

BURLEY PARK AND ADJACENT BUSHLAND, BULLSBROOK

Boundary Definition: bushland (part taken to cadastre)/vegetation complex boundary

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 86

Area (ha): bushland: 65.2

Map no. 25

Map sheet series ref. no. 2134-IV SW

Other Names: Pearce 6; Submission Area 314; Location 105 (Keighery, BJ and Trudgen 1992)

Local Authorities (Suburb): Shire of Swan (Bullsbrook)

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS

Dandaragan Plateau/Gingin Scarp

Laterite (Ql: G2)

Foothills

Colluvial Sand (Qs: S6)

Leederville Formation (Klb: ST1)

VEGETATION AND FLORA

Vegetation Complexes

Plateaus

Mogumber Complex — South (Dandaragan Plateau, most southern occurrence)

Scarps

Reagan Complex (Dandaragan Plateau, one of two most southern occurrences)

Floristic Community Types: *not sampled, types inferred

Supergroup 1: Foothills/Pinjarra Plain

*S8 *Eucalyptus wandoo* woodlands (Scarp)

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau

*S9 *Banksia attenuata* woodlands over dense low shrublands

*S18 *Eucalyptus marginata*/*E. calophylla* woodlands on laterites

Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes

*28 Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands (eastern representation of this community type)

WETLANDS

Wetland Types: creek

Natural Wetland Groups (undefined areas included in boundary)

Darling Plateau

Walyunga (D.1)

Wetland Management Objectives: Conservation (DEP 1999)

Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: very steep quartzite bluff and sand patches adjacent to a creek (small area within boundary)

Vegetation and Flora: limited survey (DEP 1999, Keighery, BJ, and Trudgen 1992, Stephens 1998)

Structural Units: mapping (Keighery, BJ and Trudgen 1992)

Uplands: *Eucalyptus accedens* and *E. wandoo* Woodland; *Eucalyptus accedens*, *E. calophylla* and *E. marginata* Open Forest to Woodland; *Allocasuarina humilis* and *Calytrix angulata* Open Heath; *Eucalyptus calophylla* and *E. marginata* Low Woodland to Low Open Forest; *Eucalyptus marginata* and *E. accedens* Woodland

Wetlands: *Eucalyptus rudis* and *E. calophylla* Woodland to Open Forest

Scattered Native Plants: adjacent canopy connection to Ki-it Monger Brook outside Site

Vegetation Condition: >75% Excellent to Very Good, <25% Good to Degraded, with areas of severe localised disturbance

Total Flora: 170 native taxa, 10 weeds (estimated >60% expected flora) (DEP 1999, Keighery, BJ, and Trudgen 1992, Stephens 1998)

Significant Flora: *Acacia anomala* (R), *Lambertia multiflora* var. *darlingensis* (3); *Brachysema praemorsum* (disjunct, unusual form), *Astroloma macrocalyx*, *Hakea* aff. *lasiantha* (L. Pen s.n.), *Gastrolobium spinosum* (typically a Darling Scarp species)

Fauna: not known

Linkage: no adjacent bushland; part of fragmented and contiguous bushland/wetland linkages (Part A, Map 7)

Other Special Attributes: the creek is completely vegetated and apparently free of weeds, no other similar creek has been observed (DEP 1999); part of the Bullsbrook Bushland area recommended for inclusion in a regional park (Keighery, BJ, and Trudgen 1992); Threatened or Poorly Reserved Plant Community (EPA 1994 GIS); contains plant communities representative of the eastern side of the Swan Coastal Plain

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Subject to protection under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Diversity, Rarity, General criteria for the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation

Recommendation: Part A: Other Government Land Mechanism. Part B: Rural Complementary Mechanism (see Table 3. Volume 1).

BURLEY PARK AND ADJACENT BUSHLAND, BULLSBROOK

Boundary Definition: bushland (part taken to cadastre)/vegetation complex boundary

SECTION 1: CADASTRAL INFORMATION

(Lots, locations and derived information to be updated in the public submission period)

Bushplan Site no. 86 **Map no.** 30 **Map sheet series ref. no.** 2134-IV SW

Other Names **Area (ha):** total 65.6; bushland: 65.2

Pearce 6; Submission Area 314; Location 105 (Keighery, BK, and Trudgen 1992)

Local Authorities (Suburb)
Shire of Swan (Bullsbrook)

Zoning
MRS: Rural
TPS: Landscape
Lot/Location/Reserve numbers (Purpose), Street name
M857 Burley Rd; 2, 3 Smith Rd; 108 Dirk Rd; 0, 2, 3291 Chittering Rd
Crown Reserve

Ownership Categories
Private (including commercial organisation), Local Government, State Government

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS

Dandaragan Plateau/Gingin Scarp

Laterite (Ql: G2)

Foothills

Colluvial Sand (Qs: S6)

Leederville Formation (Klb: ST1)

VEGETATION AND FLORA

Vegetation Complexes

Plateaus

Mogumber Complex — South (Dandaragan Plateau, most southern occurrence)

Scarps

Reagan Complex (Dandaragan Plateau, one of two most southern occurrences)

Floristic Community Types: *not sampled, types inferred

Supergroup 1: Foothills/Pinjarra Plain

*S8 *Eucalyptus wandoo* woodlands (Scarp)

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau

*S9 *Banksia attenuata* woodlands over dense low shrublands

*S18 *Eucalyptus marginata*/*E. calophylla* woodlands on laterites

Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes

*28 Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands (eastern representation of this community type)

WETLANDS

Wetland Types: creek

Natural Wetland Groups (undefined areas included in boundary)

Darling Plateau

Walyunga (D.1)

Wetland Management Objectives: not assessed

Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: very steep quartzite bluff and sand patches adjacent to a creek (small area within boundary)

Vegetation and Flora: limited survey (Keighery, BJ, and Trudgen 1992)

Structural Units: mapping (Keighery, BJ, and Trudgen 1992)

Uplands: *Eucalyptus accedens*, *E. calophylla* and *E. marginata* Open Forest to Woodland; *Allocasuarina humilis* and *Calytrix angulata* Open Heath; *Eucalyptus calophylla* and *E. marginata* Low Woodland to Low Open Forest; *Eucalyptus marginata* and *E. accedens* Woodland

Wetlands: *Eucalyptus rudis* and *E. calophylla* Woodland to Open Forest

Scattered Native Plants: adjacent canopy connection to Ki-it Monger Brook outside Bushplan Site

Vegetation Condition: >75% Excellent to Very Good, <25% Good to Degraded, with areas of severe localised disturbance

Total Flora: not known

Significant Flora: *Acacia anomala* (R); *Hakea* sp. *Walyunga* (L. Pen s.n.) [aff. *lasiantha*] (2), *Lambertia multiflora* var. *darlingensis* (3); *Brachysema praemorsa* (disjunct, unusual form), *Astroloma macrocalyx*

Fauna: no known information

Linkage: no adjacent bushland; part of fragmented and contiguous bushland/wetland linkages (Volume 2A, Map 8)

Other Special Attributes: part of the Bullsbrook Bushland area recommended for inclusion in a regional park (Keighery, BJ, and Trudgen 1992); Threatened or Poorly Reserved Plant Community (EPA 1994 GIS); contains plant communities representative of the eastern side of the Swan Coastal Plain

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Diversity, Rarity

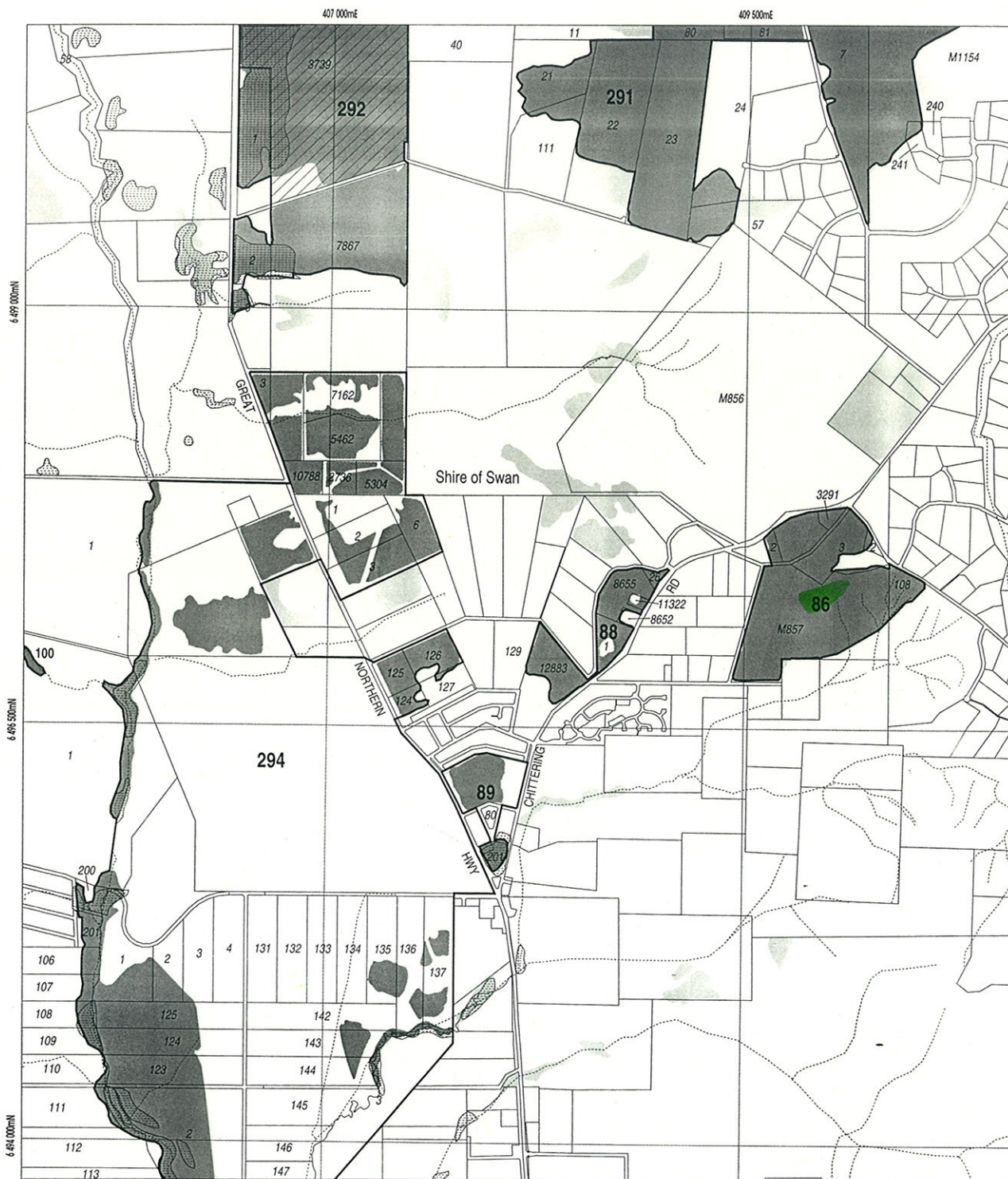
Opportunities and/or Constraints

Opportunities: Bushplan Site/part Bushplan Site subject to Swan and Canning Rivers EPP; location of Declared Rare Flora; under TPS Landscape Zoning, Crown Reserve

Constraints: private land; under General Mineral Resource Area (clay)

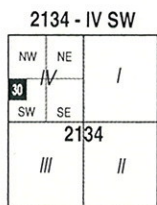
Recommendation: The most appropriate mechanism for the protection of this Bushplan Site be considered through the public comment period in consultation with the land owner(s).





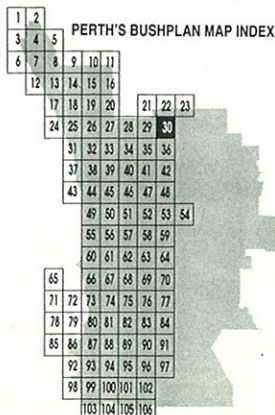
LEGEND

- 472 Bushplan Sites With Regionally Significant Bushland
- Other Native Vegetation
- Conservation Category Wetlands
- Bushplan Sites With Some Existing Protection
- 696 Lot Number, Location Number
- Channel Wetlands
- Local Government Boundary

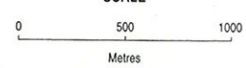


1: 25 000 AMG Reference Grid showing Perth's Bushplan Map Sheet Breakdown

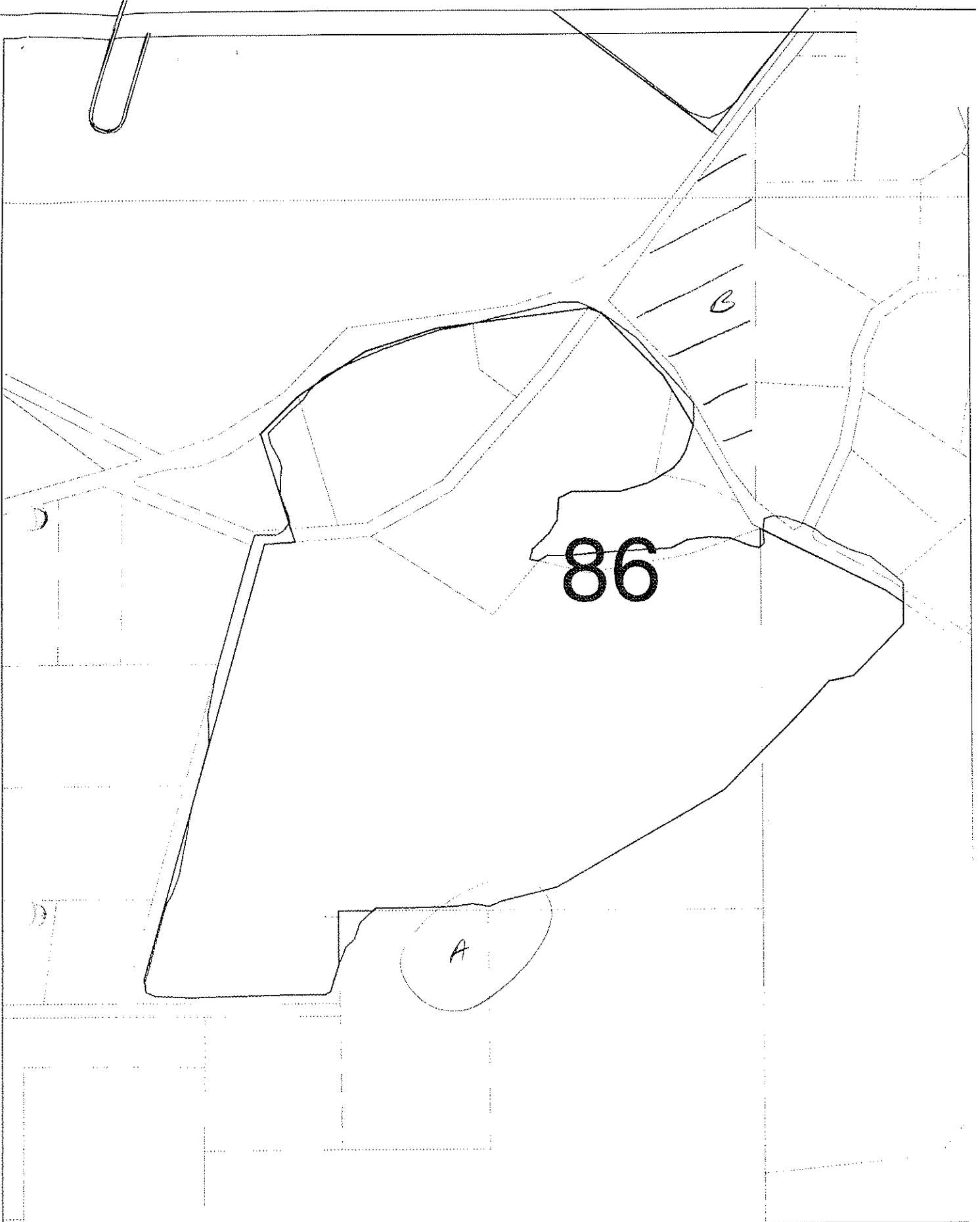
PERTH'S BUSHPLAN MAP INDEX



SCALE



Produced by Project Mapping Section
 Land Information Branch, Ministry for Planning, Perth W.A. November 1998
 ntw-map11/environ/bushplan/bushv2_30.dgn
 Cadastral Data supplied by Department of Land Administration, W.A.
 Wetlands Data supplied by Water and Rivers Commission
 Native Vegetation Extent for Study Area supplied by Agriculture Western Australia



BUSHPLAN SITES CORRECTED

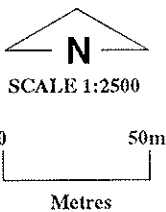


WESTERN
AUSTRALIAN
PLANNING
COMMISSION



CUSTOMER
FOCUS
WESTERN AUSTRALIA

B 76/10/98



BJK

2/7

BS 86

vegetation

Additional areas, A links to
creek B consolidates in
place of 84

changes

As WA
Done.

