td>Limited due to inaccessibility.</td>
</tr>
<tr>
<td>1b</td>
<td>Boulder strewn denudation slopes, up to 60° occurring beneath scarp; relief 100 m.</td>
<td>Lithosols.</td>
<td>Low open woodland, dominated by <em>E.</em> <em>tectifica</em>, also stunted <em>Erythrophleum chloroacta</em>, <em>Cochlospermum fraseri</em>, <em>Ptilotus obovatus</em>; dominant grasses <em>Sorghum stipoides</em> and occasional <em>Triodia</em> spp.</td>
<td>Extreme slope, shallow erodible soils.</td>
<td>Not suitable for any form of agricultural or urban development.</td>
</tr>
</tbody>
</table>

* From Stewart et al. (1970).
PLATE 1

Land Units 1a, 1b, 4bl

Land Unit 1b
<table>
<thead>
<tr>
<th>Land Unit</th>
<th>Landform</th>
<th>Soils</th>
<th>Vegetation</th>
<th>Limitations</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>Upper footslopes gently sloping at 2-10%; scattered limestone pavement or outcrop, and hard silicified sandstone boulders.</td>
<td>Lithosols.</td>
<td>Low open woodland; dominated by <em>E. tectifica</em> and <em>Erythrophleum chlorontachya</em>, with some <em>T. platyptera</em> and <em>E. grandifolia</em>; dominant grasses <em>Sorghum</em> spp. (annual) with occasional <em>Tridias</em> spp., <em>Chrysopegon</em> spp. and <em>Heteropogon</em> sp.</td>
<td>Shallow soils; slope; stony surface; erodible, particularly in lower areas.</td>
<td>Extractive industries - road fill material; limited rough grazing during wet season.</td>
</tr>
<tr>
<td>2b1</td>
<td>Lower footslopes 2-4% slope, with few surface stones.</td>
<td>Moderately deep, yellow earthy sands with slight internal drainage impedance.</td>
<td>Low open woodland; dominant <em>Terminalia platyptera</em> with <em>E. microtheca</em> subdominant; some <em>Ptilotus obovatus</em> occurs along drainage lines; dominant grass, <em>Sorghum</em> spp. (annual) with some <em>Tridias</em> sp.</td>
<td>Reasonably shallow imperfectly drained soil which tends to be erodible.</td>
<td>Possible pasture improvement with minimal soil disturbance; limited rough grazing.</td>
</tr>
</tbody>
</table>
Gravel Pit, Land Unit 2a. Note also Land Units 1a, 1b

Land Unit 2a
<table>
<thead>
<tr>
<th>Land Unit</th>
<th>2b2</th>
<th>Landform</th>
<th>Lower footslopes 3-4%, with few surface stones; gullies occur along drainage lines.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Soils</td>
<td>Moderately deep yellow earthy sands with slight drainage impedance above a gravel pan.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vegetation</td>
<td>Open woodland, dominant <em>Erythrophleum chlorostachya</em> and some <em>Terminalia platyphylla</em>, <em>E. latifolia</em>; dominant grass, <em>Sorghum</em> spp. (annual) and some <em>Chromopogon fallax</em>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limitations</td>
<td>Erodible soil, imperfectly drained, perched water table.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential</td>
<td>As for 2b1.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Land Unit</th>
<th>2c</th>
<th>Landform</th>
<th>Lower footslopes gently sloping at 2-4%.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Soils</td>
<td>Shallow gravelly yellow earths.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vegetation</td>
<td>Tall shrubland, dominated by <em>Melaleuca minutifolia</em> with some minor <em>Terminalia platyptera</em>; dominant grass, <em>Aristida latifolia</em> with some <em>Themeda australis</em>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limitations</td>
<td>Shallow erodible soil with moderate amounts of surface stone and gravel.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential</td>
<td>Very poor rough grazing but best left undisturbed. Insufficient gravel to support extractive industries.</td>
</tr>
</tbody>
</table>
Land Unit 3a

Secondary Creek containing ephemeral water supplies and recent alluvial deposits. Erodible area; careful management of stock numbers at access points in wet season required.

