

FLYNN DRIVE BUSHLAND, NEERABUP

Boundary Definition: bushland (part taken to zoning)/management boundary (Part Site, part Lots 1, 2001 Flynn Dr, subject to Ministerial Condition No. 280, 21 August 1992.)

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 295

Area (ha): bushland 112.6

Map no. 21

Map sheet series ref. no. 2034-I SW

Other Names: not known

Local Authorities (Suburb): Shire of Wanneroo (Neerabup, Carramar, Cockman)

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)

Spearwood Dunes

Sands derived from Tamala Limestone (Qts: S7)

Lagoonal and Estuarine Deposits (within the Spearwood Dunes)

Lagoonal and Estuarine Deposits (Vasse) (Qhg: S4)

VEGETATION AND FLORA

Vegetation Complexes

Spearwood Dunes

Karrakatta Complex — Central and South

Cottesloe Complex — Central and South

Wetlands

Pinjar Complex

Floristic Community Types: *not sampled, types inferred

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau

22 *Banksia ilicifolia* woodlands

*23a Central *Banksia attenuata* — *B. menziesii* woodlands

Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes

*28 Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands

WETLANDS

Wetland Types: sumpland

Natural Wetland Groups

Bassendean Dunes

Pinjar (B.1)

Gnangara (B.2)

Wetland Management Objectives: Conservation (2ha)

Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated uplands, vegetated wetlands

Vegetation and Flora: limited survey (DEP 1996 (Pinj 12), DEP 1998, DEP 1999, part Site — Bowman Bishaw Gorham 1992b, WAWA 1995)

Structural Units: mapping (part Site — Bowman Bishaw Gorham 1992b, WAWA 1995)

Uplands — Sands derived from Tamala Limestone: Low Woodland to Low Open Forest dominated by *Banksia attenuata* and *B. menziesii* with scattered to co-dominant *Eucalyptus tottiana*, *E. marginata*, *Nuytsia floribunda* and *Allocasuarina fraseriana*; *Adenanthos cygnorum* Tall Closed Scrub to Tall Shrubland; *Hibbertia hypericoides*, *Daviesia triflora* and *Leucopogon conostephioides* Open to Closed Low Heath

Wetlands: not known

Scattered Native Plants: not assessed

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

Total Flora: not known

Significant Flora: *Conostephium minus* (4); *Boronia purdieana*

Fauna: Location for rare native bee (*Hylaeus globuliferus*) (Pawluk, Richard and Associates 1995)

Linkage: adjacent bushland to the north (Site 382, across road); part of a regionally significant fragmented bushland/wetland linkage (Part A, Map 7)

Other Special Attributes: recommended for protection in the study of City of Wanneroo bushland (Trudgen 1996)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

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

Recommendation: Part A: Site with Some Existing Protection; Existing Parks and Recreation Reserve. Part B: Strategic Negotiated Planning Solution. Part C: Other Government Land Mechanism. Part D: Urban Negotiated Planning Solution (see Table 3, Volume 1).

FLYNN DRIVE BUSHLAND, NEERABUP

Boundary Definition: bushland (part taken to zoning)/management boundary (Part Bushplan Site, part Lots 1, 2001 Flynn Dr, subject to Ministerial Condition No. 280, 21 August 1992.)

SECTION 1: CADASTRAL INFORMATION

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

Bushplan Site no. 295 **Map no.** 26, 27, 32 **Map sheet series ref. no.** 2034-I SW

Other Names: not known

Area (ha): total 118.1; bushland 112.6

Local Authorities (Suburb)

Zoning

Shire of Wanneroo (Neerabup, Carramar, Cockman)

MRS: Urban, Rural, Industrial, Parks and Recreation, Important Regional Roads

TPS: Landscape, Residential Development, Rural

Ownership Categories

State Government, Local Government, Private

Lot/Location/Reserve numbers (Purpose),

Street name

1, 2001, 2477 Flynn Dr; 4, 40, 41 Mather Dr; 505

Pederick Rd; 11598 Pinjar Rd

Crown Reserve

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VEGETATION AND FLORA

Vegetation Complexes

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Karrakatta Complex — Central and South

Cottesloe Complex — Central and South

Wetlands

Pinjar Complex

Floristic Community Types: *not sampled, types inferred

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Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated uplands, vegetated wetlands

Vegetation and Flora: limited survey (DEP 1996 (Pinj 0), 1998, part Bushplan Site — Bowman Bishaw Gorham 1992b, WAWA 1995)

Structural Units: mapping (part Bushplan Site — Bowman Bishaw Gorham 1992b, WAWA 1995)