A

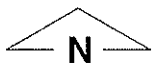
BUSHPLAN SITES CORRECTED



WESTERN
AUSTRALIAN
PLANNING
COMMISSION



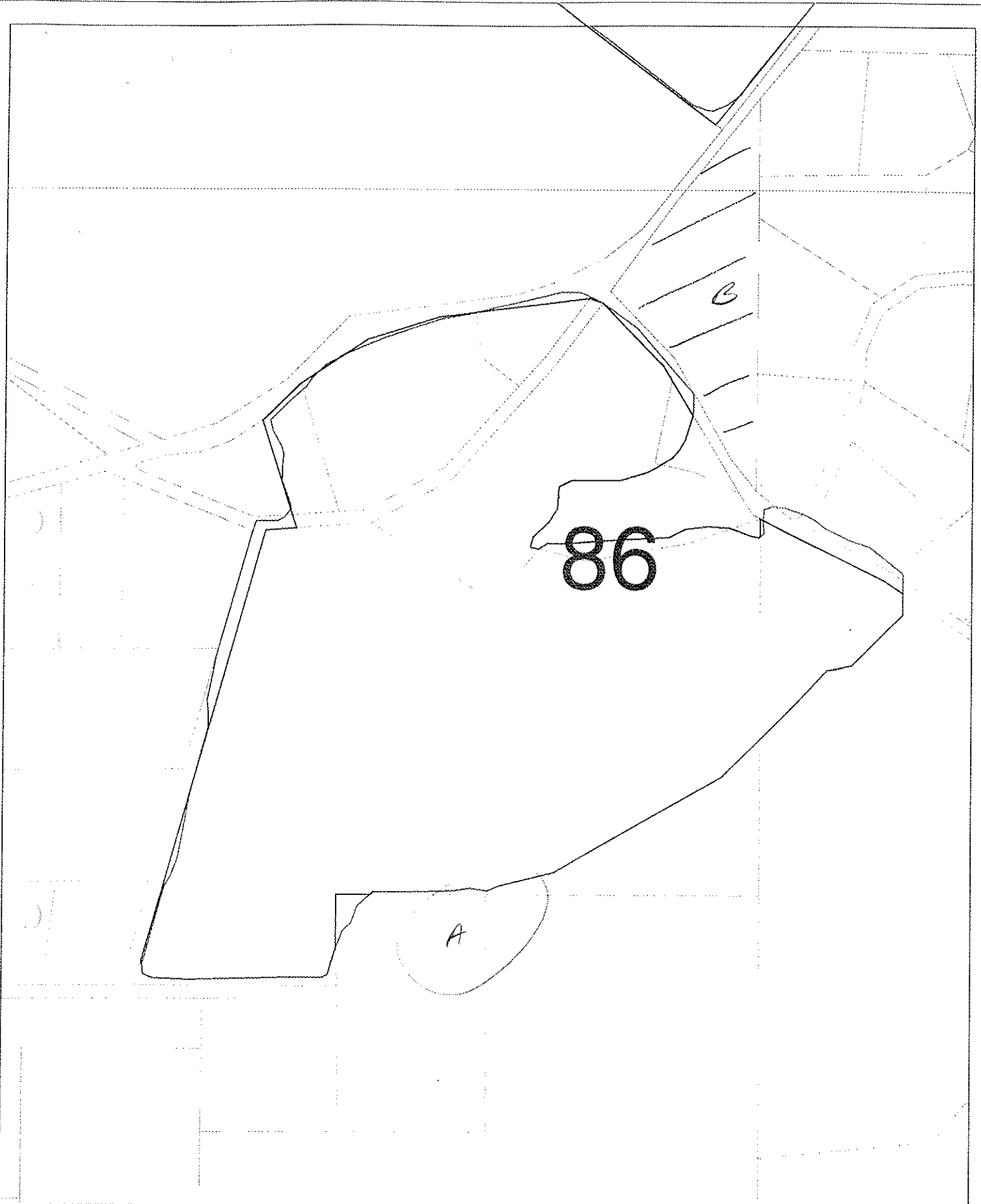
CUSTOMER
FOCUS
WESTERN AUSTRALIA



SCALE 1:2500



Metres



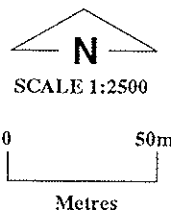
BUSHPLAN SITES CORRECTED






WESTERN
AUSTRALIAN
PLANNING
COMMISSION

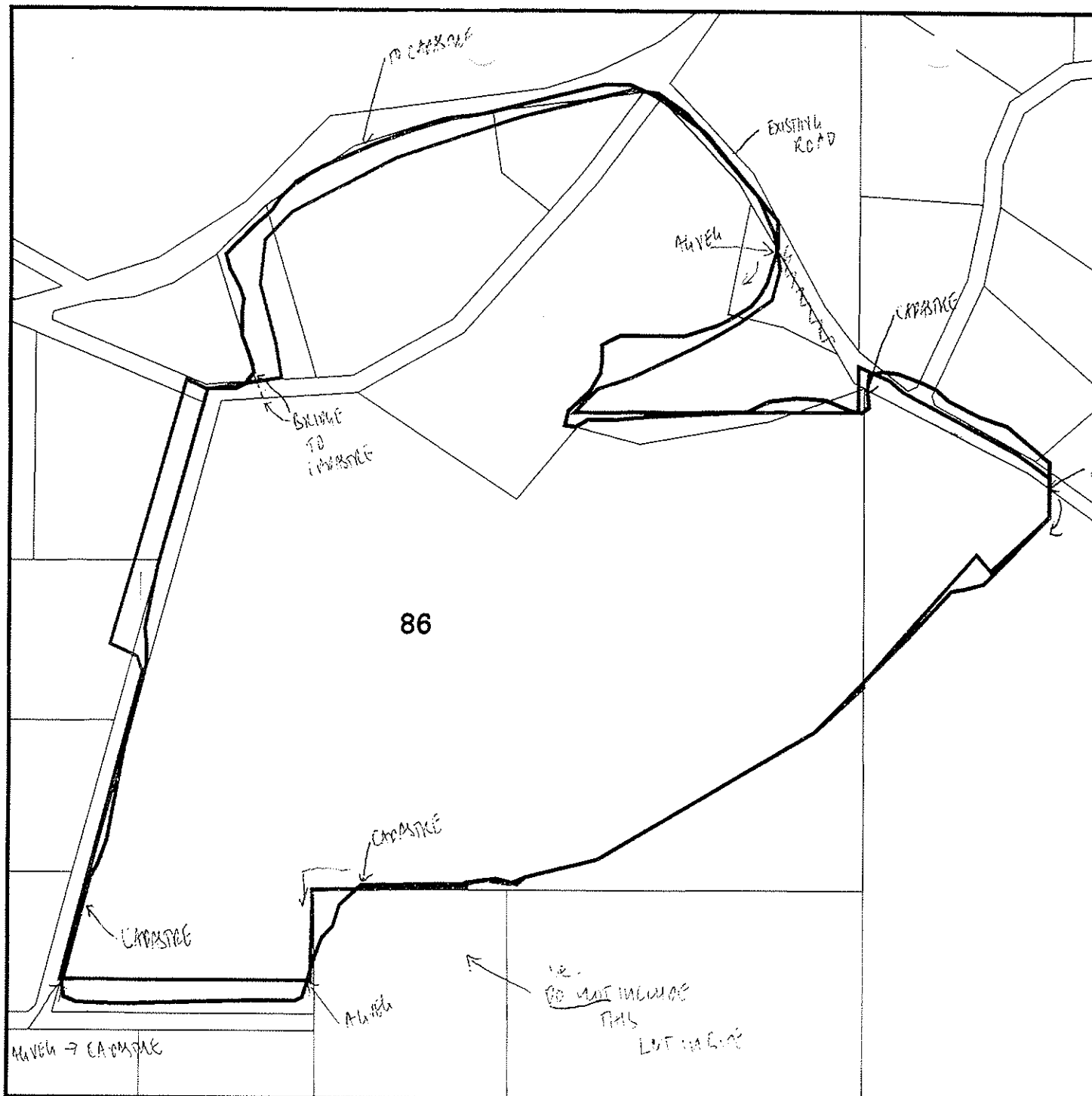


CUSTOMER
FOCUS
WESTERN AUSTRALIA



bp site 86

-  Cadastre
-  Bushplan sites refno 1-500 SCP BOUNDARY
-  AG VEG 1998 BOUNDARY THEME



BULLY PK

MFP INTERNAL USE ONLY
Prepared By: Andrea Zappacosta
Prepared For:
Map Ident: plot980610_1
Date: 10 Jun 98
Scale 1: 6598

BULLSBROOK PROGRESS ASSOCIATION Inc.

P. O. Box 239 BULLSBROOK WA 6084
Secretary Phone & Fax (08) 9571 1025

ABO 33

To: Perth's Bushplan, Ministry for Planning,
Albert Facey House 469 Wellington Street
PERTH WA 6000

Submission re:

~ PERTH'S BUSHPLAN ~

Overall this Association supports the intention and implementation of Perth's Bushplan but we do wish to see either changes to or exclusion of a few small sites in the Bullsbrook locality.

The listings about which this Association wishes to comment are Bushplan Sites:

86, 88 and 89 [all of which appear on Map 30].

~~No. 86~~

a) We support the inclusion of the north eastern half of this Site from the base of the steeper part of the escarpment to Smith and Chittering Roads. However, the less steep south western half - much of Lot M857 - should be subjected to a more detailed independent botanical analysis in liaison with the landowner. Lot M857 is privately owned land - not owned by a commercial organisation.

b) Not presently included in Site 86 is Lot 1 on the other side of Smith Road at its intersection with Chittering Road. (a triangular parcel of land clearly identifiable on Map 30) Although a small portion right at the intersection has been used as a dump for road making materials for some time nevertheless the remainder has a beautiful selection of wildflowers which are much admired in spring by individual tourists and coach parties that use the unsightly corner portion for parking. Local residents appreciate the display too!

This Lot 1 is owned by the Shire of Swan who have proposed subdividing it into 3 lots with the centre one being slightly larger than the other two. The Shire plans to sell the two flanking lots for rural residential development and use part of the proceeds from the sales to pay for upgrading the centre one to enhance its tourist potential. Caveats would be applied on the sold lots to prevent more than minimal destruction or harm of native flora thereon. Whilst this Association perceives some merit in that plan we would much prefer the whole of Lot 1 be preserved as bushland and suggest it be included as part of Site No. 86 or even made a separate Site.

~~No. 88~~

a) We support the inclusion of the portion encompassed by Ashton and Chittering Roads, namely Lots 1, 8655 and 26. This portion helps to retain a rural entry into the main part of the Bullsbrook township. Should W.A.W.A. see a need to expand its storage tanks when Bullsbrook's population grows beyond the present capacity we urge that Lot 1132 not be enlarged but that the additional tanks be located at a higher altitude elsewhere but inconspicuously. We assume the R.A.A.F. Base Pearce storage tanks on Lot 8652 may at some stage be replaced but not added to.

b) We do not support the inclusion of Lot 12883 in Site 88. This land is part of the Education Department's land around the Bullsbrook District High and Primary Schools. Those schools may need to expand their present sporting facilities in the years ahead and will need to make use of at least part of Lot 12883 for the purpose. There is no other land attached to the schools which could be utilised and we do not consider it would be appropriate for pupils to have to travel to distant locations when the present sporting facilities are fully occupied.

SUBMISSION NO. 113

MINISTRY FOR PLANNING
16 MAR 1999
805-2-1-32pt-12
FILE

BUSHPLAN SITE CASE STUDIES/ISSUES - BACKGROUND ON SITE SELECTION AND ASSOCIATED ISSUES

BASIC RAW MATERIALS POLICY

This presentation raised a series of issues

(i) What constitutes an 'approved' mining operation? Before mining can proceed in a mining lease it is subject to consideration for environmental assessment.

(ii) Areas effected need to be considered in the following categories - % of Bushplan area (protected and non-protected) subject to General Mineral Resource Area, Priority Mineral Resource Area, mining leases, mining leases application, mining lease with current approvals for mining.

(iii) What consideration did the Basic Raw Materials Policy give to environmental constraints? Was/is this Policy available for public comment?

(iv) Revegetated areas cannot be considered for inclusion in Bushplan unless they meet the definition of bushland.

(v) Representation of ecological communities is one of five criteria for selection. Also, the aim was for greater than 10% and when there is less than 400ha all is recognised. There is only 622ha of Bassendean Complex - central and South transition.

(vi) Some mining leases are over lands that have been recognised conservation areas for many years.

(vii) Areas outside the PMR will be subject to Stage two of Bushplan. In keeping with % considered to be needed to be recognised CAR reserve system expect 15 -20%.

(viii) Majority of 'approvals' are protected lands, impact will be greater.

PART LOT 271/254/339 BUSHPLAN SITE 349 - LEDA AND ADJACENT BUSHLAND, LEDA

Issues relevant in the selection of the area of BS 349, additional to the area of P&R Reservation (see area indicated on Map 1, Map 88 from Volume 2, Part C Perth's Bushplan)

Issues 1 - Specific issues related to the selection criteria: Representation of ecological communities

Vegetation Complexes

Bassendean Dunes (Bassendean Complex — Central and South) and Spearwood Dunes (Karrakatta Complex — Central and South) and the interface of these are represented in the area. Less than 10% of the Karrakatta Complex — Central and South is proposed to be protected in Perth's Bushplan.

Floristic Community Types

The area is typical of and contains good examples of the regional floristic groupings typical of the vegetation complexes mapped, containing both floristic community type 21a, Central *Banksia attenuata* — *Eucalyptus marginata* woodlands, from Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau; and floristic community type 25, Southern *Eucalyptus gomphocephala* — *Agonis flexuosa* woodlands and 28, Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands (most southerly occurrence sampled), both from Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes).

Vegetation and Flora: limited survey (DEP 1996 (Leda 01-04), EPA and WAWA 1990, Gibson *et al.* 1994 (Well 01-02), Weston 1993)

Structural Units

Uplands: *Eucalyptus marginata*, *E. gomphocephala* and *Allocasuarina fraseriana* Woodland; *Banksia menziesii*, *Eucalyptus marginata* and *Allocasuarina fraseriana* Low Woodland; *Banksia attenuata* and *B. grandis* Low Woodland; *Banksia attenuata* and *B. menziesii* Low Woodland with scattered emergent *Eucalyptus gomphocephala*; *Eucalyptus gomphocephala* Open Forest

Vegetation Condition: >70% Excellent to Very Good, <20% Good, 10% Degraded, with areas of severe localised disturbance (Weston 1993)

Total Flora: 129 native species and 31 weeds (estimated >60% expected flora) (DEP 1996 (Leda 01-04), Gibson *et al.* 1994 (Well 01-02))

Significant Flora: *Glischrocaryon aureum* (uncommon in the PMR)

Issue 2 - System 6 (1983)

Some of the eastern section of M104 was not included in P&R Reservation (see Map 2) even though the eastern portion is the area in best condition and is at the interface of the Bassendean and Spearwood Dune systems. Additional land was included to the north west and west of the System area but the vegetation in this area is in variable condition, generally poorer. The delineation of the boundaries of the P&R were not subject to environmental assessment.

Additional Comments in Relation to Proposed Negotiated Planning Solution Presentation

- The present P&R area is relatively narrow proposed protected area consolidates this with an additional bushland area in good to very good condition, proposal adds area but does not consolidate the narrow corridor to the east to improve long term management prospects.
- Road reserve seen as a constraint is not indicated on Map 2 Volume 1 Perth's Bushplan as a MRS reserved road under the MRS therefore it appears that there is the opportunity to adjust the alignment of this road to achieve consolidation of the area.

BUSHPLAN SITE 119 - UNDERWOOD AVENUE BUSHLAND, SHENTON PARK

Issues relevant in the selection of the BS 119

Issues - Selection criterion: Representation of ecological communities

Vegetation Complexes

The Bushplan Site is entirely located on the Spearwood Dunes in the Karrakatta Complex — Central and South. Less than 10% of the Karrakatta Complex — Central and South is proposed to be protected in Perth's Bushplan.

Floristic Community Types

Floristic community types 28, Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands from Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes is expected to occur in the area as this was sampled in the nearby BS 218. That is the area is typical and representative on the vegetation complex mapped.

Vegetation and Flora: limited survey (DEP 1996, surveyed from roadside)

Structural Units

Uplands: Woodland dominated by *Eucalyptus marginata* or *E. gomphocephala* over *Banksia attenuata*, *B. menziesii* and *Allocasuarina fraseriana* Low Woodland; *Banksia attenuata*, *B. menziesii* and *Allocasuarina fraseriana* Low Woodland generally with scattered emergent *Eucalyptus marginata* or *E. gomphocephala* and sometimes with scattered emergent *Eucalyptus calophylla*

Vegetation Condition: >50% Very Good, <50% Good to Degraded, with areas of severe localised disturbance

**Additional Information from Tingay, Alan & Associates 1999
Structural Units**

Uplands: *Eucalyptus marginata* or *E. calophylla* over *Banksia prionotes* Low Woodland
Significant Flora: *Jacksonia sericea* (3)

Additional Comments in Relation to Proposed Negotiated Planning Solution Presentation

- Recent disturbance history: The Bushplan Site has been fenced in the past three years and at the time of fencing a sign went up to indicate it was a research area for the University of WA, previous to this it was not fenced. The BS has not been fenced for many years as stated. Over the last three years clearing in the area has occurred associated with a research turf farm, service corridor (sewerage) and fence/fire break construction.
- The presence of areas of *Banksia prionotes* Low Woodland in the BS is significant, a typical feature, but uncommon, of the Spearwood Dune communities. However the size of the strip proposed for protection is too small. It is possible that the *Banksia prionotes* Low Woodland would be maintained but the understorey is currently disturbed and would not be able to be restored and maintained in such a small area without permanent high level management. Spearwood Dune communities have a lower resilience to disturbance than eastern side of the Plain plant communities (Pinjarra Plain/Foothills). In addition it was proposed that the housing area to the south of this area would be at a lower level, earthworks associated with this would impact on the viability of this remnant.
- The BS has a prominent NS ridge dominated by Tuart (*Eucalyptus gomphocephala*), this were not mentioned, this is an important feature of the Site.
- The proposed eastern conservation area is a better management proposition but is not of sufficient size to support a 'research establishment' or research that impacts the vegetation.

PART LOT M857, BUSHPLAN SITE 86 - BURLEY PARK AND ADJACENT BUSHLAND, BULLSBROOK

Issues relevant in the selection of the area of BS 86, additional to the area of the Shire of Swan reserve (see area indicated on Map 3, Map 30 from Volume 2, Part C Perth's Bushplan)

Issues 1 - Specific issues related to the selection criteria:

1.1 Representation of ecological communities

Vegetation Complexes

As mapped the area of Lot M857 within the Bushplan Site contains two units associated with the Dandaragan Plateau, the Mogumber Complex — South on the Dandaragan Plateau (most southern occurrence) and the Reagan Complex on the Gingin Scarp the western margin of the Dandaragan Plateau (one of two most southern occurrences). The area of Lot M857 outside the Bushplan Site is an area of the Darling Scarp vegetation complex and is not covered by Perth's Bushplan.

Floristic Community Types

While the area has not been sampled for the floristic community types it was inferred from descriptions of the flora of the area that it contained: floristic community type S8, *Eucalyptus wandoo* woodlands from Supergroup 1: Foothills/Pinjarra Plain (associated with the Darling Scarp); floristic community types S9, *Banksia attenuata* woodlands over dense low shrublands and S18, *Eucalyptus marginata/E. calophylla* woodlands on laterites from Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau and floristic community type 28, Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands (eastern representation of this community type) from Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes. Average species diversity for these groups ranges from 35.7 (S18) through 44 (S8), 38.9 (S9) to 55.1 (28).

The flora of sections of the Lot indicates the presence of vegetation most similar to Scarp vegetation, floristic community type S8, *Eucalyptus wandoo* woodlands from Supergroup 1: Foothills/Pinjarra Plain (associated with the Darling Scarp). Markey (1997) studied the Darling Scarp floristic groupings from Walyunga National Park to North Dandalup. Similar areas of Darling Scarp vegetation were found, the closest being in Walyunga National Park. Markey identified this group as Darling Scarp floristic community type 1a with an average species diversity of 66.9.

Landscape Features: very steep quartzite bluff and sand patches adjacent to a creek (small area within boundary)

Vegetation and Flora: limited survey (Keighery, BJ, and Trudgen 1992)

Structural Units: mapping (Keighery, BJ, and Trudgen 1992)

Uplands: *Eucalyptus accedens*, *E. calophylla* and *E. marginata* Open Forest to Woodland; *Allocasuarina humilis* and *Calytrix angulata* Open Heath; *Eucalyptus calophylla* and *E. marginata* Low Woodland to Low Open Forest; *Eucalyptus marginata* and *E. accedens* Woodland

Wetlands: *Eucalyptus rudis* and *E. calophylla* Woodland to Open Forest

Vegetation Condition: 70% Excellent to Very Good, 30% Good, with areas of severe localised disturbance (gravel mine)

1.2 Diversity

Four different major landform elements meet in the Bushplan Site, the Darling Scarp, Gingin Scarp and the Dandaragan Plateau. In addition it is likely that elements of the Foothills of the Dandaragan and Darling Plateaus are also present. Associated with this is are four expected floristic community types. As the area contains communities on sands and laterites, plant communities with relatively few species in common, there is expected to be a high species diversity in the lot. This is supported by the 170 native taxa currently recorded for Lot 857.

1.3 Rarity

Lot M857 is known to contain one species of Declared Rare Flora, *Acacia anomala* and two priority taxa, *Hakea* sp. Walyunga (L. Pen s.n.) [aff. *lasiantha*] (priority 2) and *Lambertia multiflora* var. *darlingensis* (priority 3).