Land Unit 3b

Landform: Backplains and drainage flats associated with Timber Creek; slopes less than 2%.

Soils: Moderately deep, dark brown non cracking clays, with silty clay loam organic surface horizons over calcareous subsoils.

Vegetation: Open woodland; dominant E. papuana, E. grandifolia over Acacia aff. bidwillii, Scaebania sp.; grasses Sehima nervosa, Themeda australis and Chrysopogon fallax.

Limitations: Some evidence of flooding over area, although soil appears quite stable. Crotalaria sp. (Rattlepod) present which may prove detrimental to stock.

Potential: Suitable for urban development or improved pastures providing soil conservation measures are incorporated.
25.

**Land Unit**

**3c1**

**Landform**: Levees and backplains of Timber Creek, slopes 2-3° on western side of creek.

**Soils**: Moderately deep calcareous red earths over a calcareous pan at 60 cm.

**Vegetation**: Open woodland; dominant *E. tectifica* with some *E. latifolia*; dominant grasses *Sehima nervosum, Themeda australis* with some *Heteropogon contortus*.

**Limitations**: Evidence of possible flash flooding although soil appears stable, no erosion present. Relative inaccessibility of eastern side.

**Potential**: As for 3b on western side of Timber Creek.

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**Land Unit**

**3c2**

**Landform**: Levee banks and terraces of Timber Creek, lower than 3c1.

**Soils**: Moderately deep calcareous red earths, over calcareous pan at 90 cm. Pan continuous with that of 3c1. Silty alluvial surface due to flood deposits.

**Vegetation**: Open woodland, dominant *E. terminalis* with subdominant *E. tectifica*, also *Terminalia arartrata, Lysiphyllum cunninghamii;* dominant grasses, *Sehima nervosum, Themeda australis* with *Chrysopogon fallax*.

**Limitations**: Some evidence of flooding although soil appears stable in higher areas. Lower sections tend to erode where vegetation is removed.

**Potential**: As for 3b with possible exception of lower more erodible areas where vegetative cover should be preserved.
PLATE 5

Land Unit 3c1

Land Unit 3c2
Land Unit 3c3

Landform: Levees and drainage flats of Timber Creek.

Soils: Deep calcareous red clays on higher levees and deep, dark brown clays in lower drainage flat areas.

Vegetation: Open woodland; dominance shared between *Eucalyptus tectifica*, *Terminalia arrostrata* and *E. terminalis*, with subdominant *Hakea arborescens*, *Lyssiphyllum cunninghamii* in higher areas. Lower drainage flats contain dominant *E. papuana*, *E. microtheca* with some *Grevillea* spp.; grasses *Chrysochaon fallax*, *Enneapogon* sp. and *Heteropogon contortus* in high areas, *Themeda australis* and *Sobisa nervosa* in lower wetter areas.

Limitations: Slow permeability of soils, one to two metres relief between higher areas and lower drainage flats.

Potential: Possible improved pastures or grazing on higher areas, although lower areas may be subject to seasonal waterlogging, limiting access to higher areas.

Land Unit 4a

Landform: Backplains of Victoria River Containing numerous drainage lines.

Soils: Shallow, brown non cracking clays.

Vegetation: Open woodland; dominant *E. microtheca* with subdominant *Terminalia platyphylla*, also *Adansonia* sp., and *Lyssiphyllum cunninghamii*; *Sorghum* spp. (annual) dominant over *Chrysopogon* spp..

Limitations: Shallow soil, slow permeability, presence of eroded creeks and drainage lines.

Potential: Not suitable for agricultural or urban development.
PLATE 6

Land Unit 3c3

Land Unit 4a
Land Unit 4b1

Landform: Gently undulating gilgaid backplains associated with Victoria River; 20-25% surface cover of sandstone, limestone and chert stones and gravel.