Uplands - Sands derived from Tamala Limestone: Low Woodland to Low Open Forest dominated by *Banksia attenuata* and *B. menziesii* with scattered to co-dominant *Eucalyptus todtiana*, *E. marginata*, *Nuytsia floribunda* and *Allocasuarina fraseriana*; *Adenanthos cygnorum* Tall Closed Scrub to Tall Shrubland; *Hibbertia hypericoides*, *Daviesia triflora* and *Leucopogon conostephioides* Open to Closed Low Heath

Wetlands: no known information

Scattered Native Plants: not assessed

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

Total Flora: not known

Significant Flora: *Conostephium minus* (4); *Boronia purdieana*

Fauna: no systematic survey. Location for rare native bee (*Hylaeus globuliferus*) (Pawluck, Richard and Associates 1995)

Linkage: adjacent bushland to the north (BS382, across road), south and west; part of proposed Greenway 17 (Tingay, Alan & Associates 1997a); part of a regionally significant fragmented bushland/wetland linkage (Volume 2A, Map 8)

Other Special Attributes: recommended for protection in the study of City of Wanneroo bushland (Trudgen 1996).

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

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

Opportunities and/or Constraints

Opportunities: Bushplan Site/part Bushplan Site location of conservation category wetlands; under MRS Parks and Recreation Reservation and TPS Landscape Zoning, Planning Control Area No. 29, Crown Reserve








Constraints: private land; under MRS Urban Zoning, MRS Industrial Zoning, MRD regional road requirements

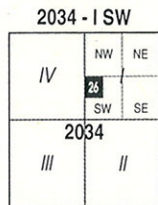
Recommendation: The most appropriate mechanism for the protection of this Bushplan Site be considered through the public comment period in consultation with the land owner(s). (Note: Part Bushplan Site, part Lots 1, 2001 Flynn Dr subject to Ministerial Condition No. 280, 21 August 1992.)





LEGEND

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



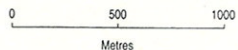
1 : 25 000 AMG Reference Grid showing Perth's Bushplan Map Sheet Breakdown

PERTH'S BUSHPLAN MAP INDEX

1	2										
3	4	5									
6	7	8	9	10	11						
12	13	14	15	16							
17	18	19	20	21	22	23					
24	25	26	27	28	29	30					
31	32	33	34	35	36						
37	38	39	40	41	42						
43	44	45	46	47	48						
49	50	51	52	53	54						
55	56	57	58	59							
60	61	62	63	64							
65	66	67	68	69	70						
71	72	73	74	75	76	77					
78	79	80	81	82	83	84					
85	86	87	88	89	90	91					
92	93	94	95	96	97						
98	99	100	101	102							
103	104	105	106								



SCALE

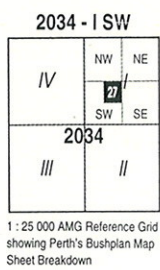


Produced by Project Mapping Section
 Land Information Branch, Ministry for Planning, Perth W.A. November 1998
 ntw-map11/environ/bushplan/bushv2_26.dgn
 Cadastral Data supplied by Department of Land Administration, W.A.
 Wetlands Data supplied by Water and Rivers Commission
 Native Vegetation Extent for Study Area supplied by Agriculture Western Australia



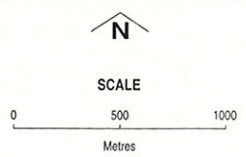
LEGEND

- 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



PERTH'S BUSHPLAN MAP INDEX

1	2					
3	4	5				
6	7	8	9	10	11	
12	13	14	15	16		
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	32	33	34	35	36	
37	38	39	40	41	42	
43	44	45	46	47	48	
49	50	51	52	53	54	
55	56	57	58	59		
60	61	62	63	64		
65	66	67	68	69	70	
71	72	73	74	75	76	77
78	79	80	81	82	83	84
85	86	87	88	89	90	91
92	93	94	95	96	97	
98	99	100	101	102		
103	104	105	106			



Produced by Project Mapping Section
 Land Information Branch, Ministry for
 Planning, Perth W.A. November 1998
 ntw-map11\environ\bushplan\bushv2_27.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