In 1994 the EPA identified Lot M857 as containing Threatened or Poorly Reserved Plant Community (EPA 1994 GIS). Threatened ecological communities have not been identified in the lot by CALM but of the four expected groups three are supplementary groups that have not been considered by CALM. Also it is possible that sampling and analysis of the sandy areas of the Lot could identify floristic community type 20. However in comparison with other areas on the Plain/Plateau interface it is considered that the combination of vegetation associations is rare and individual vegetation associations could well be established as being rare if the required work is done (see comments below).

Comments on Criteria: This Bushplan Site is located in a unique position lying in the area of the confluence of the Gingin and Darling Scarps. While the floristic community types of the Lot have been inferred it is likely that the Lot contains communities not sampled elsewhere. For example the *Eucalyptus accedens* and *E. wandoo* Woodland understorey is dominated by two species not recorded by Markey in her Scarp survey - *Hakea* sp. Walyunga (L. Pen s.n.) and *Brachysema praemorsa*. The Lot is of additional interest at there is no other location known where sands meet the laterites/quartzites of the Scarp.

Additional Information/Criterion from Stephens 1998 and MFP/DEP Site visit April 1999

Structural Units: *Eucalyptus accedens* and *E. wandoo* Woodland

Total Flora: 170 native taxa, 10 weeds (estimated >60% expected flora) (DEP 1999, Keighery, BJ, and Trudgen 1992, Stephens 1998)

Additional Criterion

General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation

While there was creekline mapped for the area there was no information available on the creek prior to the release of Bushplan, the mapped information is from Perth's Bushplan is amended below

Wetland Types: creek

Natural Wetland Groups (undefined areas included in boundary)

Darling Plateau

Walyunga (D.1)

Wetland Management Objectives: not assessed - Conservation (DEP 1999 - the creek is completely vegetated and apparently free of weeds, no other similar creek has been observed on the Scarp)

Additional Comments in Relation to Proposed Negotiated Planning Solution Presentation

- Access to Lot M857 and determination of floristic community types and threatened ecological communities

DEP has DEP/EPA have corresponded with Vispo Holdings (92 Amelia St Balcatta) on two occasions

May 1995 - Notification of the recognition of Lot M857 as containing Threatened or Poorly Reserved Plant Community in need of interim protection (No reply). The Shire of Swan was similarly notified of the location of all areas considered to contain containing Threatened or Poorly Reserved Plant Community in need of interim protection in the Shire.

October 1995 - A request to access Lot M857 to locate floristic plots (No reply). DEP also spoke with David Lamont in 1998 and requested permission to access Lot M857, this was not granted.

Subsequent to the presentation a Site visit was made by CALM, MfP and DEP.

As detailed above detailed plot based flora work is required to place the floristic community types in the lot and determine the status of the ecological communities in terms of CALM's threatened ecological communities program. Unfortunately the plot based work of Stephens (1998) sampled 20m² plots not the standard study plots of 100m² and the Stephens plots are unable to be compared with the over 1000 standard plots established.

- Dandaragan Plateau

Volume 1, Perth's Bushplan (p12) clearly states that the majority of the Dandaragan Plateau is outside the area of Perth's Bushplan. However this is not particularly relevant in regard to this Site as it lies in a unique position in regard to the Dandaragan and Darling Plateaus their Scarps and the Plain.

- Condition of the sand communities in Lot M857

These communities do appear to have been impacted structurally by past clearing. However the level of weed invasion does not appear to be high (see photos showing dominance of native grasses and descriptions Stephens 1998). The Site inspection confirmed this and indicated that repetitive fires and the recent formation of substantial firebreaks would impact on the regeneration of the sand communities. While the sand communities are in a more degraded condition than the laterite/quartzite communities it is considered that if fire/clearing disturbance is removed they will regenerate. Presence of both adds to diversity of Bushplan Site, viability of Site, habitats etc.

- Darling Scarp

All work done on Lot M857 indicates that it is predominantly part of the Darling Scarp and well worth including in the Darling Range Regional Park.

Bushplan Presentation
Balcatta
1999 was attended by David Lamont + the status of the site discussed

- Mistaken ownership of Lot M857

The original work done on Lot 857 (Keighery and Trudgen 1992) inferred that Lot M857 was part of the Shire of Swan Reserve as the gravel mine is located in both areas and there is no obvious separation of the areas (this confusion is still evident as the firebreak on the 'northern' boundary of Lot M857 associated with a part fence is in the Shire reserve). From this location it was inferred that a greater value was attributed to the land than would otherwise be the case. DEP has been aware of the ownership of the lot since 1995 when and this is not the case.

BUSHPLAN SITES 368 and 372

Representation of ecological communities

Diversity

Rarity

Maintaining ecological processes or natural systems

Scientific or evolutionary importance

General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation,

Criteria not relevant to determination of conservation value, but which may be applied when evaluating areas having similar values

Bushplan Site no. 368 **Map no. 89, 95** **Map sheet series ref. no. 2033-II NE**
System 6 (1983): Part M105 area of bushland goes beyond System area boundaries, all bushland described

Other Names

Lowlands — eastern block; Lowlands

Local Authorities (Suburb)

Shire of Serpentine-Jarrahdale (Mardella)

Area (ha): total 1064.5 (includes open water); bushland 1034.1**Zoning****MRS:** Rural**TPS:** Rural**Ownership Categories**

Private

Lot/Location/Reserve numbers (Purpose),
Street name

3 Mundijong Rd; 2 Roe Rd; 1 street not identified

SECTION 2: REGIONAL INFORMATION**LANDFORMS AND SOILS****Pinjarra Plain**

Guildford Formation (Qpa: Cs, C2) (Qha: Msc1)

Bassendean Dunes

Bassendean Sands (Qpb: S8)

Bassendean Dunes/Pinjarra Plain

Bassendean Sands over Guildford Formation (Qpb/Qpa:S10)

Wetlands (within the Bassendean Dunes/Pinjarra Plain)

Holocene Swamp Deposits (Qhw: Spc.)

VEGETATION AND FLORA**Vegetation Complexes****Pinjarra Plain**

Guildford Complex

Dardanup Complex (most northern occurrence)

Bassendean Dunes

Bassendean Complex — Central and South

Combinations of Bassendean Dunes/Pinjarra Plain

Southern River Complex

Floristic Community Types**Supergroup 2: Seasonal Wetlands**4 *Melaleuca preissiana* damplands

5 Mixed shrub damplands

11 Wet forests and woodlands

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau21a Central *Banksia attenuata* — *Eucalyptus marginata* woodlands21c Low lying *Banksia attenuata* woodlands or shrublands23a Central *Banksia attenuata* — *B. menziesii* woodlands**WETLANDS****Wetland Types:** sumpland, palusplain, creek**Natural Wetland Groups**

Pinjarra Plain

Keysbrook (P.1)

Bassendean—Pinjarra transition OR Bassendean with fluvial features

Bennett Brook (B/P.4)

Swan Coastal Plain Rivers

Goegrup (R.4)

Wetland Management Objectives: Conservation (16.8ha, 1393m), Resource Enhancement, Multiple Use

Swan Coastal Plain Lakes EPP: 4.9 ha

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: open water, vegetated wetland, creek, river, vegetated uplands

Vegetation and Flora: detailed survey (Keighery, BJ, *et al.* 1995); limited survey (Gibson *et al.* 1994 (Rowe 01–02, Low 01, 04, 6a–10b, 12a–14a))

Structural Units: mapping (Keighery, BJ, *et al.* 1995)

Uplands: *Banksia attenuata* and *B. menziesii* Woodlands to Forest with scattered emergent *Eucalyptus marginata* and *E. calophylla* and with *Xylomelum occidentale*, *Allocasuarina fraseriana*, *Banksia grandis* and *B. ilicifolia* being sometimes co-dominants in the *Banksia* layer; *Eucalyptus gomphocephala* Open Forest; *Banksia attenuata*, *B. menziesii* and *Allocasuarina fraseriana* Woodlands to Forests; *Jacksonia sternbergiana* Low Woodland; *Banksia attenuata* and *B. menziesii* Woodland over *Kunzea ericifolia* Closed Tall Scrub

Wetlands: *Melaleuca preissiana*, *Banksia attenuata*, *B. menziesii* and *Allocasuarina fraseriana* Woodland to Forest; *Melaleuca raphiophylla* Low Woodland to Tall Shrubland; *Eucalyptus rudis* Forest to Woodland; Woodlands over Sedgeland, where the dominants may be *Melaleuca preissiana*, *Eucalyptus calophylla* and *E. rudis*

Scattered Native Plants: Areas of *Banksia attenuata* and *B. menziesii*, *Eucalyptus marginata*, *E. rudis* and *E. calophylla* Forest to Woodland occur within areas that have been cleared for pasture — regionally significant vegetation recognised as being included in the area of Bushplan Site in need of protection

Vegetation Condition: >80% Excellent to Very Good, <20% Good to Degraded, with areas of severe localised disturbance

Total Flora: 335 native taxa (Keighery, BJ, *et al.* 1995) (estimated >90% expected flora of BS372 and BS368)

Significant Flora: *Caladenia huegelii* (R), *Drakaea elastica* (R); Keighery, BJ, *et al.* 1995 — *Eryngium pinnatifidum* subsp. *palustre* ms, (2), *Stylidium longitubum* (3), *Dillwynia dillwynioides* (3), *Stylidium mimeticum* (3), *Conostephium minus* (4, southernmost population); *Drosera gigantea* subsp. *geniculata* ms, *Stylidium utricularioides*, *Stylidium roseo-alatum*, *Boronia crenulata*, *Johnsonia* aff. *pubescens* (GJK 5249), *Evandra pauciflora*, *Eucalyptus gomphocephala* (unusual record, normally confined to coastal Quindalup and Spearwood Dunes).

Fauna: multiple surveys by RAOU (1996 D) for birds (88). Good assemblage of insectivorous birds. Significant bird species: Golden Whistler, Yellow Robin and Yellow-plumed Honeyeater. Significant mammal species: Quenda, Western Brush Wallaby, Brush-tailed Wambenger and Water Rat

Linkage: adjacent bushland to the south, east (BS371, canopy) and west; part of proposed Greenway 81 (Tingay, Alan & Associates 1997a); part of a regionally significant fragmented bushland/wetland linkage (Volume 2A, Map 8)

Other Special Attributes Farm buildings within the property are on the Register of the National Estate; rare example of intact riverine communities (Keighery, BJ, *et al.* 1995); large area of mature *Banksia* Woodland habitat that has not been subject to periodic logging or burning; mature examples of *Eucalyptus marginata*, *Eucalyptus rudis* and *Banksia* species in woodlands; largest privately owned bushland area in the PMR managed for conservation; contains 4820m of regionally significant river (WRC 1996a GIS)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Interim List of Register of the National Estate

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Diversity, Rarity, Maintaining ecological processes or natural systems, Scientific or evolutionary importance, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation, Criteria not relevant to determination of conservation value, but which may be applied when evaluating areas having similar values

Opportunities and/or Constraints

Opportunities: Bushplan Site/part Bushplan Site subject to Swan Coastal Plain Lakes EPP, Peel-Harvey Estuary EPP/SPP; location of Declared Rare Flora, conservation category wetlands

Constraints: Bushplan Site private land; under General Mineral Resource Area (clay)

Recommendation: The private ownership and management intent of the Bushplan Site is endorsed. Appropriate mechanisms to support and reinforce existing management for conservation and provide long-term security to be applied in consultation with the land owner(s).

LOWLANDS BUSHLAND — WESTERN BLOCK (HYMUS SWAMP), PEEL ESTATE

Boundary Definition: bushland (part taken to cadastre) boundary

SECTION 1: CADASTRAL INFORMATION

(Lots, locations and derived information to be updated in the public submission period)

Bushplan Site no. 372 **Map no. 94** **Map sheet series ref. no. 2033-II NW**
System 6 (1983): Part M105 Part System area bushland, only bushland described

Other Names

White Gum Block; Lowlands — western block;
 Lowlands, Hymus Swamp

Local Authorities (Suburb)

Shire of Serpentine-Jarrahdale (Hopeland)

Area (ha): total 141.5; bushland 133.6

Zoning

MRS: Rural

TPS: Rural

Ownership Categories

Private

Lot/Location/Reserve numbers (Purpose),

Street name

807 River Rd

SECTION 2: REGIONAL INFORMATION**LANDFORMS AND SOILS****Bassendean Dunes**

Bassendean Sands (Qpb: S8)

Bassendean Dunes/Pinjarra Plain

Bassendean Sands over Guildford Formation (Qpb/Qpa: S10)

Wetlands (within the Bassendean Dunes/Pinjarra Plain)

Holocene Swamp Deposits (Qhw: Cps)

VEGETATION AND FLORA**Vegetation Complexes****Pinjarra Plain**

Dardanup Complex

Bassendean Dunes

Bassendean Complex — Central and South

Combinations of Bassendean Dunes/Pinjarra Plain

Southern River Complex

Floristic Community Types

Supergroup 2: Seasonal Wetlands

11 Wet forests and woodlands

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau

21c Low lying *Banksia attenuata* woodlands or shrublands

WETLANDS

Wetland Types: dampland, palusplain, artificial channel

Natural Wetland Groups

Swan Coastal Plain Rivers

Goegrup (R.4)

Wetland Management Objectives: Conservation (114.6ha), Resource Enhancement, Multiple Use

Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated wetland, vegetated uplands

Vegetation and Flora: detailed survey (Keighery, BJ, *et al.* 1995); limited survey (Dames and Moore 1988b, Gibson *et al.* 1994 (Hymus 01-06))

Structural Units: mapping (Keighery, BJ, *et al.* 1995)

Uplands: *Banksia attenuata* and *B. menziesii* Woodland over *Kunzea ericifolia* Closed Tall Scrub; *Banksia attenuata* and *B. menziesii* Woodlands to Forest with scattered emergent *Eucalyptus calophylla*; *Banksia attenuata*, *B. ilicifolia*, *Nuytsia floribunda* Low Open Forest

Wetlands: *Melaleuca preissiana*, *M. raphiophylla* Low Woodland; *Melaleuca raphiophylla* Low Woodland to Forest; mixed Herbland; *Restio stenostachyus* Sedgeland

Scattered Native Plants: areas of *Eucalyptus gomphocephala*, *E. rudis* and *E. calophylla* Forest to Woodland occur within areas that have been cleared for pasture — regionally significant vegetation recognised as being included in the area of Bushplan Site in need of protection

Vegetation Condition: >60% Very Good to Excellent, <40% Good to Degraded, with areas of severe localised disturbance

Total Flora: 335 native taxa (Keighery, BJ, *et al.* 1995) (estimated >90% expected flora of BS372 and 368)

Significant Flora: Keighery, BJ, *et al.* 1995 — *Stylidium longitubum* (3), *Dillwynia dillwynioides* (3), *Stylidium mimeticum* (3); *Drosera gigantea* subsp. *geniculata* ms, *Stylidium utricularioides*, *Eucalyptus gomphocephala* (unusual record, normally confined to coastal Quindalup and Spearwood Dunes)

Fauna: no known information

Linkage: adjacent bushland in the south, east and west; part of proposed Greenway 81 (Tingay, Alan & Associates 1997a); part of a regionally significant fragmented bushland/wetland linkage (Volume 2A, Map 8)

Other Special Attributes: mature examples of *Eucalyptus gomphocephala*, *E. rudis*, *Banksia ilicifolia* and *Melaleuca preissiana* in woodlands

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Listed on the Register of the National Estate

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Rarity, Scientific or evolutionary importance, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation, Criteria not relevant to determination of conservation value, but which may be applied when evaluating areas having similar values

Opportunities and/or Constraints

Opportunities: Bushplan Site subject to Peel-Harvey Estuary EPP/SPP; location of conservation category wetlands

Constraints: private land; General Mineral Resource Area (clay)

Recommendation: The private ownership and management intent of the Bushplan Site is endorsed. Appropriate mechanisms to support and reinforce existing management for conservation and to provide long-term security to be applied in consultation with the land owner(s).

BUSHPLAN SITE CASE STUDIES/ISSUES - BACKGROUND ON SITE SELECTION AND ASSOCIATED ISSUES from Meeting of 2/3/99

PART LOT M857, BUSHPLAN SITE 86 - BURLEY PARK AND ADJACENT BUSHLAND, BULLSBROOK

Issues relevant in the selection of the area of BS 86, additional to the area of the Shire of Swan reserve (see area indicated on Map 3, Map 30 from Volume 2, Part C Perth's Bushplan)

Issues 1 - Specific issues related to the selection criteria:

1.1 Representation of ecological communities

Vegetation Complexes

As mapped the area of Lot M857 within the Bushplan Site contains two units associated with the Dandaragan Plateau, the Mogumber Complex — South on the Dandaragan Plateau (most southern occurrence) and the Reagan Complex on the Gingin Scarp the western margin of the Dandaragan Plateau (one of two most southern occurrences). The area of Lot M857 outside the Bushplan Site is an area of the Darling Scarp vegetation complex and is not covered by Perth's Bushplan.

Floristic Community Types

While the area has not been sampled for the floristic community types it was inferred from descriptions of the flora of the area that it contained: floristic community type S8, *Eucalyptus wandoo* woodlands from Supergroup 1: Foothills/Pinjarra Plain (associated with the Darling Scarp); floristic community types S9, *Banksia attenuata* woodlands over dense low shrublands and S18, *Eucalyptus marginata*/*E. calophylla* woodlands on laterites from Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau and floristic community type 28, Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands (eastern representation of this community type) from Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes. Average species diversity for these groups ranges from 35.7 (S18) through 44 (S8), 38.9 (S9) to 55.1 (28).

The flora of sections of the Lot indicates the presence of vegetation most similar to Scarp vegetation, floristic community type S8, *Eucalyptus wandoo* woodlands from Supergroup 1: Foothills/Pinjarra Plain (associated with the Darling Scarp). Markey (1997) studied the Darling Scarp floristic groupings from Walyunga National Park to North Dandalup. Similar areas of Darling Scarp vegetation were found, the closest being in Walyunga National Park. Markey identified this group as Darling Scarp floristic community type 1a with an average species diversity of 66.9.

Landscape Features: very steep quartzite bluff and sand patches adjacent to a creek (small area within boundary)

Vegetation and Flora: limited survey (Keighery, BJ, and Trudgen 1992)

Structural Units: mapping (Keighery, BJ, and Trudgen 1992)

Uplands: *Eucalyptus accedens*, *E. calophylla* and *E. marginata* Open Forest to Woodland; *Allocasuarina humilis* and *Calytrix angulata* Open Heath; *Eucalyptus calophylla* and *E. marginata* Low Woodland to Low Open Forest; *Eucalyptus marginata* and *E. accedens* Woodland

Wetlands: *Eucalyptus rudis* and *E. calophylla* Woodland to Open Forest

Vegetation Condition: 70% Excellent to Very Good, 30% Good, with areas of severe localised disturbance (gravel mine)

1.2 Diversity

Four different major landform elements meet in the Bushplan Site, the Darling Scarp, Gingin Scarp and the Dandaragan Plateau. In addition it is likely that elements of the Foothills of the Dandaragan and Darling Plateaus are also present. Associated with this is

are four expected floristic community types. As the area contains communities on sands and laterites, plant communities with relatively few species in common, there is expected to be a high species diversity in the lot. This is supported by the 170 native taxa currently recorded for Lot 857.

1.3 Rarity

Lot M857 is known to contain one species of Declared Rare Flora, *Acacia anomala* and two priority taxa, *Hakea* sp. Walyunga (L. Pen s.n.) [aff. *lasiantha*] (priority 2) and *Lambertia multiflora* var. *darlingensis* (priority 3).