Soils: Deep, brown cracking clays, heavily gilgaid, self mulching surface, calcareous throughout; many floaters present in some areas.

Vegetation: Low open shrubland; dominant *Lysoiphylum cunninghamii* with subdominant *Acacia* aff. *bidwillii*, also *Sebestiana* sp., and *E. microtha;* dominant grass, *Chrysopogon* sp. with subdominant *Sorghum* spp. (annual) and *Lasiema* sp.

Limitations: Temporary ponding; gilgaid soil unstable due to swelling and contraction of clays in alternate wet, dry periods; slow permeability and poor drainage; considerable surface stone cover.

Potential: Limited agricultural potential, urban development only at considerable cost due to engineering problems associated with cracking and gilgai characteristics.
PLATE 7

Land Unit 4b1. Note also 1a, 1b, in background

Land Unit 4b3
31.

Land Unit 4b2

Landform: Gently undulating gilgaid backplains of Victoria River.

Soils: Deep, brown cracking clays, gilgaid, self-mulching surface; calcareous throughout.

Vegetation: Low open shrubland; dominant E. microtheca with subdominant Lysiphyllum cunninghamii; dominant grass Chrysopogon fallax with some Aristida latifolia and Iseilema sp.

Limitations: Evidence of temporary ponding; unstable soil due to swelling and contraction of clays in alternate wet and dry periods; slow permeability and poor drainage.

Potential: As for 4b1.

Land Unit 4b3

Landform: Gently undulating gilgaid backplains of Victoria River.

Soils: Deep, brown cracking clays, calcareous throughout with self-mulching surface.

Vegetation: Low open shrubland; dominant Ficus opposita with occasional E. microtheca, Acacia aff. bidwillii and Carissa lanceolata; dominantly Sorghum spp. (annual).

Limitations: Unstable soil due to swelling and shrinking of clays in alternate wet and dry periods; slow permeability and poor drainage.

Potential: As for 4b1.
<table>
<thead>
<tr>
<th>Land Unit</th>
<th>Landform</th>
<th>Soils</th>
<th>Vegetation</th>
<th>Limitations</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>4c</td>
<td>Levees adjacent to Victoria River; and some cleared, levelled areas.</td>
<td>Alluvial sandy red earths in undisturbed areas; some levelled areas (old airstrip) containing shallow gravelly soils.</td>
<td>Low woodland; dominant <em>E. tectifica</em> and some <em>Terminalia platyptera</em>, <em>Acacia</em> sp. and <em>Gyrocarpus americana</em>; dominant grass, <em>Sorghum</em> spp. (annual) with some <em>Chrysopogon</em> sp.</td>
<td>Cleared areas contain shallow soil with much introduced surface stone and gravel; lacks vegetation and hence tends to be erodible. Undisturbed areas also erodible due to inherent soil instability.</td>
<td>Some potential for pasture development and light grazing with careful management to avoid erosion. Possible urban development in the higher, cleared and levelled areas providing soil conservation measures are applied. Potential not as high as that in 3b, 3c1 or 3c2.</td>
</tr>
<tr>
<td>4d</td>
<td>Eroded areas within Victoria River deposits.</td>
<td>Sandy red earths, calcareous red and brown clays.</td>
<td>Generally low to low open woodland; dominant <em>E. microtheca</em> and <em>Lymphium cunninghamii</em>.</td>
<td>Severe erosion.</td>
<td>Unsuitable for any form of agricultural or urban development.</td>
</tr>
</tbody>
</table>
APPENDIX I.

GEOLOGY

The geology of the Victoria River area, encompassing Timber Creek has been described by Pontifex and Sweet (1972) in their "Explanatory Note on the Auvergne Geological Sheet". Previous references to the area have been made by Wells (1907), Woolnough (1912), Wade (1924) and Traves (1955). These authors are cited by Pontifex and Sweet (1972).