In 1994 the EPA identified Lot M857 as containing Threatened or Poorly Reserved Plant Community (EPA 1994 GIS). Threatened ecological communities have not been identified in the lot by CALM but of the four expected groups three are supplementary groups that have not been considered by CALM. Also it is possible that sampling and analysis of the sandy areas of the Lot could identify floristic community type 20. However in comparison with other areas on the Plain/Plateau interface it is considered that the combination of vegetation associations is rare and individual vegetation associations could well be established as being rare if the required work is done (see comments below).

Comments on Criteria: This Bushplan Site is located in a unique position lying in the area of the confluence of the Gingin and Darling Scarps. While the floristic community types of the Lot have been inferred it is likely that the Lot contains communities not sampled elsewhere. For example the *Eucalyptus accedens* and *E. wandoo* Woodland understorey is dominated by two species not recorded by Markey in her Scarp survey - *Hakea* sp. Walyunga (L. Pen s.n.) and *Brachysema praemorsa*. The Lot is of additional interest at there is no other location known where sands meet the laterites/quartzites of the Scarp.

Additional Information/Criterion from Stephens 1998 and MfP/DEP Site visit April 1999

Structural Units: *Eucalyptus accedens* and *E. wandoo* Woodland

Total Flora: 170 native taxa, 10 weeds (estimated >60% expected flora) (DEP 1999, Keighery, BJ, and Trudgen 1992, Stephens 1998)

Additional Criterion

General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation

While there was creekline mapped for the area there was no information available on the creek prior to the release of Bushplan, the mapped information is from Perth's Bushplan is amended below

Wetland Types: creek

Natural Wetland Groups (undefined areas included in boundary)

Darling Plateau

Walyunga (D.1)

Wetland Management Objectives: not assessed - Conservation (DEP 1999 - the creek is completely vegetated and apparently free of weeds, no other similar creek has been observed on the Scarp)

Additional Comments in Relation to Proposed Negotiated Planning Solution Presentation

- Access to Lot M857 and determination of floristic community types and threatened ecological communities

DEP has DEP/EPA have corresponded with Vispo Holdings (92 Amelia St Balcatta) on two occasions

May 1995 - Notification of the recognition of Lot M857 as containing Threatened or Poorly Reserved Plant Community in need of interim protection (No reply). The Shire of Swan was similarly notified of the location of all areas considered to contain containing Threatened or Poorly Reserved Plant Community in need of interim protection in the Shire.

October 1995 - A request to access Lot M857 to locate floristic plots (No reply). DEP also spoke with David Lamont in 1998 and requested permission to access Lot M857, this was not granted.

Subsequent to the presentation a Site visit was made by CALM, MfP and DEP.

As detailed above detailed plot based flora work is required to place the floristic community types in the lot and determine the status of the ecological communities in terms of CALM's threatened ecological communities program. Unfortunately the plot based work of Stephens (1998) sampled 20m² plots not the standard study plots of 100m² and the Stephens plots are unable to be compared with the over 1000 standard plots established.

- Dandaragan Plateau

Volume 1, Perth's Bushplan (p12) clearly states that the majority of the Dandaragan Plateau is outside the area of Perth's Bushplan. However this is not particularly relevant in regard to this Site as it lies in a unique position in regard to the Dandaragan and Darling Plateaus their Scarps and the Plain.

- Condition of the sand communities in Lot M857

These communities do appear to have been impacted structurally by past clearing. However the level of weed invasion does not appear to be high (see photos showing dominance of native grasses and descriptions Stephens 1998). The Site inspection confirmed this and indicated that repetitive fires and the recent formation of substantial firebreaks would impact on the regeneration of the sand communities. While the sand communities are in a more degraded condition than the laterite/quartzite communities it is considered that if fire/clearing disturbance is removed they will regenerate. Presence of both adds to diversity of Bushplan Site, viability of Site, habitats etc.

- Darling Scarp

All work done on Lot M857 indicates that it is predominantly part of the Darling Scarp and well worth including in the Darling Range Regional Park.

- Mistaken ownership of Lot M857

The original work done on Lot 857 (Keighery and Trudgen 1992) inferred that Lot M857 was part of the Shire of Swan Reserve as the gravel mine is located in both areas and there is no obvious separation of the areas (this confusion is still evident as the firebreak on the 'northern' boundary of Lot M857 associated with a part fence is in the Shire reserve). From this location it was inferred that a greater value was attributed to the land than would otherwise be the case. DEP has been aware of the ownership of the lot since 1995 when and this is not the case.

**PART LOT M857, BUSHPLAN SITE 86 - BURLEY PARK AND ADJACENT BUSHLAND,
BULLSBROOK - DEP Keighery 28/3/99**

Issues relevant in the selection of the area of BS 86, additional to the area of the Shire of Swan reserve (see area indicated on Map 3, Map 30 from Volume 2, Part C Perth's Bushplan)

Issues 1 - Specific issues related to the selection criteria:

1.1 Representation of ecological communities

Vegetation Complexes

As mapped the area of Lot M857 within the Bushplan Site contains two units associated with the Dandaragan Plateau, the Mogumber Complex — South on the Dandaragan Plateau (most southern occurrence) and the Reagan Complex on the Gingin Scarp the western margin of the Dandaragan Plateau (one of two most southern occurrences). The area of Lot M857 outside the Bushplan Site is an area of the Darling Scarp vegetation complex and is not covered by Perth's Bushplan.

Floristic Community Types

While the area has not been sampled for the floristic community types it was inferred from descriptions of the flora of the area that it contained: floristic community type

S8, *Eucalyptus wandoo* woodlands from Supergroup 1: Foothills/Pinjarra Plain (associated with the Darling Scarp); floristic community types S9, *Banksia attenuata* woodlands over dense low shrublands and S18, *Eucalyptus marginata*/*E. calophylla* woodlands on laterites from Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau and floristic community type 28, Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands (eastern representation of this community type) from Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes. Average species diversity for these groups ranges from 35.7 (S18) through 44 (S8), 38.9 (S9) to 55.1 (28).

The flora of sections of the Lot indicates the presence of vegetation most similar to Scarp vegetation, floristic community type S8, *Eucalyptus wandoo* woodlands from Supergroup 1: Foothills/Pinjarra Plain (associated with the Darling Scarp). Markey (1997) studied the Darling Scarp floristic groupings from Walyunga National Park to North Dandalup. Similar areas of Darling Scarp vegetation were found, the closest being in Walyunga National Park. Markey identified this group as Darling Scarp floristic community type 1a with an average species diversity of 66.9.

Landscape Features: very steep quartzite bluff and sand patches adjacent to a creek (small area within boundary)

Vegetation and Flora: limited survey (Keighery, BJ, and Trudgen 1992)

Structural Units: mapping (Keighery, BJ, and Trudgen 1992)

Uplands: *Eucalyptus accedens*, *E. calophylla* and *E. marginata* Open Forest to Woodland; *Allocasuarina humilis* and *Calytrix angulata* Open Heath; *Eucalyptus calophylla* and *E. marginata* Low Woodland to Low Open Forest; *Eucalyptus marginata* and *E. accedens* Woodland

Wetlands: *Eucalyptus rudis* and *E. calophylla* Woodland to Open Forest

Vegetation Condition: 70% Excellent to Very Good, 30% Good, with areas of severe localised disturbance (gravel mine)

1.2 Diversity

Four different major landform elements meet in the Bushplan Site, the Darling Scarp, Gingin Scarp and the Dandaragan Plateau. In addition it is likely that elements of the Foothills of the Dandaragan and Darling Plateaus are also present. Associated with this is are four expected floristic community types. As the area contains communities on sands and laterites, plant communities with relatively few species in common, there is expected to be a high species diversity in the lot. This is supported by the 170 native taxa currently recorded for Lot 857.

1.3 Rarity

Lot M857 is known to contain one species of Declared Rare Flora, *Acacia anomala* and two priority taxa, *Hakea* sp. Walyunga (L. Pen s.n.)[aff. *lasiantha*] (priority 2) and *Lambertia multiflora* var. *darlingensis* (priority 3).

In 1994 the EPA identified Lot M857 as containing Threatened or Poorly Reserved Plant Community (EPA 1994 GIS). Threatened ecological communities have not been identified in the lot by CALM but of the four expected groups three are supplementary groups that have not been considered by CALM. Also it is possible that sampling and analysis of the sandy areas of the Lot could identify floristic

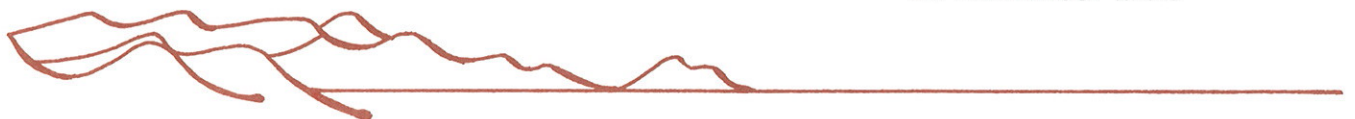
- Mistaken ownership of Lot M857

The original work done on Lot 857 (Keighery and Trudgen 1992) inferred that Lot M857 was part of the Shire of Swan Reserve as the gravel mine is located in both areas and there is no obvious separation of the areas (this confusion is still evident as the firebreak on the 'northern' boundary of Lot M857 associated with a part fence is in the Shire reserve). From this location it was inferred that a greater value was attributed to the land than would otherwise be the case. DEP has been aware of the ownership of the lot since 1995 when and this is not the case.

**ENVIRONMENTAL
ASSESSMENT
and
LAND CAPABILITY STUDY**

**Suitability for subdivision
Part Lot M857 Burley Road
Bullsbrook**

20 November 1998



Lindsay Stephens BSc MSc

LANDFORM RESEARCH

25 Heather Road
Roleystone WA 6111
Phone (08) 9397 5145

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1.0 INTRODUCTION

This study of Part Lot M857, Burley Road, Bullsbrook, was carried out to assess the current environmental status of the land, determine the land capability and identify particular land uses suited to the site.

Detailed vegetation studies were conducted by Jeff Lewis BSc (Hons. Botany) in association with Landform Research to determine the vegetation condition and conservation value of the site.

Site visits were carried out on 3 September, 20 September, 28 September and 2 November 1998 at which time the soils, geology, vegetation, hydrology and landscape qualities were investigated. Other information was obtained through knowledge of the area, aerial photography interpretation and published information.

The site lies 2 km north east from Bullsbrook townsite, bounded by Burley Road in the west, touching Smith Road in the north east and Burley Reserve in the north with agricultural land to the south.

The site has been used for agricultural purposes over the years and was mostly cleared in 1968's although much of the site has been allowed to regrow in recent years. Part Lot M857 has at times been mistakenly included as part of Burley Reserve and has been incorrectly mapped as such during regional botanical mapping.

2.0 EXISTING ENVIRONMENT

2.1 Geology and Geomorphology

The land occupies portion of a breakaway slope on the edge of the Darling Scarp, with the footslopes forming part of the Ridge Hill Shelf. The site varies from just over 198 metres in the north east on the edge of the plateau remnant down to 98 metres in the south western corner.

The Darling Scarp lies to the east of the Darling Fault whose interpreted position is through Bullsbrook townsite, with the scarp having retreated eastwards through erosion, (Geo. Surv. WA. Perth Environmental 1 : 50 000 Geology Series, Muchea Sheet). The site is underlain by sediments of the eastern edge of the Perth Basin which are left as remnants from higher sea levels or from isostatic adjustments of the Yilgarn Shield.

Underlying the site and exposed in the base of the breakaway slope are Mesozoic shales and siltstones thought to belong to the Leederville Formation, overlain by alluvial sandstones of the Bullsbrook beds that outcrop on Chittering Road.

Superimposed on this are lateritised alluvial terraces formed from stream erosion of the scarp in possibly Tertiary times. These terrace remnants are reflected by coarse angular white quartz grains and pebbles deposited close to their source and cemented by bog iron to form ferruginous sandstone. Laterite profiles developed in the late Tertiary as sub-soil features form the resistant cap of the breakaway on the northern boundary.

Sands on the western half are probably due to beach and dune formation formed at higher sea levels during the Pleistocene. The site forms the southern end of the Gingin Scarp as it breaks away from the Darling Scarp. The elevation from 98 to 180 metres is above what is normally regarded as the Ridge Hill Shelf (25 to 76 metres), Baxter 1976 and Markey 1997, and the laterite sandy soils have less clay than the alluvial, colluvial and shoreline deposits associated with the Ridge Hill Shelf which runs southwards along the base of the scarp. In the eastern half the sands have largely been removed by erosion, and the underlying Mesozoic shales are exposed.

2.2 Soils

Soils are related almost exclusively to the underlying geology.

The eastern half is covered by loam over clay, developed on the Mesozoic shales, with ferruginous sandstone, gravels and duricrust on remnants of the ancient laterite subsoils. Sands with variable amounts of leaching cover the western half of the site from Pleistocene(?) beach and dune deposits. A small area of sand shed from Bullsbrook Beds overlies clay in the central north.

Leached Sand is leached yellow quartz sand that is either white or light yellow in the upper horizons with leaching tending to be more pronounced higher up slope. These sands extend over the gravel soils in the central north. Soil quality decreases in proportion to the degree and depth of leaching, but with the yellow sand or gravel at depth and their elevation above the water table, the sand, soil profiles have high phosphate retention. Typical profiles are:

Central part of site

0 - 200 mm	Coarse grey sand grading to cream sand
200 - 730 mm	Coarse yellow sand
730 - 840 mm	Yellow sand with minor clay
>840 mm	Ferruginous sandstone

North western corner (leached sand profile)

0 - 410 mm	Grey - white leached sand
410 - > 1000 mm	White leached quartz sand

North western corner (yellow sand profile)

0 - >760 mm	Pale yellow quartz sand
-------------	-------------------------

Duricrust/Gravel caps the plateau remnant at the edge of the breakaway, but only a small area of this soil type occurs on the northern boundary. Minor gravel overlies massive duricrust which is developed on the Mesozoic sediments. The laterite duricrust restricts root penetration ensuring that the soil has low capability.

Gravel occurs in the central west extending down a spur from the breakaway. The gravel has been shed from upslope in most parts with some in situ over shales and sandstones of the Mesozoic sediments.

Loam over Clay occurs across most of the eastern part of Part Lot M857 where cream to light brown to pink loams overly brown and yellow brown loams and clays at depths of 300 mm over shales of the Leederville Formation. Slopes are steep in the north and these soils are typically unstable if significantly cut and filled or loaded with excess water.

Down slope towards the south the soils become darker and more yellow brown. A typical profile is:

North eastern corner

0 - 150 mm	Brown pinky loam with minor surface gravel
150 - 350 mm	Lighter pinky brown loam grading to friable clay
350 - > 1 200 mm	Light pinky loam clay.

Sandy Loam over Clay occurs on the Bullsbrook Beds in the central north.

0- 200 mm	Yellow sand with minor clay and some surface gravel
200 - > 1 000 mm	More yellow brown with increasing clay to form a clay sand over sandstone.

Ferruginous Sandstone occurs on the alluvial terrace remnants where coarse conglomeratic sands have been cemented with ferricrete to form a conglomeratic sandstone. The sandstone has been indurated by iron oxides during formation which has formed a rock overlying silts and clays of the Mesozoic sediments.

2.3 Climate

The climate of the area is typically Mediterranean with warm to hot dry summers followed by cool to mild wet winters. Data is recorded at Bullsbrook.

Summer maximum temperatures range from just over 33 °C in the hottest months down to between 17 - 18 °C in winter. Minima range from 17 °C in summer down to 8 °C in winter. Rainfall at Bindoon averages about 658 mm.

Wind directions are predominantly from the east on summer mornings and south west in the afternoon depending on the arrival of the sea breeze. Winter winds are more variable.

2.4 Hydrology

The site drains rapidly to the south in the eastern half where the loam/clay soils predominate, forming two small but incised gullies with another on the eastern boundary and a tributary entering from the east.

A small soak has been deepened on the more central gully to form a small permanent dam. Water seeps from the slopes in the gullies as precipitation drains through the upper soil horizons and is forced to the surface by the underlying silts and clays of the Leederville Formation. This groundwater has elevated salinity and has formed salt scars through evaporation. Water in the gully was 1190 mSm and in the dam 1120 mSm (potable water is < 180 mSm). The water is high in iron oxides and only suitable for stock.

In the western half there is no surface drainage with precipitation entering the sands and being directed along the top of the underlying sediments to emerge lower down slope outside the southern boundary as small soaks when forced to the surface by underlying clay beds in the Leederville Formation.

Clearing of the eastern area or the reserve to the north will increase the water loading leading to increased recharge of the shallow aquifers, increased flows in the soaks and likely increased salinity effects.

2.5 Vegetation

Introduction

Detailed vegetation studies were carried out on Part Lot M 857 to identify the vegetation communities and search for Rare and Priority Species. Site visits were conducted on 3 September, 20 September, 28 September and 2 November 1998.

The vegetation over the site was mapped by Jeff Lewis BSc (Hons - Botany) in association with Lindsay Stephens BSc MSc (Botany). The vegetation was surveyed to identify the major floristic community types based on the composition of the understorey species as used by Gibson et. al, 1994, and Markey, 1997. Communities were mapped and two 20 m² sample plots established for species richness and density assessment, in the eastern portion of the site and in the western part, Appendix 1. In addition all species noted during the study were identified from published information and where identifications were unclear the species were checked at the WA Herbarium, Appendix 2.

The majority of the site was cleared and grazed in the 1960's as shown by the aerial photograph (1964) but substantial portions, particularly the eastern half, have been allowed to regrow since that time.

Fire has frequently burnt the site over the years and may have affected the species composition and community structure.

Previous Work

Part Lot M857 has at times been mistakenly included as part of Burley Reserve and has been incorrectly mapped as such during regional botanical mapping. The site was first looked at by Keighery and Trudgen 1992 and this work was revisited and extended by Gray, 1994.

The information and map (11a), provided by Keighery and Trudgen 1992, shows that they assessed Part Lot M857 thinking it was Burley Park and did not appear to have assessed the real Burley Park. They rated the vegetation as Very Good to Poor although this does not match the Condition ratings shown under 105a, 105b 105c and 105d which are listed as Good to Very Good.

The inclusion of Part Lot M 857 as Burley Park by Keighery and Trudgen 1992, was repeated in Gray 1994 who listed the site as "Area adjacent to Burley Park" on one map, but included Part Lot M857 as Burley Park in the map "Bullsbrook Bushland Location Map".

These 2 studies were 10 x 10 = 100 m² size → 4 x 4 m²

Individual is best veg other statements is general.

This is not
the
values
are very
arbitrary

Whilst the inclusion of Part Lot M857 as part of Burley Park does not change the quality of the vegetation on the site, it is likely to have led to the vegetation in Burley Park being given higher status than is justified, which may influence planning decisions.

The vegetation on the site was divided into four communities by Keighery and Trudgen 1992, but these have been slightly modified during the current study.

- Powderbark Wandoo, Marri and Jarrah Open Forest to Woodland in the east.
- *Allocasuarina humilis* and *Calytris angulata* Open Heath in the central south.
- Marri and Jarrah Low Woodland to Low Open Forest in the western portion.
- Jarrah and Powderbark Wandoo Woodland in the central and northern parts.

System 6

Neither Burley Park nor Part Lot M857 is listed as a System 6 reserve in the Recommendations (EPA Red Book 1983) or EPA Status Report 1993. However the Shire of Swan 1996 Environmental Report shows Part Lot M857 as an Interim Listed System 6 Reserve but does not list Burley Park. Part Lot M857 is private property and not a reserve. The listing is probably due to Keighery and Trudgen 1992 assessing Part Lot M857 and thinking it was Burley Park but not apparently assessing the real Burley Park. They then published their findings of Part Lot M857 as Location 105 Burley Park.

This refers to 'Threatened and poorly preserved plant communities' this info to landholders also.

Vegetation Summary

The vegetation on Part Lot M857 - Bullsbrook contains remnant bushland of varying quality on the Darling Scarp. It lies adjacent to Burley Park, a local government reserve at Bullsbrook. The site contains a narrow section of the lateritic uplands of the Darling Plateau, the steep slopes of the western margin of the Plateau and a small section of the Ridge Hill Shelf. Soils range from gravel and duricrust at the top of the slope to sandy loams and gravelly sand over clay on the steep slopes, and leached white and yellow sands to the west of the breakaway. The western portion and lower slopes are presently regenerating after previous clearing and grazing and after a fire in the summer of 1997/98.

Three communities were identified which differ slightly in their margins from that nominated by Keighery and Trudgen 1992. These were traced in the field directly onto colour aerial photography.

• Community Type A

Eucalyptus accedens - *E. wandoo* Woodland found on the laterite mantle and extending down the steep breakaway slope and along minor drainage lines

• Community Type B

Eucalyptus calophylla - *E. marginata* low Woodland to Low Open Forest on the sands, loams and gravels of central parts. A small area of *Allocasuarina humilis* low shrubland noted by Keighery and Trudgen 1992 is included in this community on the basis that it is a micro community.

Probably done growth very since clearing in 60's

• Community Type C

Eucalyptus calophylla - *Banksia attenuata* Woodland on the leached white and yellow sands on the western portion of the site.



Figure 1 *Eucalyptus calophylla* - *Banksia attenuata* Woodland Remnant
Community C

Stipa compressa
widest in good bush



Figure 2 *Eucalyptus calophylla* - *E. marginata* Low Woodland remnant in the north western corner. Community B



Figure 3 Soak and *Eucalyptus wandoo* Woodland. Community A



Figure 4 *Eucalyptus wandoo* Woodland. Community A

Description of Major Community Types

Community Type A

Eucalyptus accedens - *E. wandoo* Woodland

- Condition: very good
- Soil: gravel and duricrust, loam over clay, ferruginous sandstone over clay
- Aspect: steep to gentle SSE - breakaway slope and creek lines
- Drainage: Very good, good
- Comments: Predominantly uncleared, burnt frequently but not recently
- Species Richness: 17.5 species/20m²
- Plant Density: 6.9 plants/m²
- Cover: trees - 23%, shrubs > 1m - 25%, shrubs/groundcover < 1m - 80%

This vegetation community type, extends from the laterite ridge where Powderbark Wandoo is the dominant tree species, down the breakaway slope and along two minor drainage lines to the south where Powderbark Wandoo is replaced by Wandoo. It is a combination of types 1a and 9 - Markey 1997 although the incidence of *E. accedens* appears to be greater than in those described by Markey. Understorey species change in response to slope and the proximity of the gullies.

Priority
to ~
understorey

The upper slopes of the ridge support an open scrub of *Hakea aff. lasianthoides*, *H. undulata*, *Gastrolobium spinosum*, *Brachysema praemorsa*, and *Lambertia multiflora*. Other common species here are *Astroloma pallidum*, *Lasiopetalum floribundum*, *Boronia ovata*, *Davesia cordata*, *Hibbertia amplexicaulis*, *H. lasiopus*, *Conostylis setosa*, *Davesia decurrens*, *Cheiranthra preissianus* *Acacia willdenowiana* and *Bossiaea eriocarpa*.

Further down the slope a low open shrubland occurs on clay loam soils. Common species here include *Xanthorrhoea acanthostachya*, *Macrozamia riedlei*, *Dryandra lindleyana*, *Hibbertia hypericoides*, *Conostylis setigera*, *Lobelia rhombifolia*, *Hakea lissocarpa*, *Kennedia coccinea*, *Sphaerolobium vimineum* and *Chamaescilla corymbosa*. Extending south along two minor drainage lines, understorey species include *Scaevola calliptera*, *Tetradlea hirsuta*, *Dryandra armata*, *Stylidium amoenum*, *Thelymitra crinita*, *Burchardia congesta*, *Comesperma calymega*, *Caesia parviflora*, *Petrophile striata*, *Baeckea camphorosmae*, *Dampiera alata*, *Hypocalymma angustifolium*, *Glischrocaryon aureum*, *Kunzea recurva*, *Stackhousia monogyna*, *Xanthosia candida* and *Verticordia acerosa*.

Markey 1997 lists the species richness for communities 1a and 9 as averaging 66.9 and 68.7 for 100 m² which may not be dissimilar or may be slightly above Community Type A because of seasonal factors and the larger sample size.

Community Type B

Eucalyptus calophylla - *E. marginata* Low Woodland to Low Open Forest

- Condition: good
- Soil: loam over clay, gravel, leached white and yellow sand
- Aspect: S, SW, SE - Gingin Scarp and slopes below breakaway
- Drainage: good

This community is found through central parts of the site, west of the breakaway slope. The presence of some orchid species shows much of this community was burnt during the previous summer and numerous young marri trees indicate previous clearing. The vegetation community contains elements of types 7 and 11 - Markey 1997, and community types 3b and 3c (Gibson et al 1994). Community types 3b on the more sandy soils and 3c on the loams.

Jarrah and marri are the dominant tree species with Jarrah increasing on the more leached sands towards the north western corner as the community changes from a Marri low woodland to a Jarrah low open forest. A small area of *Allocasuarina humilis* low open shrubland occurs within the community on a sandy area in the central south. Because of its limited extent and past clearing and grazing, the *Allocasuarina humilis* low open shrubland is not regarded as a sufficiently significant community to be given status in its own right, but rather as a sub-community of Community Type B.

The Marri woodland found on the clay loam soils commonly supports the following understorey species; *Hibbertia huegelii*, *Thysanotus multiflorus*, *Phyllanthus calycinus*, *Dryandra lindleyana*, *Lechenaultia biloba*, *Eriostemon spicatus*, *Baeckea camphorosmae*, *Xanthorrhoea gracilis*, *Calothamnus quadrifidus*, *Acacia pulchella*, *Davesia decurrens*, *Drosera erythrorhiza*, *Tetraria octandra*, *Caesia parviflora*, *Neurachne alopecuroidea* and *Chamaescilla corymbosa*. Additional species occurring in the *Allocasuarina humilis* shrubland include *Calytrix angulata*, *Andersonia lehmannii*, *Anigozanthos manglesii*, *Hybanthus calycinus*, *Xanthorrhoea preisii*, *Anagallis arvensis* and *Laxmannia squarosa*. Moving uphill into the more leached sands the Marri woodland gives way to a Jarrah low open forest and the following additional species can be found; *Waitzia paniculata*, *Gompholobium tomentosum*, *Loxocarya fasciculata*, *Ptilotus manglesii*, *Kennedia prostrata*, *Acacia nervosa*, *Stylidium hispidum*, *Conostephium pendulum*, *Hovea trisperma*, *Chorizema dicksonii* and thickets of *Dryandra sessilis*.

Community Type C

Eucalyptus calophylla - *Banksia attenuata* Woodland

- Condition: poor - good
- Soil: leached white and yellow sand
- Aspect: SSW - Gingin Scarp
- Drainage: good
- Species Richness: 7.5 species/20m²
- Plant Density: 3.9 plants/m²
- Cover: trees - 5%, shrubs > 1m - 7%, shrubs and groundcover < 1m - 25%

Community C has affinities with Community Type 28, Gibson et al 1994, which occurs on the yellow sands of the Spearwood System in the more western regions of the Swan Coastal Plain with an easterly variant on the yellow sands at the base of the Darling Scarp. Its greatest similarities to published data are with the easterly variant of Community Type 28 which was recorded at four sites listed with latitudes of 131.62/3 degrees an elevation of 75 metres. This places the populations near Talbot Road, Stratton, well south of the marker shown on the map for Community Type 28, Gibson et al, 1994. From brief field data Community C has similarities with vegetation on sands of the Gingin Scarp to the north of Bullsbrook.

On Part Lot M857, Community C has a large number of weed species with decreasing condition to poor to the west and south west where more pasture species and reduced species richness have resulted from previous clearing, grazing and frequent and recent burning.

Woods
Slope

Species richness is 7.5 per 20 m² for the perennial species compared to 17.5 per m² in the Upper slope *Eucalyptus accedens* - *E. wandoo* Woodland in the east. This relatively low value for species richness can be attributed to past clearing and grazing together with the sandy soils and fire history. Even so the species richness of 9 per 20 m² for perennial species is low when compared to Banksia Woodland on yellow or white sand.

In addition to a low species richness the Banksia Woodland carries a significant density and richness of exotic species which have become much more dominant following the 1997/98 summer fire. It may be in the long term that with effective management the level of exotic species could be lowered as most weed species are opportunists, growing when competition is reduced.

Dominant tree species are a mixture of *Banksia attenuata*, *Eucalyptus calophylla* and to a lesser extent *E. marginata*, *B. grandis* and *B. menziesii*. Understorey species include *Conostylis aculeata*, *Stirlingia latifolia*, *Petrophile linearis*, *Loxocarya flexuosa*, *Adenanthos cygnorum*, *Nuytsia floribunda*, *Scaevola canescens*, *Jacksonia sternbergiana*, *Pimelea suaveolens*, *Thysanotus dichotomus*, *Sowerbaea laxiflora*, *Davesia physodes*, *Ursinia anthemoides*, *Hyalosperma cotula*, *Anigozanthos humilis*, *Gladiolus caryophyllaceus*, *Patersonia occidentalis*, *Briza maxima* and *Stipa sp.*

No pasture weeds listed two widespread
pasture weeds listed

Discussion

Rare Flora

Rare and Priority Species were noted from the List of August 1998.

Contact with Department of Conservation and Land Management shows that *Acacia anomala* is known to occur in the north of Part Lot 857 as shown on the attached vegetation plan. However it was not noted during the vegetation study even though the field work was conducted on 20 and 28 September 1998 at the end of the known flowering period. *Grevillea althoferurum* and *G. curviloba* are recorded as occurring in the Bullsbrook area but neither was noted on the site.

Woods
not
inspect
Yes

The vegetation on Part Lot M857 forms part of a series of remnant bushlands in the Bullsbrook area, some of which are of botanical significance. The site displays vegetation elements of both the Swan Coastal Plain and the Darling Scarp and contains ~~some~~ areas with high conservation value.

+ Dandaajan Plateau

Community A is of the greatest significance because of its species composition, richness and vegetation condition. Community A, *Eucalyptus accedens* - *E. wandoo* Woodland, at this site appears to be one of the few examples of Type 9 (Markey 1997) in which Powderbark Wandoo and Wandoo are the dominant tree species instead of Jarrah. It is possibly transitional between Types 9 and 1a. Additionally, the section of Community A occurring on the breakaway slope contains three important species; *Brachysema praemorsa* (at the northern limit of its distribution and growing as an unusual form of the species), *Hakea aff. lasianthoides* an as yet un-named taxa and *Xanthorrhoea acanthostachya* (known from only three other locations). *Acacia anomala* (a declared rare species) occurs in the Bullsbrook area on gravelly soils but was not noted during the field investigations. *Hakea aff. lasianthoides* is a priority 2 species and occurs on the breakaway slope along the top of the site.

Even though Community Type A is listed by Markey 1997 as contained in secure reserves the community is regarded as having high conservation value because it appears to be relatively unique.

Community Type B contains elements of types 7 and 11 (Markey 1997), and community types 3b and 3c (Gibson et al 1994). Community type 3b occurs on the more sandy soils and 3c on the loams. It has lower species richness and more exotic species in its composition than Community Type A. The community types from which this vegetation has similarities are listed as well reserved by Markey 1997 and Gibson et al 1994, with the exception of 3c which is listed as Poorly Reserved. Vegetation of apparently similar elements occurs along the Gingin Scarp to the north west.

1EC's

On the basis of the community composition and reservation and level of disturbance it is felt that the Community B has reduced conservation value.

Community C is an example of vegetation community Type 28 (Gibson et. al., 1994), related to the more common Spearwood System found along the western edge of the Swan Coastal Plain, Perth with some eastern representatives. Occurrences of this community type have been found on yellow sands on the Gingin Scarp to the north of the Bullsbrook, and this site appears to be an additional location for the eastern community. The slightly differing species composition at this site appears to be related to differences in the origin of the sand and the degree of leaching.

Not to be mentioned in text!

In pristine condition Community Type C may have in the past been a significant stand of vegetation because of its species composition and geomorphic position, however it's poor condition, reduced species richness, proportion of exotic species and limited size have significantly reduced its conservation value. Community Type 28 is listed as Well Reserved, although this applies particularly to the western populations. In addition there are vegetation communities with apparently similar species composition on much less disturbed sites on yellow sands to the north along the Gingin Scarp.

At this location, however, Community C is therefore regarded as having lower conservation value.

2.6 Fauna

Fauna will be dependant on the size and quality of the vegetation present. As fire is a frequent occurrence some species are likely to be depleted particularly in the western half which was burnt in summer 1997/98. The long term survival of indigenous fauna will depend on the proportion of indigenous vegetation remaining and the number of feral animals. The site does join Burley Park to the north which will allow exchange of fauna.

2.7 Heritage

Discussions with the owners reveal that there may be some areas of ethnographic significance to some aboriginal people, associated with the gullies and quartz pebbles in the eastern portion.

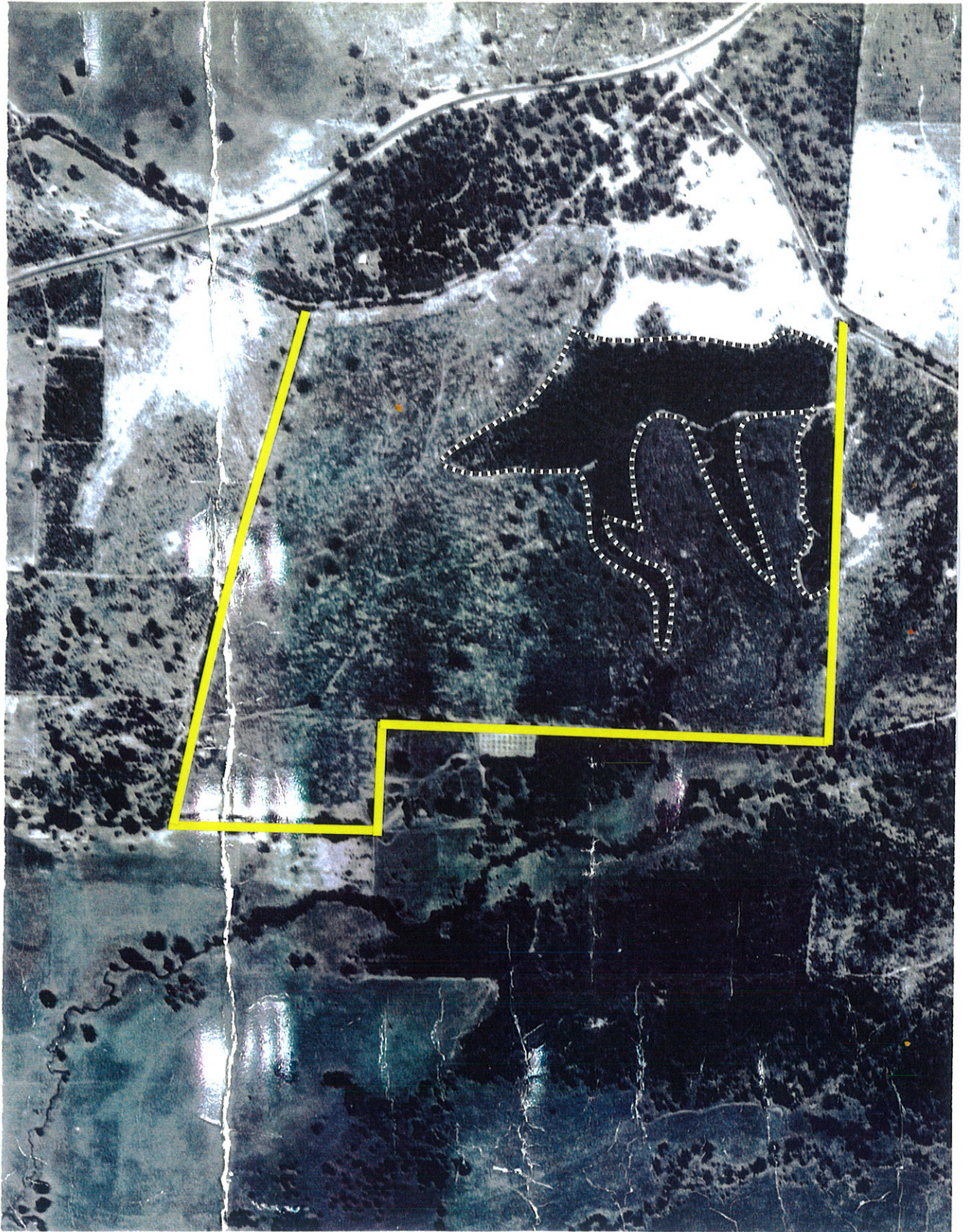


Figure 5 Limit of clearing in the late 1960's. Source 1968 aerial photography, (DOLA).

3.0 LAND CAPABILITY

The opportunities of the site are:

- Sloping nature of the site with views across the Swan Coastal Plain
- Proximity to Bullsbrook and service facilities.
- Proximity to Bullsbrook Primary and High Schools.
- Proximity to Great Northern Highway.
- The site is near existing clusters of small lots and services.
- Lots in the west could be connected to scheme water.
- Remnant vegetation over a significant proportion of the site.
- The quality and conservation value of the remnant vegetation in eastern parts of the site.
- The presence of yellow sand and gravelly soils or duricrust which have good phosphorous retention.
- The amount of trees over the site that will provide screening of developments when viewed from the Swan Coastal Plain.
- The ability of the site to provide a walk trail link from Bullsbrook to Burley Park.

The constraints on the site are:

- The small area of leached white sands over yellow sand in the north west.
- The breakaway slopes which are potentially unstable and should not be cleared.
- Noise from Pearce Airbase.
- Retaining indigenous vegetation will increase the fire hazard.
- Ethnographic significance of part of the eastern site may inhibit development potential in that area.
- There is a lack of shallow groundwater or supplementary water supply.
- The potential for increased salinity if the upper eastern slopes are cleared.
- Soil types and the presence of gullies in the eastern half will restrict waste water disposal.

Previous Studies

Part Lot M857 is shown as having "Fair" capability for rural residential use in Shire of Swan *The 1996 Environmental Report*.

3.1 Water Availability

Supplementary water supplies are restricted. Runoff is the predominant flow of water on the loam soils in the eastern half with little entering the shallow groundwater system. Shallow groundwater in the east has elevated iron oxides and salinity and is only suitable for stock and not irrigation of crops, horticulture or gardens.

There may be minor potential for small quantities of shallow ground water in the south west but its availability will be very restricted because of the geology and small catchment size. Small supplies of water may be available for several dwellings.

3.2 Soil Types

Soil in the western half are sandy and very suitable for dwellings although the sand is leached in the surface horizons in parts which will reduce soil fertility and increase the potential for wind erosion. With development, this will be managed by additional planting and the construction of structures which will tend to break up the wind flows and stabilise the soil.