Four main geological formations occur in the area covered by this report; the Proterozoic Timber Creek Formation, belonging to the Bullita Group, the Proterozoic Jasper Gorge Sandstone, belonging to the Auvergne Group, the Cainozoic sand, soil and colluvium, and the Quaternary deposits (alluvium and terrace deposits). The relationship of these formations to each other is shown in Figures 4, 5, and described briefly below.

PROTEROZOIC

Adelaidean? Bullita Group.

(i) Timber Creek Formation: These sediments are greater than 120 m thick and consist of dolomitic siltstone, siltstone, fine sandstone, dolomite and minor chert. Deposition is considered to have occurred in a shallow sea with periodical subaerial exposure.

Adelaidean? Auvergne Group.

(ii) Jasper Gorge Sandstone: Massive quartz sandstone and minor siltstone, in places greater than 60 m thick, occur above the Timber Creek Formation. The boundary between these two formations in the survey area is marked by a prominent scarp of resistant Jasper Gorge Sandstone.
CAINOZOIC

(iii) Superficial sand, residual soil and colluvium: These occur as piedmont deposits adjacent to the sandstone ranges.

(iv) Quaternary Deposits:

(a) Terrace deposits (mud, sand, gravel): These are associated in the survey area with the Victoria River and are up to 15 m thick.

(b) Alluvium: Mud, silt and fine sand occur near the Victoria River and Timber Creek. These deposits are up to 10 m thick.
Figure 4  Geology of the Timber Creek region.
APPENDIX II

SOILS

TERMINOLOGY USED.

(i) Colour. Moist soil colours were rated in terms of hue, value and chroma using the Munsell soil colour charts (1954):

(ii) Texture. Field texture assessments were made based on the behaviour of a small handful of soil when moistened and kneaded into a ball and then pressed out between thumb and forefinger. This behaviour has been related to laboratory particle size analysis and categories defined by the texture diagram (U.S.D.A. Soil Survey Manual 1951).

<table>
<thead>
<tr>
<th>Soil Texture Class</th>
<th>Symbol</th>
<th>Clay percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>S</td>
<td>less than 10</td>
</tr>
<tr>
<td>Loamy Sand</td>
<td>LS</td>
<td></td>
</tr>
<tr>
<td>Clayey Sand</td>
<td>CS</td>
<td></td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>SL</td>
<td>10-20</td>
</tr>
<tr>
<td>Loam</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Silty Loam</td>
<td>SiL</td>
<td>approx. 25</td>
</tr>
<tr>
<td>Silt</td>
<td>Si</td>
<td></td>
</tr>
<tr>
<td>Sandy Clay Loam</td>
<td>SCL</td>
<td>30-35</td>
</tr>
<tr>
<td>Silty Clay Loam</td>
<td>SiCL</td>
<td></td>
</tr>
<tr>
<td>Clay Loam</td>
<td>CL</td>
<td></td>
</tr>
<tr>
<td>Sandy Clay</td>
<td>SC</td>
<td></td>
</tr>
<tr>
<td>Silty Clay</td>
<td>SiC</td>
<td>35-40</td>
</tr>
<tr>
<td>Clay</td>
<td>C</td>
<td>greater than 40</td>
</tr>
</tbody>
</table>

(iii) Consistence. The measure of the forces of cohesion within a soil mass as indicated by resistance of soil aggregates to crushing between thumb and forefinger.
(iv) Structure—Pedality. Pedality refers to the relative proportion of individual, natural soil aggregates, called peds, within the soil. Structure is concerned with the arrangement of all soil particles. The only term used in this report relating to structure is massive. This term refers to that condition of a soil layer in which the layer appears as a coherent or firm, mass which is largely devoid of peds.

(v) Fabric. This term describes the general appearance of the soil mass. The terms used in this report are—

- Earthy: where more than 50% of the soil mass is porous and coherent, sand and clay particles are visible and clay skins may be present.

- Smooth Ped: where more than 50% of the soil mass is composed of peds that have a smooth lustrous appearance.