In the eastern half the soils are loams over clay which are commonly steeply sloping.

The presence of sand with partially leached surface horizons and steep loam soils ensure that the agricultural capability of the soils is restricted.

3.3 On Site Effluent Disposal - Nutrient Management

All soil profiles have high phosphate adsorbing qualities based on the level of sesqui-oxides and clay at depth. Permeability will be reduced at depth in parts of the eastern half because of increasing clay content. The small gullies will also restrict effluent disposal. Even the leached white sands profile which overly yellow sand or gravel ensure retention of phosphate because the sesqui-oxides in the gravel and sand coatings have very high phosphate adsorbing qualities.

Soils in the western half are capable of supporting conventional effluent disposal systems. In the eastern half only small areas are suitable for conventional septic systems and this is dependant on adequate buffers being available to the gullies. Close to the gullies alternative waste water systems will be required, and adjacent to the gullies and on the breakaway slope there should be no waste water disposal.

See map "Capability for Dwellings on Small Holdings" and 6.4 Nutrient Management - Effluent Disposal.

3.4 Wind and Water Erosion

Wind erosion of the site is currently low provided adequate vegetation cover is maintained on the western sandy areas. With clearing, this area will be more prone to wind erosion and minimal removal of existing vegetation is recommended during development.

In the east the steeper slopes and loam/clay soils carry high water erosion potential. This will restrict development such as on the breakaway slopes, and in other areas care will be required during any development.

3.5 Basic Raw Materials

The sand has minor potential for fill sand, but is restricted by its small size, proximity to dwellings and restricted depth. Supplies of gravel on the site are minimal. Sedimentary clay does occur but is overlain by other sediments and in parts of the east is covered by vegetation of high conservation value.

The potential for basic raw materials from this site is very restricted.

3.6 Stocking Rates

The low capability of leached surface sands in the north west, the steep loamy soils in the east and vegetation of high conservation in parts of the eastern half restrict the potential for stocking the site.

The leached white sands have stocking rates of less than 1 DSE (one dry sheep equivalent per hectare if maintained on site all year round). It should be noted that a horse is rated as equivalent to 12 DSE. Whilst the loam soils have much higher stocking rates the potential for water erosion of the steeper slopes will preclude stock from the north eastern portion and reduce the capability elsewhere.

Stocking is not recommended.

4.0 POTENTIAL LAND USES

4.1 Current Land Uses

Most of Part Lot M857 was cleared in the 1960's and grazed, but has been allowed to regenerate in more recent times. The site is not currently used for agricultural purposes.

4.2 Potential Land Uses

The low capability of the majority of the site for sustainable agriculture means that there is little productive use for the site. The productivity of the sandy western soils could be improved by irrigation, but there is little or no water available.

The sustainable agricultural potential of Part Lot M857 is thus low and the "better" eastern portion of the site should be considered for "conservation".

Sensitive residential development is possible with most of the dwellings to be located in the western half of the site. Lot sizes should increase towards the east and it may be possible to locate several dwellings in the eastern half in areas 2a, 2b and possibly 3a with the remainder of the eastern half being conservation, protected through covenants on the titles.

5.0 GEOTECHNICAL CONSIDERATIONS

5.1 House and Road Construction - Foundation Stability

Roads

Foundation stability and ease of construction of roads on the sandy western area is high. On the more gentle slopes in central and eastern parts the ease of construction is moderate, but on the steeper slopes construction is more difficult and foundation stability poor.

Dwellings

The foundation stability and ease of construction of dwellings follows the same pattern.

To the west foundation stability is High (AS 2870 Site Class A). This decreases to M on the sloping loam soils and P on all steeper slopes and the breakaway. Cut and fill exceeding 400 mm requires a P classification.

The breakaway slope is potentially unstable if vegetation is cleared from the slope or on the plateau remnant to the north, or the site loaded with additional water. Landslips are common on these types of slopes when cut and fill is used.

Developments on sloping loam and clay soils will require cut off drains to be installed upslope of any development.

House pads could be located in previously cleared areas, particularly in central and eastern parts.

See map "Capability for Dwellings on Small Holdings"

	GEOTECHNICAL FACTOR	MANAGEMENT
5.1.1	Foundation/construction - roads	<ul style="list-style-type: none"> Foundation stability and ease of construction on the sandy western half are high with both decreasing significantly on the loam soils of the east in response to increases in slope. Road construction in the eastern half will require care and sympathetic development to ensure the conservation values are maintained.
5.1.2	Foundation Stability	<ul style="list-style-type: none"> Foundation stability on the sandy soils is AS 2870 Class A The breakaway slopes are potentially unstable and are not recommended for dwellings AS 2870 Site Class P. Dwellings on steeper slopes, where cut and fill exceeds 400 mm and where water loading is increased are AS 2870 Site Class P.

6.0 ENVIRONMENTAL MANAGEMENT

The following items are identified as the most likely to impact on the environment. These items can be managed by the implementation of the management recommendations. Other items are unlikely to impact or the impact is regarded as small.

6.1 Aesthetics

The sloping nature of Part Lot M857 as it rises to the east increases the aesthetic quality.

The site is classified as "High Visual Resources" in the Shire of Swan Bullsbrook Rural Strategy and High Scenic Quality in the Darling Range Regional Park and Landscape Study, DEPUD 1993. Great Northern Highway is classified as a Public Sensitivity Level 1 in Darling Range Regional Park Supplementary Report No 3 DEPUD.

The site has a cover of scattered regrowth Eucalypt trees amongst which any developments could be located. When viewed from the Swan Coastal Plain and Bullsbrook, houses on the western half or lower on the eastern side would not be visible or would have low visual impact. Some sympathetic siting and construction would be required for developments higher on the eastern part of the site.

From Great Northern Highway developments on Part Lot 857 would be classified as midground, Darling Range Regional Park Supplementary Report No 3 DEPUD. Dwellings located on the more gentle western slopes will have little visual impact during daylight hours because of the existing tree cover that will be retained.

The colour and style of dwellings and other structures should be visually compatible with the area and to this end developments should be coloured, painted or colour bond sheeting used where applicable. The use of grey galvanised or zinc/alum sheeting should be avoided unless as an integral part of a development such as a roof on a "country style" home or shielded from key sight lines.

Strategic vegetation could be planted during the subdivision construction stage to further minimise potential visual impact.

	ENVIRONMENTAL FACTOR	MANAGEMENT
6.1.1.	Remnant vegetation	<ul style="list-style-type: none"> • Development should include preservation of existing remnant trees and where possible by the sympathetic location of building envelopes. • Mature trees should be preserved. • Development should be restricted to the western half and lower slopes of the eastern half if that half is to be developed. • There should be no development on the breakaway slopes.
6.1.2	Setbacks	<ul style="list-style-type: none"> • Developments should be set back from the gullies in the east.
6.1.3	Dwellings, fences and other developments are to be aesthetically compatible with the area.	<ul style="list-style-type: none"> • Restrictions should be placed on the use of visually non compatible materials. • Strategic vegetation should be planted during the subdivision construction stage to further minimise potential visual impact.

6.2 Flora and Fauna

Vegetation on Part Lot M857 varies from high conservation value to low conservation.

Community A has high conservation value, particularly the upper slopes which are in better condition. This vegetation is an uncommon community with high species richness and density, (see Appendix 1) and contains several species that are considered significant although they are not Gazetted as Rare. Three species contained within this community; *Brachysema praemorsa*, *Hakea aff. lasianthoides* and *Xanthorrhoea acanthostachya* all occur in this upper section of the site and warrant protection. The community also covers the gullies that should be protected and includes the areas of ethnographic significance.

Community B has lesser significance because it is more common, with three of the communities with which it has affinity listed as well reserved by Markey 1997 and Gibson et al 1994, and one, 3c, is listed as Poorly Reserved.

Community C has affinity with Community Type 28 Gibson et al, 1994, which is shown as Well Reserved. In addition the vegetation is in relatively poor condition with a low species richness and the common presence of exotic species, particularly in the south west. Apparently similar vegetation communities with similar species composition occur on much less disturbed sites on yellow sands to the north along the Gingin Scarp. Therefore the conservation status of Community C is regarded as relatively low.

The retention of the vegetation of high conservation value on this site is important for conservation. The quality of habitat and the number of animals that will be sustained in the area will be dependant on the proportion of remnant vegetation retained in the long term and the degree of restriction placed by fences and other restraining devices.

Clearing restrictions and the nomination of building envelopes can assist in the protection of remnant vegetation and thus fauna. Old standing trees provide habitats and nest sites for birds and other fauna.

Some non local indigenous species used in rehabilitation of the adjoining Burley Park, such as *Acacia iteaphylla*, have the potential of becoming environmental weeds in the remnant vegetation on Part Lot M857 and should be monitored and removed as necessary.

Clearing restrictions will apply and firebreaks should be strategic rather than along each fence line. The preference is to use the existing firebreaks to minimise clearing. Boundary lines could be marked by lines of poles if the owners desire to allow continued movement of fauna. Preferred fencing is stranded wire, sheep mesh ringlock or other acceptable type to allow the movement of fauna, rather than diamond mesh.

System 6

Neither Burley Park nor Part Lot M857 is listed as a System 6 Reserve in the Recommendations (EPA Red Book 1983) or EPA Status Report 1993. However the Shire of Swan 1996 Environmental Report shows Part Lot M857 as an Interim Listed System 6 Reserve but does not list Burley Park. Part Lot 857 is private property and not a reserve. The listing is probably due to Keighery and Trudgen 1992 assessing Part Lot M857, thinking it was Burley Park but not apparently assessing the real Burley Park. They then published their findings from Part Lot M857 as Location 105 Burley Park.

	ENVIRONMENTAL FACTOR	MANAGEMENT
6.2.1	Remnant vegetation	<ul style="list-style-type: none"> • Mature trees should be preserved to provide habitat and nesting sites. • The number lot boundaries cutting remnant vegetation should be minimised. • No stock should be permitted on the site • Vegetation should be protected with clearing restrictions and building envelopes nominated. • Firebreaks should be strategic and not along each boundary line.
6.2.2	Significant Vegetation	<ul style="list-style-type: none"> • Community Type A on the breakaway slope in the north east has high conservation value as an unusual and poorly represented community type of the Darling Scarp and should be protected. • There should be no clearing of Community Type A apart from access and maintaining the strategic firebreaks. • Remnant vegetation could be protected by an Agreement to Reserve, Conservation Covenant or possibly by adding it to Burley Park although past management of Burley Park has been inefficient. • Fire management in remnant vegetation should be directed to maintaining the vegetation in good sustainable condition yet at the same time reducing the fire hazard, perhaps sections burnt every 5 years would be appropriate. • Firebreaks should be constructed in lots or as a hard edge to the remnant vegetation. • Existing firebreaks can be modified into multiuse paths reducing the need for additional clearing. • Future clearing for development should, where possible be restricted to the lower slopes and western section of the site in communities B and C with the smallest lots adjacent to Burley Road and larger lots with clearing restrictions adjacent to remnant vegetation. Some sensitive development could occur in selected locations in Community Type A. • Horses must be excluded from remnant vegetation to reduce the potential for weed introductions. • Local species, preferably of local provenance, should be used for rehabilitation of degraded areas on the site and adjoining Burley Park to the north. Some species used in Burley Park such as <i>Acacia iteaphylla</i> have the potential to form environmental weeds in vegetation on Part Lot M857.
6.2.3	Fauna	<ul style="list-style-type: none"> • Fencing should be open mesh or boundaries marked with poles to allow movement of fauna

6.3 Heritage

Heritage issues concern the management of flora, mature trees and aboriginal sites.

	ENVIRONMENTAL ISSUE	MANAGEMENT
6.3.1	Ethnographic and archaeological sites	<ul style="list-style-type: none"> • There are known ethnographic sites associated with the gullies and quartz pebbles in the eastern portion of the property. • Known sites could be incorporated into the preservation of remnant vegetation and the gullies with acknowledgment shown in the naming of the area, street names and included as part of the historical records of the Bullsbrook area.
6.3.2	Vegetation	<ul style="list-style-type: none"> • Remnant Vegetation will be protected by points outlined under 6.2 Flora and Fauna.
6.3.3	Potential aboriginal sites	<ul style="list-style-type: none"> • Aboriginal sites are protected under the Aboriginal Protection Act.

6.4 Nutrient Management - Effluent Disposal

The main issue with effluent disposal in subdivisions such as this is the design and placement of the system to ensure that it works and provides adequate microbial purification and no nutrient export.

Phosphorous is the main nutrient implicated in algal blooms in waterways. Nitrates are normally removed by soil micro flora under anoxic conditions and are taken up by vegetation, denitrified by bacteria under anoxic soil conditions or lost through volatilisation of ammonia.

When there is insufficient depth to clay for microbial material to be inactivated by soil micro-organisms waste water may pose a health risk. Water and Rivers prefers conventional septic systems to be set back 100 metres, with 50 metres for alternative waste water systems. The dry soils high in the landscape, the fact that the gullies only flow after rain and contain small amounts of water only when the soils are saturated in winter, together the soil types indicate that these distances may be excessive and half may be more appropriate at this site.

Laterite duricrust, gravel and yellow sands have high phosphate absorbing qualities based on the level of sesquioxides, with retention indices (PRI) of greater than 20 being common.

Soils in the western half are capable of supporting conventional effluent disposal systems. In the eastern half only small areas are suitable for conventional septic systems and this is dependant on adequate buffers being available to the gullies. Close to the gullies alternative waste water systems will be required and adjacent to the gullies and on the breakaway slope there should be no waste water disposal. See map "Capability for Dwellings on Small Holdings" and 6.4 Nutrient Management - Effluent Disposal.

The permeability of clay subsoils may need to be determined for the loam over clay soils in the eastern half when installing conventional septic systems. These systems may need to be semi-inverted on sloping sites provided they are bunded by natural soil.

Nutrient Loadings

Estimations of the impact of the nutrient loading can only be made based on denitrification, volatilisation of ammonia, recycling, uptake by vegetation and phosphate absorption by sesquioxides.

The greatest input of phosphorous will come from fertiliser application on gardens and waste water systems.

A typical conventional septic system releases 5.5 kg P year and 18 kg N/year. However allowing for six chickens, a dog and cat and a 250 m² area of fertilised horticulture, a further loading of 12.3 kg N/year and 5.2 kg P/year can be added for the dwelling area. (Data from Select Committee on Metropolitan Development and Groundwater Supplies, Legislative Assembly 1994 and Nitrate management in the Jandakot UWPCA, Dames and Moore, undated). Note alternative waste water treatment systems are assumed to adsorb all phosphorous on amended soils and reduce nitrates by half through denitrification.

Perhaps the most researched field data is shown in the following publications. Gerritse R G and J A Adeney, *Nutrient export from various land uses on the Darling Plateau in Western Australia CSIRO Report 92/41*, found that in a residential sub catchment with 2 000 m² lots only 5% of nitrogen is exported to stream flow and that phosphate concentrations are "low and barely affected by land use and only marginally higher in streams in sub catchments dominated by orchards". Gerritse et al, found that the impact of septic systems in similar soils to be low and that nutrients were retained within a few metres, (Gerritse et al, 1995, *Retention of Nitrate and Phosphate in Soils of the Darling Plateau in Western Australia: Implications for Domestic Septic Tank Systems*, Aust. J. Soil Res. 33, 353-67.)

Typical nutrient loadings that can be expected from the various soil types

Soil type	Possible lot size and activity	Nitrogen loading per hectare	Phosphorous loading per hectare	Likely nutrient scenario
Yellow and leached sands, gravel and sandy loam over clay	0.5 ha with conventional septic system.	60.6 kg/N/ha/year	21.4 kg/P/ha/year	Unlikely to be nutrient export
	0.5 ha with alternative waste water treatment system.	24.6 kg/N/ha/year	16 kg/P/ha/year	Unlikely to be nutrient export
	0.25 ha with conventional septic system.	121.2 kg/N/ha/year	42.4 kg/ha/year	Unlikely to be nutrient export.

The impact of nutrients from effluent disposal systems is low considering the structure and composition of the soil profiles.

	ENVIRONMENTAL FACTOR	MANAGEMENT
6.4.1	Effluent disposal	<ul style="list-style-type: none"> The sandy soils are well suited to conventional septic systems The permeability of clay subsoils under loams in the south east may need to be established prior to the installation of conventional septic systems. Lot sizes should increase towards the east. There should be no more than one effluent disposal unit per lot. Conventional septic systems are recommended to be set back 50 metres and alternative waste water disposal systems are recommended to be set back 25 metres from the gullies.
6.4.2	Land use and stocking	<ul style="list-style-type: none"> Stock should not be permitted.

6.5 Drainage, Salinity and Flood Risk

All areas are well drained.

There is potential for increases in salinity of the soaks if the plateau remnant to the north or breakaway slope is cleared. The existing small saline scar at the dam is naturalised and should be left.

The only risk of flooding is from storm events, within drainage lines.

	ENVIRONMENTAL FACTOR	MANAGEMENT
6.5.1.	Potential flooding	<ul style="list-style-type: none"> The only risk of flooding is from storm events, within drainage lines. Development should be restricted by 50 metre setback from Rocky Creek.
6.5.2	Salinity	<ul style="list-style-type: none"> No action required apart from clearing restrictions.

6.6 Mature Trees

The large trees have heritage value and are important as fauna habitats and nesting sites and should be protected. However building envelopes should be located at sufficient distance to ensure dwellings are not subjected to risk associated with falling limbs or trees blown over.

	ENVIRONMENTAL ISSUE	MANAGEMENT
6.6.1.	Mature trees	<ul style="list-style-type: none"> Developments should be located at sufficient distance to ensure dwellings are not subjected to risk associated with falling limbs or trees blown over.

6.7 Wind and Water Erosion

The potential for wind erosion is high if the leached sands in the west are cleared without adequate protection being established. These areas should be cleared sympathetically and where possible all trees retained. Potential water erosion could occur on the steeper eastern slopes, and care is needed in the establishment of firebreaks and access.

The current firebreaks should be maintained as they exist and generally are not being eroded excessively apart from the eastern boundary.

	ENVIRONMENTAL ISSUE	MANAGEMENT
6.7.1	Soil erosion	<ul style="list-style-type: none"> • There should be no clearing of the breakaway slopes. • Adequate vegetation cover must be maintained on all soils throughout the year. • Firebreaks should continue to be located in their present position where possible and altered as necessary to minimise runoff and erosion. • Developments in the sandy soils should be conducted to EPA Guidelines "Land development sites and impacts on air quality" 1996.

6.8 Fire Control

Fire Control falls under the Bush Fires Control Act (as amended) and the Shire of Swan.

Fire management will depend on lot sizes and permitted land uses. Fire risk is normally reduced through subdivision design, reduction in fuel by burning off, the design and maintenance of strategic firebreaks, the availability of machinery and water to fight fires and the provision of emergency escapes.

The fire risk to property will increase following subdivision so it is important that the risk is minimised. The existing dam could be retained as a water source for fire fighting as it will be near remnant vegetation Community A. The roads and existing firebreaks will act as firebreaks, with a wide firebreak along the southern side adjoining the cleared pasture.

	ENVIRONMENTAL FACTOR	MANAGEMENT
6.8.1	Fire Risk	<ul style="list-style-type: none"> • Increased access and water points will assist fire reduction risk. • The roads will act as fire breaks. • A fire break should be maintained along the southern boundary of the site adjacent to the pasture. • Existing firebreaks should be modified into multiuse paths, which can double as firebreaks.