(vi) pH. Field pH (soil reaction) was determined using a C.S.I.R.O. Soil pH Test kit (inoculo Laboratories).

(vii) Presence or absence of CaCO₃. This was determined by noting the presence or absence of effervescence produced by a few drops of normal hydrochloric acid added to a soil sample.

(viii) Self mulching. This term is used to describe that condition of the surface soil, in which a high degree of pedality is exhibited with the peds falling apart naturally, as the soil dries to form a loose surface mulch.
**REPRESENTATIVE PROFILES.**

Great Soil Group : Alluvial Soils.
Factual Key : Gn2.11
Drainage : Well
Parent Material : Alluvial material deposited by Victoria River.
Occurrence : Specific : 4c
           General : 4c, 4d.

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10</td>
<td>Yellowish red (5YR 4/6) fine loamy sand; massive structure, earthy fabric; dry hard consistence; pH 6.5.</td>
</tr>
<tr>
<td>10 - 25</td>
<td>Dark red (2.5YR 3/6) fine loamy sand; massive structure, earthy fabric; dry very hard consistence; pH 6.5.</td>
</tr>
<tr>
<td>25 - 40</td>
<td>Dark reddish brown (2.5YR 3/4) fine sandy loam; massive structure, earthy fabric; dry very hard consistence; pH 6.5.</td>
</tr>
<tr>
<td>40 - 70</td>
<td>Dark red (2.5YR 3/6) sandy clay loam; massive structure, earthy fabric; dry very hard consistence; pH 6.0.</td>
</tr>
<tr>
<td>70 - 150</td>
<td>Dark red (2.5YR 3/6) clay loam with fine sand; massive structure, earthy fabric; moist friable consistence; pH 6.0.</td>
</tr>
</tbody>
</table>
Great Soil Group: Lithosoles
Factual Key: (K-) Uc1.23
Drainage: Well
Parent Material: Colluvial material, mostly sandstone
Occurrence: General: 1b, 2a

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 15</td>
<td>Dark reddish brown (5YR 3/3) loamy sand to sandy loam; massive structure, earthy fabric; dry slightly hard consistence; pH 6.0.</td>
</tr>
<tr>
<td>&gt; 15</td>
<td>Many sandstone floaters preventing further sampling.</td>
</tr>
</tbody>
</table>
Great Soil Group : Earthy sands (yellow).
Factual Key : Uc5.21
Drainage : Imperfect
Parent Material : Quaternary colluvium, mostly sandstone.
Occurrence : Specific : 2b1
             General : 2b1, 2b2

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 15</td>
<td>Dark brown (10YR 3/3) fine loamy sand; massive structure, earthy fabric; dry slightly hard consistence; pH 6.0.</td>
</tr>
<tr>
<td>15 - 30</td>
<td>Dark yellowish brown (10YR 3/4) fine loamy sand; massive structure, earthy fabric; dry slightly hard consistence; pH 6.5.</td>
</tr>
<tr>
<td>30 - 100</td>
<td>Dark yellowish brown (10YR 4/4) fine light sandy loam; massive structure, earthy fabric; moist friable consistence; faint yellow brown and red brown mottling; pH 6.5.</td>
</tr>
<tr>
<td>100 - 150</td>
<td>Yellowish brown (10YR 5/4) fine sandy loam; massive structure, earthy fabric; moist very friable consistence; distinct brown, and faint brown mottling; pH 6.0.</td>
</tr>
</tbody>
</table>
Great Soil Group : Red clays (calcareous)
Factual Key : Gc1.22
Drainage : Well
Parent Material : River alluvium
Occurrence : Specific : 3c3, 4d.
General : 3c3, 4d.