6.9 Social Impact

Social impact of the proposed sub division will be minimal but will be positive by bringing additional people to Bullsbrook or providing alternative lifestyle opportunities.

The existing firebreak through the centre of the property, running to the north eastern corner at Burley Park, can form a multiuse pathway as a firebreak, emergency access and bridle/walking trail leading along the stream from Bullsbrook to Burley Park and the equestrian properties in Smith Road. This will be very positive for the community because it will allow horses to access Bullsbrook without using Chittering Road.

	ENVIRONMENTAL FACTOR	MANAGEMENT
6.9.1	Bridle/walking trail	<ul style="list-style-type: none">A bridle/walking rail can be incorporated into any subdivision linking Burley Park to Bullsbrook along existing firebreaks which can serve as multi use paths.

7.0 CONCLUSIONS

Part Lot M857 contains areas of significant natural vegetation that have high conservation value. These are in the east of the site and could be protected by restricting development in the east and allowing development in the western half. Lot sizes could range from small lots of perhaps 0.4 ha in the west, with some larger lots adjacent to any remnant vegetation retained.

The site has been inadvertently classified as Burley Park by past researchers and this may have overstated the conservation value of nominated Community Types B and C in the western parts of the site, which reduce in species richness and vegetation quality towards the west. Data from researchers who believed that Part Lot M857 was Burley Park, was included in material prepared for the National Heritage Commission and Heritage Council of Western Australia.

Even so there is an opportunity for a compromise to protect the vegetation of high conservation value in the east, which coincides with an aboriginal ethnographic site and steeply sloping potentially unstable soils, whilst at the same time allowing some developments on suitable soils in the west where vegetation is of lesser quality and significance. Vegetation retention must be the priority and should be covenanted in the eastern half of the site.

Soils are suitable for development in the central and western parts of the site with several selected suitable sites in the south east. Any environmental issues identified can be managed through subdivision design and conditions as shown under the Environmental Management section.

There is also an opportunity to develop an existing firebreak into a bridle/walking trail to link between Bullsbrook and Burley Park through vegetation not normally available to members of the public.

Considering the site in terms of aesthetics and land capability, this site is capable of sustaining small lots from perhaps 0.4 hectares or less on the western portion, increasing to the east adjacent to remnant vegetation that could be preserved. There is potential for restricted development of the eastern half as one or possibly two very large lots in private ownership provided the vegetation is protected by Conservation Covenants or Agreements to Reserve. It is also possible for portion of the eastern part of the site be added to Burley Park, provided management is better than the previous management of Burley Park.

Lindsay Stephens

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Soil Characteristics	Laterite Duricrust/Gravel	Gravel	Leached Sand	Loam over Clay	Sandy Loam over Clay	Ferruginous Sandstone
Location	On the higher elevations and low ridges	Upper slopes and breakaway	Western area	Eastern half	Central north	Lower slopes in the east
Topsoil Texture	Yellow brown gravel and duricrust	Gravel	Grey quartz sand and yellow sand	Cream - pink - brown loam	Yellow sand to sandy loam	Ferruginous coarse sandstone and conglomerate with sandy loam
Subsoil Texture	Yellow brown gravel and duricrust over loam-clays at depth	Lighter loam and sandy loam over mottled clays at depth	Pale yellow to yellow sand and gravel	Light coloured clay	Light coloured sandy loam - clay	Mottled bedded clay
Stone	Duricrust a major component of ridge tops	Minor	Nil - minor	Minor	Minor	Major component
Gravel	Major component	Common in upper soil horizons	Minor	Minor	Minor	Minor to Major
Depth to Bedrock	Estimated >6 metres	Estimated >4 metres	Estimated >3 metres,	>3 metres	>3 metres	1- 2 metres
Hardpan	Duricrust	Unlikely	Minor traffic hardpans possible	Possible	Minor	Surface rock
pH	Acidic to neutral	Acidic to neutral	Acidic to neutral	Acidic to neutral	Acidic to neutral	Acidic to neutral
Salinity	Low	Low	Low	Low but some occurs in soaks	Low	Low
Soil Permeability	High	Good in gravel and friable subsoils	High	Moderate, reducing with depth	High but reducing in the sub-soils	High, but reducing in underlying sedimentary clay
Soil Shrinkage	Nil	Low	Low	Low to moderate	Low	Low

Land Qualities	Laterite Duricrust/Gravel	Gravel	Leached Sand	Loam over Clay	Sandy Loam over Clay	Ferruginous Sandstone
Slope	Low	Moderate	Gentle to moderate	Low to steep	Moderate to steep	Low to moderate
Slope Stability	High	High	High	Very low to moderate	Moderate to low	High
Rock/Gravel	Common	Common	Nil - low	Minor	Common	Major
Wind Erosion Risk	Low	Low	Moderate to high	Nil	Low	Nil
Water Erosion Risk	Low	Moderate	Low - moderate	High	High	Low
Drainage	Well drained	Well drained	Well drained	Good	Good	Good
Moisture Availability	Very low	Moderate	Low	Moderate	Moderate	Low
Water Logging	Nil	Nil	Nil	Nil apart from stream line	Nil	Nil
Wetability	Moderate	May be non wetting	Non wetting	Potentially non wetting on upper slopes	Potentially non wetting	Sometimes non wetting
Flood Risk	Nil	Nil	Nil	Nil, only in drainage lines	Nil	Nil
Surface Water - Availability/Quality	Nil	Very low	Nil	Low - moderate, elevated salinity	Nil	Nil
Ground Water - Availability/Quality	Nil	Very low	Nil with minor potential on lower slopes	Nil - low	Nil	Nil
Salinity Risk	Low	Low	Low	Low to moderate on lower slopes	Low	Low
Microbial Purification	Moderate	Moderate - high	Moderate - high	Moderate to low	Moderate to high	Low - moderate
Water Pollution Risk	Low	Low	Low	Moderate	Moderate	Moderate
Soil Profile; Phosphate absorption	High based on the proportion of iron oxides and depth of soils	High based on sesqui-oxide content	High based on clay content	High based on clay and sesqui-oxides	High based on clay and sesqui-oxides	Moderate - high based sesqui-oxides
Soil Profile; Nitrogen Removal	Low to moderate depending on the degree of anoxic conditions	Moderate depending on the degree of anoxic conditions	Low to moderate depending on the degree of anoxic conditions	Moderate depending on the degree of anoxic conditions and speed of run off	Moderate depending on the degree of anoxic conditions and speed of run off	Moderate depending on the degree of anoxic conditions and speed of run off
Existing Degradation	Moderate - high	Low - moderate	Moderate to high due to clearing, fire and weeds	Low	Low	Low

Agricultural Capability	Laterite Duricrust/Gravel	Gravel	Leached Sand	Loam over Clay	Sandy Loam over Clay	Ferruginous Sandstone
Soil workability/trafficability	Very low	Moderate	Moderate to high	Low, steep slopes, erosion potential	Low, steep slopes, erosion potential	Very low
Rooting Conditions	Very low	Moderate	High	Moderate	Moderate	Low
Grazing	Very low	Moderte	Low, wind erosion	Low - steep slopes and erosion potential	Low - steep slopes and erosion potential	Low
Grain/hay crops	Very low	Moderate	Low - moderate depending on degree of leaching	Very low - steep slopes and erosion potential	Very low - steep slopes and erosion potential	Very low
Annual Horticulture	Very low	Low	Low	Very low in most areas	Very low	Very low
Perennial Horticulture	Very low	Low, lack of water	Low, lack of water	Very low in most areas	Low to moderate, lack of water	Low
Irrigated Activities	Very low	Low, lack of water	Low, lack of water	Very low in most areas	Very low	Very low

APPENDIX 1

Sample Plots - Community A

Species	Plants /10 m ²	Plants /10 m ²	Average /10m ²
<i>Hakea undulata</i>	6	3	4.5
<i>Hakea lasianthoides</i>	7	2	4.5
<i>Hibbertia lasiopus</i>	12	3	7.5
<i>Lasiopetalum floribundum</i>	9	12	10.5
<i>Hovea chorizemifolia</i>	5	1	3.0
<i>Astroloma ciliatum</i>	6	5	5.5
<i>Boronia ovata</i>	2	2	2
<i>Hakea lissocarpha</i>	1	1	1
<i>Stylidium amoenum</i>	1	2	1.5
<i>Gompholobium knightianum</i>	2	-	1
<i>Acacia pulchella</i>	1	-	0.5
<i>Drosera pallida</i>	1	-	0.5
<i>Xanthorrhoea gracilis</i>	1	-	0.5
<i>Lepidosperma longitudinale</i>	3	-	1.5
<i>Kunzea recurva</i>	1	5	3.0
<i>Hibbertia hypericoides</i>	1	9	5.0
<i>Brachysema praemorsa</i>	7	7	7
<i>Eucalyptus accedens</i>	1	-	0.5
<i>Petrophile striata</i>	-	5	2.5
<i>Xanthorrhoea preissii</i>	-	3	1.5
<i>Thomasia foliosa</i>	-	4	2.0
<i>Dryandra armata</i>	-	3	1.5
<i>Cassytha sp</i>	-	3	1.5
Species Richness	18	17	17.5 /10m ²
Plant density	67 /10m ²	70 /10m ²	6.9 /m ²
Cover			
Trees	40 %	5 %	23 %
Shrubs > 1 m	40 %	10 %	25 %
Shrubs < 1 m and groundcover	90 %	70 %	80 %

Sample Plots - Community C

Species	Plants /10 m ²	Plants /10 m ²	Average /10m ²
<i>Scaevola canescens</i>	2	-	
<i>Hibbertia hypericoides</i>	2	7	
<i>Dryandra lindleyana</i>	16 #	30 #	
<i>Bossiaea eriocarpa</i>	3	3	
<i>Haemodorum laxum</i>	6	1	
<i>Calothamnus quadrifidus</i>	2	2	
<i>Podotheca angustifolia</i>	30	4	
<i>Sowerbaea laxiflora</i>	3	2	
<i>Burdettia nigricans</i>	15	-	
<i>Patersonia juncea</i>	-	2	
<i>Xanthorrhoea gracilis</i>	-	1	
<i>Burchardia multiflora</i>	-	2	
<i>Jacksonia sternbergiana</i>	-	1	
Species Richness (perennial)	7	8	7.5 /10m ²
Plant density (perennial)	3.1 /10m ² #	4.7 /10m ² #	3.9 /m ² #
Cover			
Trees			5 %
Shrubs > 1 m			7 %
Shrubs < 1 m and groundcover			25 %

Dryandra lindleyana has many stems probably from the same rootstock. The true number of plants will be much lower.

APPENDIX 2

Keighly + Inigo, 1992
Keighly 1993

SPECIES LIST FOR PART LOT M857, BURLEY ROAD, BULLSBROOK

Family	Genus	Species	#	Sig	species
Adiantaceae	# Cheilanthes	1 austrotenuifolius			
Amaranthaceae	Ptilotus	2 mangesii			2 Ptil. marginata
Anthericaceae	Caesia	3 parviflora			
Anthericaceae	Chamaescilla	4 corymbosa			
Anthericaceae	Laxmannia	5 squarrosa			
Anthericaceae	Sowerbaea	6 Laxiflora			
Anthericaceae	Thysanotus	7 dichotomus			
Anthericaceae	Thysanotus	8 manglesianus			
Anthericaceae	Thysanotus	9 multiflorus			
Apiaceae	Eryngium	10 pinnatifidum subsp. pinnatifidum			
Apiaceae	Xanthosia	1 candida			
Asteraceae	# Craspedia	2 variabilis			
Asteraceae	Hyalosperma	3 cotula			
*Asteraceae	1 *Hypochaeris	glabra			
Asteraceae	Podotheca	4 angustifolia			
Asteraceae	2 * Taraxacum	officinale			unlikely
*Asteraceae	3 * Ursinia	anthemoides			
Asteraceae	Waitzia	5 suaveolens			
Casuarinaceae	Allocasuarina	6 humilis			
Colchicaceae	Burchardia	7 congesta			
Colchicaceae	Burchardia	8 multiflora			
Cyperaceae	Lepidosperma	9 angustatum			3 Cyath. ovatum
Cyperaceae	Lepidosperma	20 longitudinale			4 Cochlos. ...
Cyperaceae	# Mesomelaena	1 tetragona			5 Moso pseudostyria
Cyperaceae	Tetraria	2 octandra			
Dasyopogonaceae	Dasyopogon	3 bromeliifolius			
Dasyopogonaceae	Lomandra	4 spp.			
Dilleniaceae	Hibbertia	5 amplexicaulis			6 Hibb. spicata
Dilleniaceae	Hibbertia	6 commutata			
Dilleniaceae	Hibbertia	7 huegelii			
Dilleniaceae	Hibbertia	8 hypericoides			
Dilleniaceae	Hibbertia	9 lasiopus			
Droseraceae	Drosera	30 erythrorhiza			
Droseraceae	Drosera	1 glanduligera			
Droseraceae	Drosera	2 pallida			
Epacridaceae	Astroloma	3 ciliatum			7 A. microdonta
Epacridaceae	Astroloma	4 pallidum			8 macrocalyx
Epacridaceae	Conostephium	5 pendulum			9 Andersonia lehmanniana
Epacridaceae	Leucopogon	6 gracillimus			50 Conosteph. preissii
Epacridaceae	Leucopogon	7 propinquus			
Euphorbiaceae	Phyllanthus	8 calycinus			1 Styptelic. kruitbolii
Goodeniaceae	Dampiera	9 alata			
Goodeniaceae	Dampiera	40 linearis			
Goodeniaceae	Lechenaultia	1 biloba			

Goodeniaceae	2	Scaevola	canescens
Haemodoraceae	3	Anigozanthos	humilis
Haemodoraceae	4	Anigozanthos	manglesii
Haemodoraceae	5	Conostylis	aculeata
Haemodoraceae	6	Conostylis	setigera
Haemodoraceae	7	Conostylis	setosa
Haemodoraceae	8	Haemodorum	laxum
Haloragaceae	9	Glischrocaryon	aureum
Iridaceae	4	Gladiolus	caryophyllaceus
Iridaceae	60	Patersonia	juncea
Juncaeae	1	Juncus	pallidus
Lauraceae	2	Cassythia	sp.
Lobeliaceae	3	Lobelia	gibbosa
Lobeliaceae	4	Lobelia	rhombifolia
Loranthaceae	5	Nuytsia	floribunda
Mimosaceae	6	Acacia	alata
Mimosaceae	7	Acacia	drummondii
Mimosaceae	8	Acacia	huegelii
Mimosaceae	9	Acacia	nervosa
Mimosaceae	70	Acacia	pulchella
Mimosaceae	1	Acacia	saligna
Mimosaceae	2	Acacia	teretifolia
Mimosaceae	3	Acacia	willdonoweana
Myrtaceae	4	Baeckea	camphorosmae (or sp. B)
Myrtaceae	5	Calothamnus	quadrifidus
Myrtaceae	6	Calytrix	angulata
Myrtaceae	7	Corymbia	calophylla
Myrtaceae	8	Eucalyptus	accedens
Myrtaceae	9	Eucalyptus	marginata
Myrtaceae	80	Eucalyptus	wandoo
Myrtaceae	1	Hypocalymma	angustifolium
Myrtaceae	2	Kunzea	recurva
Myrtaceae	3	Leptospermum	erubescens
Myrtaceae	4	Melaleuca	scabra
Myrtaceae	5	Verticordia	acerosa
Orchidaceae	6	Burnettia	nigricans
Orchidaceae	7	Caladenia	discoidea
Orchidaceae	8	Caladenia	flava
Orchidaceae	9	Caladenia	gemmata
Orchidaceae	70	Caladenia	marginata
Orchidaceae	1	Cyanicula	sericea
Orchidaceae	2	Diuris	corymbosa
Orchidaceae	3	Prasopphyllum	elatum
Orchidaceae	4	Thelymitra	crinita
Oxalidaceae	5	Oxalis	glabra
Papilionaceae	6	Bossiaea	eriocarpa
Papilionaceae	7	Bossiaea	ornata
Papilionaceae	8	Brachysema	praemorsa
Papilionaceae	9	Chorizema	dicksonii
Papilionaceae	9	Davesia	cordata

hom. sericea
Gono. pithy

Lob tenuior

Papilionaceae	100	Davesia	decurrens
Papilionaceae	1	Davesia	physodes
Papilionaceae	2	Davesia	preissii
Papilionaceae	3	Davesia	triflora
Papilionaceae	4	Gastrolobium	spinosum
Papilionaceae	5	Gompholobium	knightianum
Papilionaceae	6	Gompholobium	tomentosum
Papilionaceae	7	Hovea	chorizemifolia
Papilionaceae	8	Hovea	trisperma
Papilionaceae	9	Isotropis	cuneifolius
Papilionaceae	110	Jacksonia	sternbergiana
Papilionaceae	1	Kennedia	coccinea
Papilionaceae	2	Kennedia	prostrata
Papilionaceae	3	Pultenaea	ericifolia
Papilionaceae	4	Sphaerolobium	vimineum
Papilionaceae	5	Viminaria	juncea
Philydraceae	6	Philydrella	pygmaea
Phormiaceae	7	Dianella	revoluta
Pittosporaceae	8	Cheiranthra	preissianus
*Poaceae	9	Briza	maxima
*Poaceae	10	Briza	minor
Poaceae	11	Neurachne	alopecuroidea
Poaceae	120	Stipa	sp.
Polygalaceae	1	Comesperma	calymega
*Primulaceae	8	*Anagalis	arvensis
Proteaceae	9	Adenanthos	barbiger
Proteaceae	3	Adenanthos	cygnorum
Proteaceae	4	Banksia	attenuata
Proteaceae	5	Banksia	grandis
Proteaceae	6	Banksia	menziesii
Proteaceae	7	Dryandra	armata
Proteaceae	8	Dryandra	bipinnatifida
Proteaceae	9	Dryandra	lindleyana
Proteaceae	130	Dryandra	sessilis
Proteaceae	1	Grevillea	pilulifera
Proteaceae	2	Grevillea	synapheae
Proteaceae	3	Hakea	auriculata
Proteaceae	4	Hakea	lasianthoides = sp. Wolganj
Proteaceae	5	Hakea	lissocarpa
Proteaceae	6	Hakea	ruscifolia
Proteaceae	7	Hakea	undulata
Proteaceae	8	Lambertia	multiflora
Proteaceae	9	Petrophile	biloba
Proteaceae	100	Petrophile	linearis
Proteaceae	1	Petrophile	striata
Proteaceae	2	Stirlingia	latifolia
Proteaceae	3	Synaphea	spinulosa
Restionaceae	4	Loxocarya	flexuosa
Rubiaceae	5	-Opercularia	echinocephala
Rutaceae	6	Boronia	ovata

1 c. polymorphum

8 *Danthonia*
 * *Emmenanthe calycina*
 * *Eragrostis cuneata*

9 *Parsoonia sancta*

150
 1 *Mex. nitens*
 1 *Hyg. esulata*
 2 *Hyg. babaha*
 3 *Lepid. preissianus*

Rutaceae	4	Eriostemon	spicatus	
Stackhousiaceae	3	Stackhousia	monogyna	
Sterculiaceae	6	Lasiopetalum	floribundum	
Sterculiaceae	7	Thomasia	foliosa	
Stylidiaceae	8	Stylidium	amoenum	6 Stylid. dioecious
Stylidiaceae	9	Stylidium	hispidum	
Thymeleaceae	160	Pimelea	suaveolens	
Tremandraceae	1	Tetratheca	hirsuta	
Violaceae	2	Hybanthus	calycinus	
Xanthorrhoeaceae	3	Xanthorrhoea	acanthostachya	
Xanthorrhoeaceae		Xanthorrhoea	gracilis	
Xanthorrhoeaceae	4	Xanthorrhoea	preissii	
Zamiaceae	5	Macrozamia	riedlei	