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 15</td>
<td>Dark reddish brown (5YR 3/3) light clay; massive structure, earthy fabric; dry very hard consistence; pH 8.0, amorphous CaCO₃ present.</td>
</tr>
<tr>
<td>15 - 55</td>
<td>Dark red (2.5YR 3/6) medium clay; massive structure, earthy fabric; dry extremely hard consistence; pH 7.0, amorphous CaCO₃ present.</td>
</tr>
<tr>
<td>55 - 90</td>
<td>Dark reddish brown (2.5YR 3/4) heavy clay; massive structure, smooth ped fabric; dry extremely hard consistence; pH 7.0, amorphous CaCO₃ present.</td>
</tr>
<tr>
<td>90 - 150</td>
<td>Yellowish red (5YR 4/6) heavy clay; massive structure, smooth ped fabric; moist firm consistence; pH 8.5, amorphous CaCO₃ present.</td>
</tr>
<tr>
<td>&gt; 150</td>
<td>Calcareous pan with 20% calcrete from 2 mm to 2.5 cm diameter.</td>
</tr>
</tbody>
</table>
Great Soil Group: Brown clays (non cracking)
Factual Key: Ur6.5
Drainage: Imperfect
Parent Material: Victoria River terrace deposits, mud, sand, gravel.
Occurrence: Specific: 3c3
General: 3c3

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20</td>
<td>Black (10YR 2/1) organic light to medium clay; massive structure, earthy fabric; dry very hard consistence; pH 7.5.</td>
</tr>
<tr>
<td>20 - 60</td>
<td>Very dark greyish brown (10YR 3/2) heavy clay; massive structure, earthy fabric; dry extremely hard consistence; pH 7.5.</td>
</tr>
<tr>
<td>60 - 150</td>
<td>Very dark greyish brown (10YR 3/2) heavy clay; massive structure, earthy fabric; dry extremely hard consistence; pH 8.5, abundant amorphous CaCO₃ present.</td>
</tr>
</tbody>
</table>
Great Soil Group : Brown clays (non cracking)  
Factual Key : Ur6.53  
Drainage : Well  
Parent Material : Victoria River terrace deposits, mud, sand, gravel.  
Occurrence : Specific : 3b  
General : 3b, 4a  

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20</td>
<td>Black (10YR 2/1) silty clay loam; massive structure, earthy fabric; dry very hard consistence; pH 7.0.</td>
</tr>
<tr>
<td>20 - 60</td>
<td>Dark yellowish brown (10YR 4/2) medium clay; massive structure, earthy fabric; dry extremely hard consistence; pH 6.5.</td>
</tr>
<tr>
<td>60 - 100</td>
<td>Dark greyish brown (10YR 4/2) medium clay; massive structure, earthy fabric; moist very firm consistence; pH 9.0, abundant CaCO₃ nodules present.</td>
</tr>
</tbody>
</table>
Great Soil Group: Brown clays (calcareous, cracking)
Factual Key: Ug5.15
Drainage: Imperfect
Parent Material: Victoria River terrace deposits, mud, sand, gravel.
Occurrence: Specific: 4b1.
General: 4b1, 4b2, 4b3, 4d.

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2</td>
<td>Granular self mulching surface, with discrete CaCO₃ nodules.</td>
</tr>
<tr>
<td>2 - 15</td>
<td>Dark brown (7.5YR 3/2) heavy clay; weak subangular blocky structure, smooth ped; dry extremely hard consistence; pH 8.0, discrete CaCO₃ nodules present.</td>
</tr>
<tr>
<td>15 - 90</td>
<td>Brown to dark brown (10YR 4/3) heavy clay; weak subangular blocky structure, smooth ped fabric; moist very firm consistence; pH 8.0.</td>
</tr>
<tr>
<td>90 - 150</td>
<td>Dark brown (10YR 3/3) heavy clay; weak subangular blocky structure, smooth ped fabric; moist very firm consistence; pH 9.5.</td>
</tr>
</tbody>
</table>
Great Soil Group : Calcareous red earths.
Factual Key : Dr2.63
Drainage : Well
Parent Material : Siliceous sandstone, dolomite and dolomitic siltstone of the Timber Creek Formation.
Occurrence : Specific : 3c2
General : 3c1, 3c2.