166
+ 3 (err p²)
170 = $\frac{169}{170}$ Native trees
10 = 278 Weeds

+ Myrtaceae

Jeff Lewis BSc (Hons. Botany)

Field collection 20 and 28 September 1998

27-NOV-98

Threatened Flora Species Summary

Species: *Acacia anomala*

Common Name: _____ Flowering Period: _____

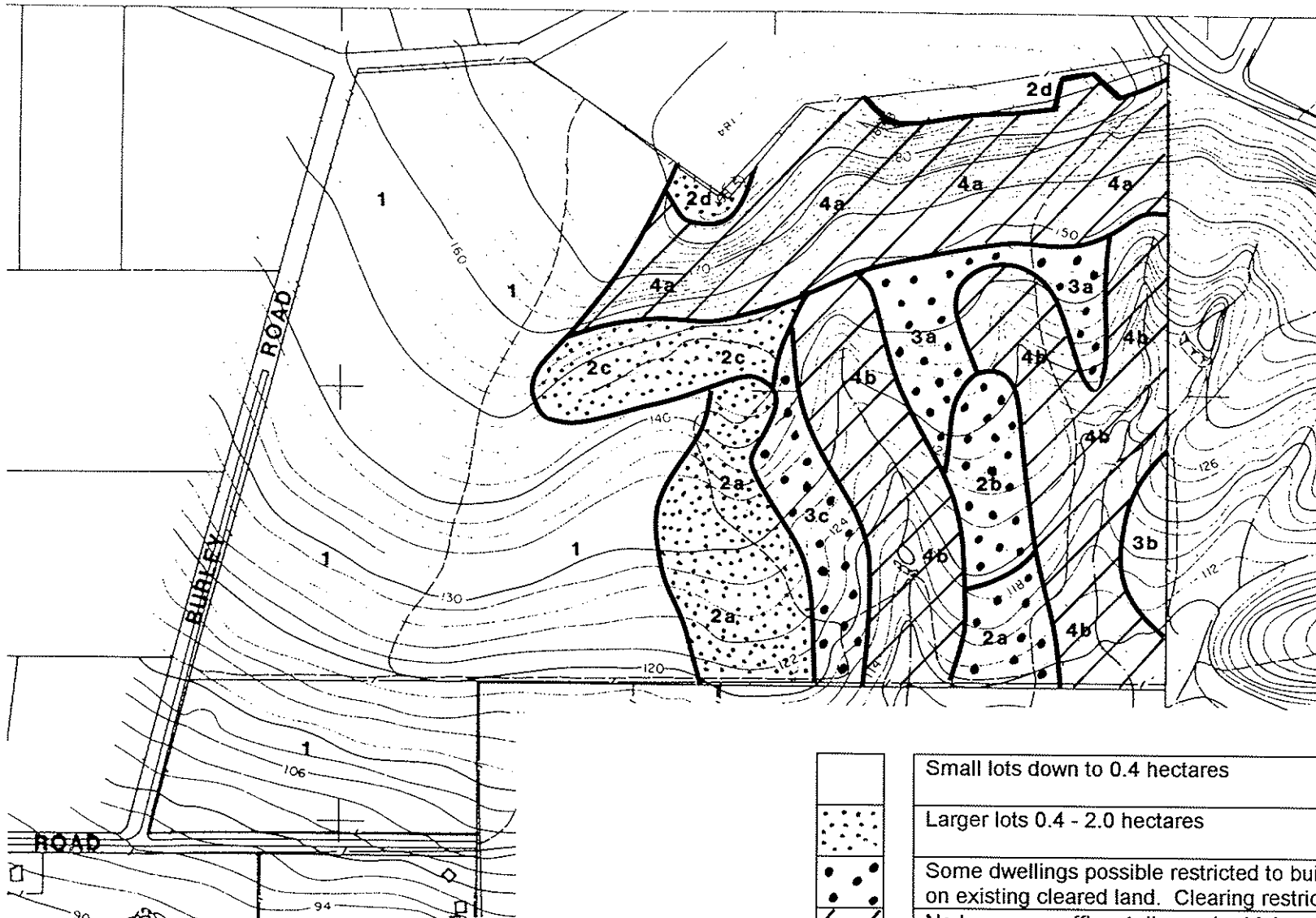
Photos: _____ Description: _____ Line Drawing: _____

Pop ID	District	Location	Vesting	Purpose	No. Plants	Last Inspect	Notific
1A	Mundaring	NE cnr Loc M857 80-100m NSW of Smith Rd & 10-40m S of adj Lot 3 fence	PRI	OTH		28-AUG-91	L/O Vis
1B	Mundaring	NE cnr Loc M857 280-300m NSW of Smith Rd & 18m S of adj Lot 3 fence	PRI	OTH		18-AUG-92	L/O Vis

27/11 '98 FRI 14:09 FAX 08 9330278

CALM-WILDLIFE BRANCH

002



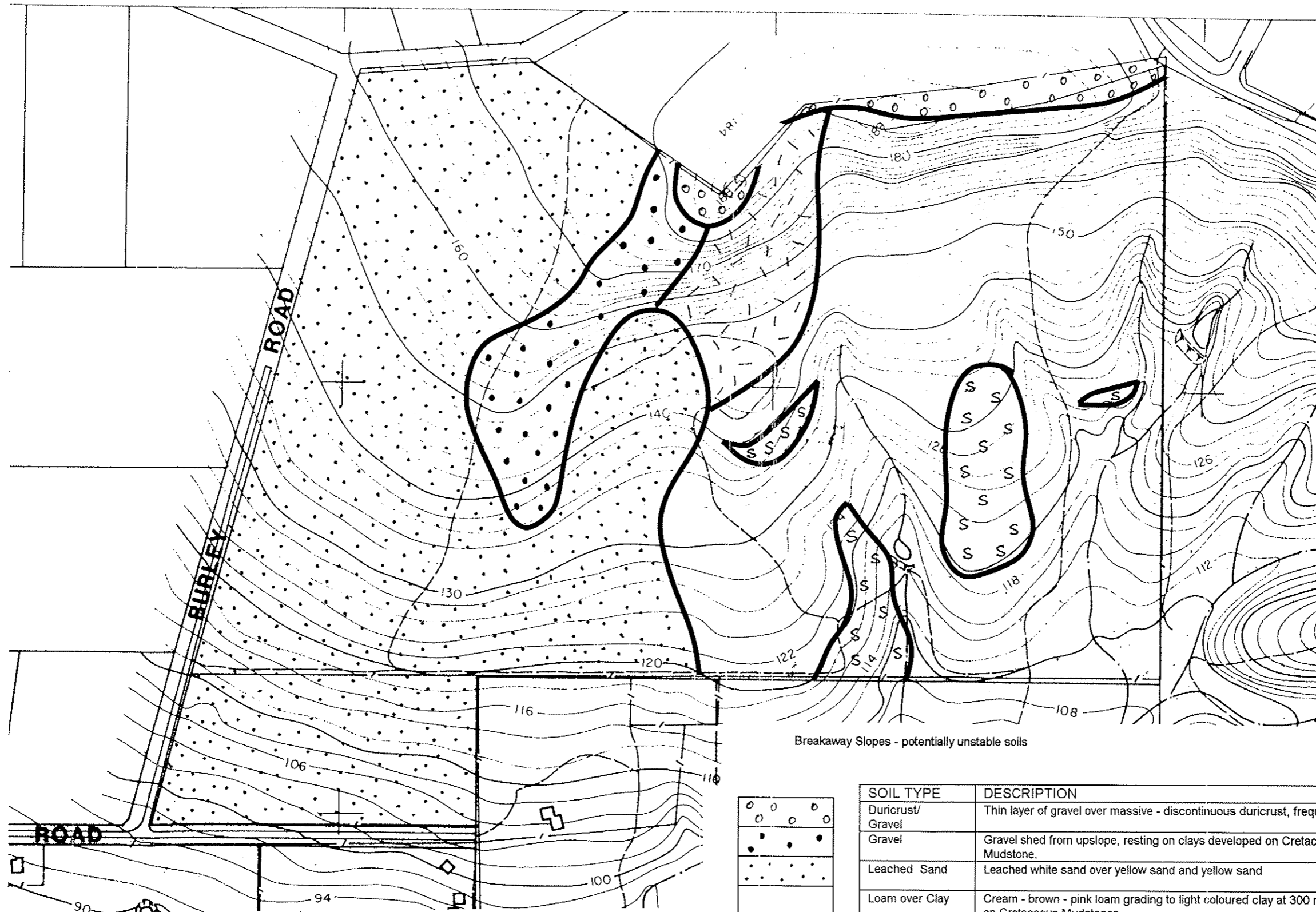
[Blank box]	Small lots down to 0.4 hectares
[Dotted pattern box]	Larger lots 0.4 - 2.0 hectares
[Diagonal lines box]	Some dwellings possible restricted to building envelopes on existing cleared land. Clearing restrictions
[Cross-hatched box]	No houses or effluent disposal; - high conservation and poor foundation conditions.

October 1998 Scale 1 : 4 000 (approx)

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 BSc - Geology, MSc - Botany
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LANDFORM RESEARCH
 Quarries - Land Systems

POTENTIAL LOT SIZES BASED ON LAND CAPABILITY

Pt Lot M 857, Burbey Road, Bullsbrook



Breakaway Slopes - potentially unstable soils

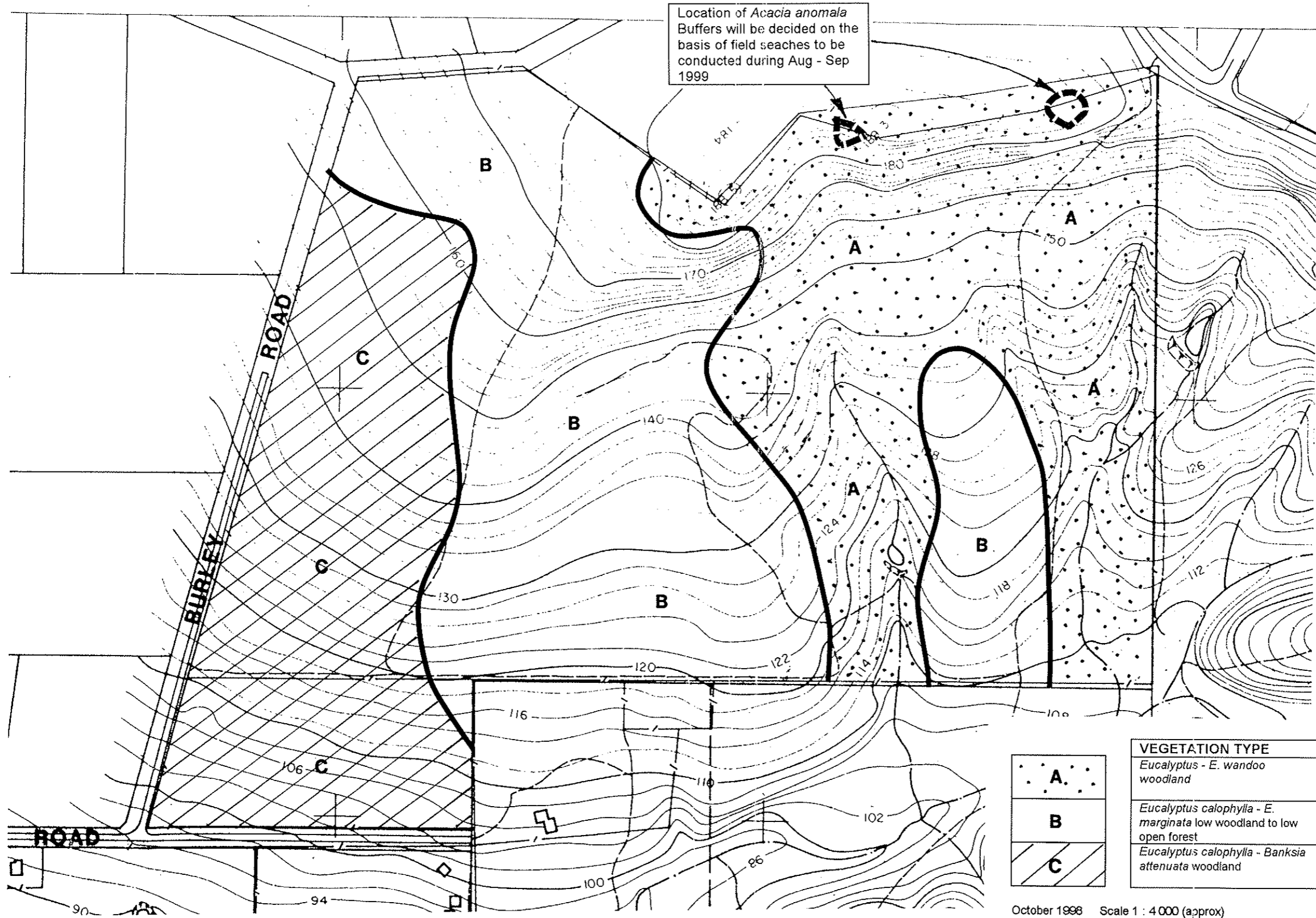
SOIL TYPE	DESCRIPTION
Duricrust/ Gravel	Thin layer of gravel over massive - discontinuous duricrust, frequent outcrop.
Gravel	Gravel shed from upslope, resting on clays developed on Cretaceous Mudstone.
Leached Sand	Leached white sand over yellow sand and yellow sand
Loam over Clay	Cream - brown - pink loam grading to light coloured clay at 300 mm developed on Cretaceous Mudstones.
Sandy Loam over Clay	Yellow sand - sandy loam over light coloured clay at depths of up to 1000 mm on Cretaceous Mudstones.
Ferruginous Sandstone	Ferruginous sandstone of alluvial terrace origin resting on Cretaceous Mudstones.

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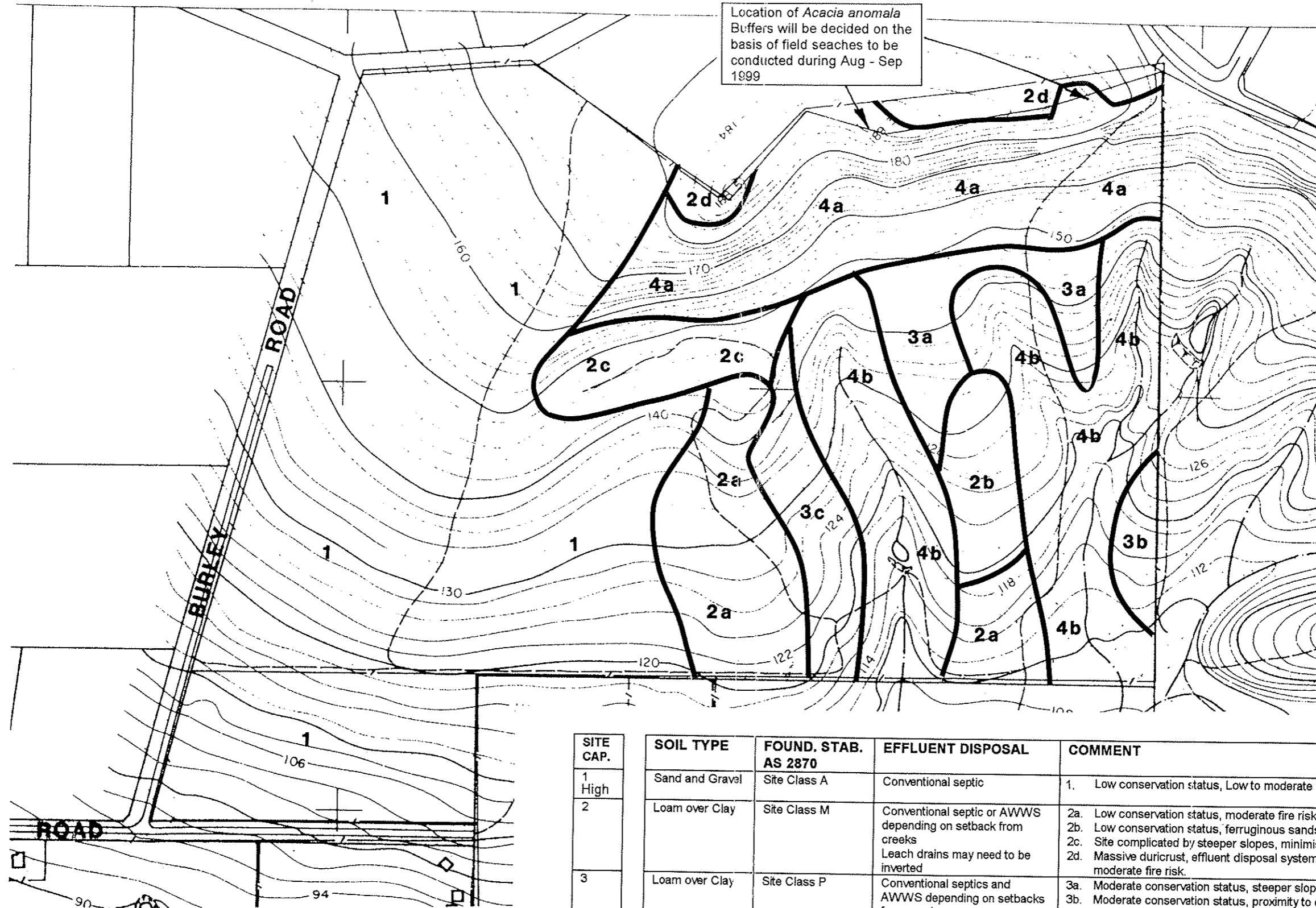
SOIL MAP

Pt M 857, Burley Road, Bullsbrook



VEGETATION MAP

Pt M 857, Burley Road, Bullsbrook



SITE CAP.	SOIL TYPE	FOUND. STAB. AS 2870	EFFLUENT DISPOSAL	COMMENT
1 High	Sand and Gravel	Site Class A	Conventional septic	1. Low conservation status, Low to moderate fire risk.
2	Loam over Clay	Site Class M	Conventional septic or AWWWS depending on setback from creeks Leach drains may need to be inverted	2a. Low conservation status, moderate fire risk 2b. Low conservation status, ferruginous sandstone will impede excavation, high fire risk. 2c. Site complicated by steeper slopes, minimise clearing, high fire risk. 2d. Massive duricrust, effluent disposal systems should be set back from breakaway, moderate fire risk.
3	Loam over Clay	Site Class P	Conventional septic and AWWWS depending on setbacks from creeks	3a. Moderate conservation status, steeper slopes, minimise clearing, high fire risk 3b. Moderate conservation status, proximity to creek, high fire risk. 3c. Moderate to high conservation values, high fire risk.
4 Low	Sand and Loam over Clay	Site Class P	Effluent disposal not recommended	4a. High conservation values, breakaway slope, unstable foundation conditions, clearing and development not recommended, high fire risk. 4b. High conservation value, unstable foundation conditions, adjacent to creek line, clearing and development not recommended, high fire risk

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CAPABILITY FOR DWELLINGS ON SMALL HOLDINGS

Pt M 857, Burley Road, Bullsbrook