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10</td>
<td>Dark brown (7.5YR 3/2) sandy clay loam; massive structure, earthy fabric; dry very hard consistence; pH 6.5.</td>
</tr>
<tr>
<td>10 – 30</td>
<td>Reddish brown (5YR 4/4) light to medium clay; massive structure, earthy fabric; dry extremely hard consistence; pH 7.0.</td>
</tr>
<tr>
<td>30 – 90</td>
<td>Yellowish red (5YR 4/6) medium clay; massive structure, earthy fabric; dry extremely hard consistence; pH 8.0, abundant CaCO₃ nodules present.</td>
</tr>
<tr>
<td>&gt; 90</td>
<td>Calcareous pan.</td>
</tr>
<tr>
<td>Great Soil Group</td>
<td>Yellow earths (gravely)</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Parent Material</td>
<td>Colluvial deposits, mainly sandstone.</td>
</tr>
<tr>
<td>Drainage</td>
<td>Imperfect</td>
</tr>
<tr>
<td>Factual Key</td>
<td>-</td>
</tr>
<tr>
<td>Occurrence : Specific</td>
<td>2c</td>
</tr>
<tr>
<td>: General</td>
<td>2c</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 15</td>
<td>Yellowish brown (10YR 5/6) clay loam massive structure, earthy fabric; dry slightly hard consistence, 10% ferruginous gravel.</td>
</tr>
<tr>
<td>&gt;= 15</td>
<td>Many sandstone floaters, preventing further sampling.</td>
</tr>
</tbody>
</table>
APPENDIX III

VEGETATION

The following is a list of vegetation species found in the Timber Creek survey area, with common names where appropriate.

A. TREES.

Adansonia gregorii
Acacia aff. bidwillii
Acacia farnesiana
Acacia hemignosta
Acacia translucens
Acacia sp.
Buchanania obovata
Cochlospermum fraseri
Erythrophleum chlorostachys
Eucalyptus confertiflora
E. foelscheana
E. grandifolia
E. latifolia
E. microtheca
E. papuana
E. tectifica
E. terminalis
Ficus opposita
Grevillea dimidiata
Gyrocarpus americanus
Hakea arborescens
Lysiphyllum cunninghamii
Opilia amentacea
Melaleuca minutifolia
Pilostigma malbaricum

Bottle tree, Baobab
Wattle
Wattle
Wattle
Wattle
Wattle
Kapok Bush
Ironwood
Cabbage Gum
Bloodwood
Cabbage Gum
Bloodwood
Coolibah
Ghost Gum
Grey Box
Sandpaper Fig
Cooliman
Bauhinia
Paperbark
B. SHRUBS

Atylosia sp.
Calotropis procera
Calytrix microphylla
Carissa lanceolata
Cochlospermum fraseri
Crotalaria novae-hollandiae
Dodonaea physocarpa
Hyptis suaveolens
Sesbania sp.
Ptilotus obovatus

C. GRASSES

Aristida browniana
A. latifolia
Aristida sp.
Chrysopogon fallax
Chrysopogon latifolius
Dichanthium sp.
Eneepogon planifolius
Eriachne obtusa
Eriachne sp.
Eulalia fulva
Heteropogon contortus
Iseilema sp.
Panicum decompositum
Panicum mindanaense
Panicum sp.
Schizachyrium sp.
Sehima nervosum

Terminalia arostrata
T. canescens
T. grandiflora
T. platyphylla
T. platyptera

Nutwood
Rosewood

White grass
Feathertop Wire Grass
Three Awned Spear Grass
Golden Beard Grass
Blue grass
Limestone Grass
Northern Wanderrie
Wanderrie Grass
Silky Browntop
Black Spear Grass
Flinders Grass
Native Millet
Panic Grass
White grass
Sorghum spp. (annual)  
Sorghum stipodeum  
Themeda australis  
Triodia sp.  
Sorghum  
Kangaroo Grass  
Spinifex
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