428

295

BUSHPLAN SITES CORRECTED



WESTERN
AUSTRALIAN
PLANNING
COMMISSION






B Bk/76 22/10/98



Bushplan site 295 Flynn Drive



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

DEB COULD PLEASE
HAVE THE CHECKPLOT
OF THIS

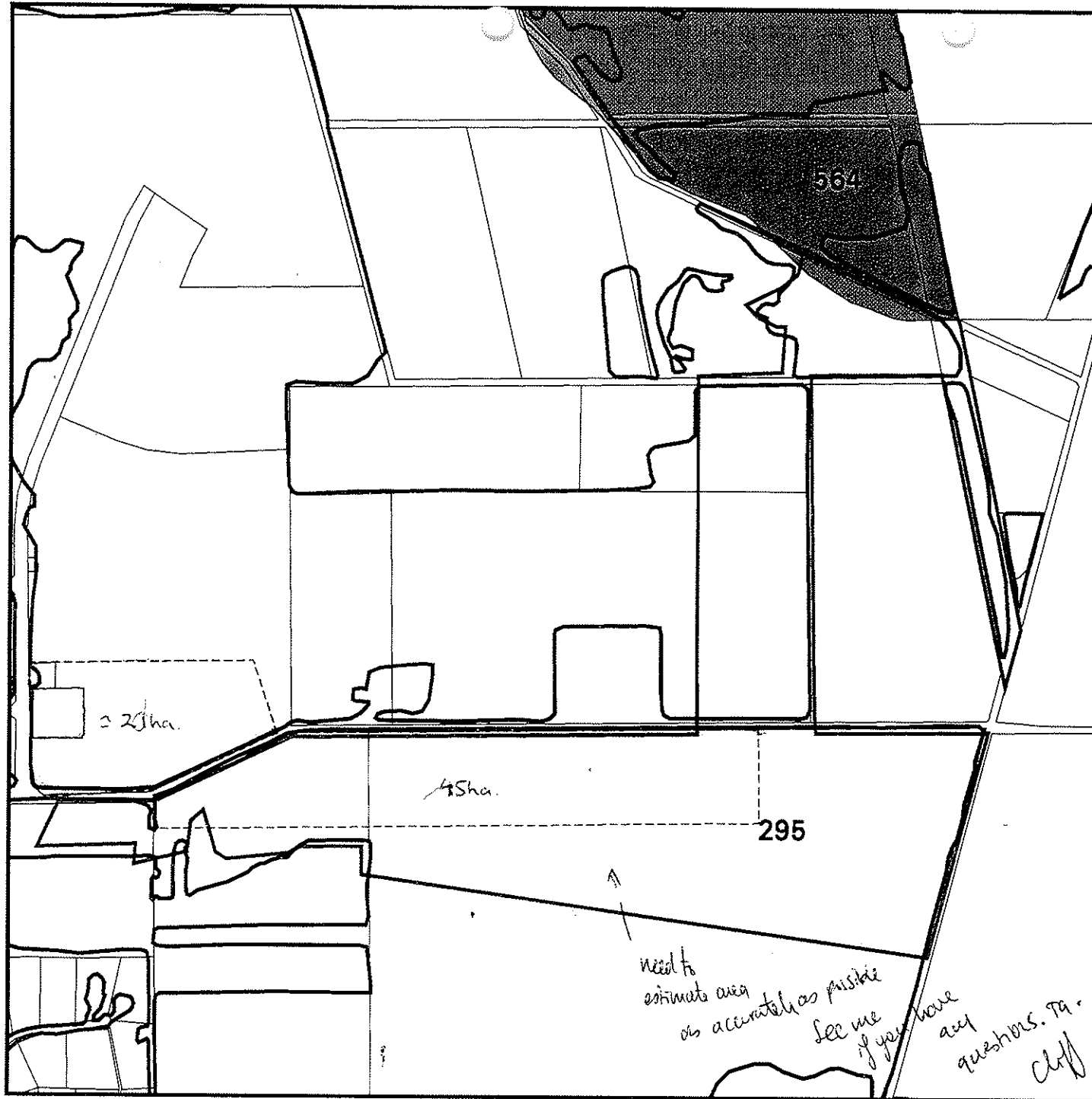
NOTE
TOP PORTION IN YELLOW
ARE ADDITIONAL LINE-
WORK CHANGES TO
AREA CALCULATIONS +
BOUNDARIES TO SOUTH






where does this line come
from, should it not follow
veg. NT/JA 2019

MFP INTERNAL USE ONLY
Prepared By: Andrea Zappacosta
Prepared For:
Map Ident: plot980729_2
Date: 29 Jul 98
Scale 1: 16864

7

bp site 295



-  Cadastre
-  Bushplan sites refno 1-500 SCP BOUNDARY
-  cons category wetlands
-  Verified CCWs
-  AG VEG 1998 BOUNDARY THEME

need to estimate area
as accurately as possible
see me if you have
any questions. TA.
cliff

MFP INTERNAL USE ONLY

Prepared By: Andrea Zappacosta

Prepared For:

Map Ident: plot980709_1

Date: 09 Jul 98

Scale 1: 16864

428

295

BUSHPLAN SITES CORRECTED

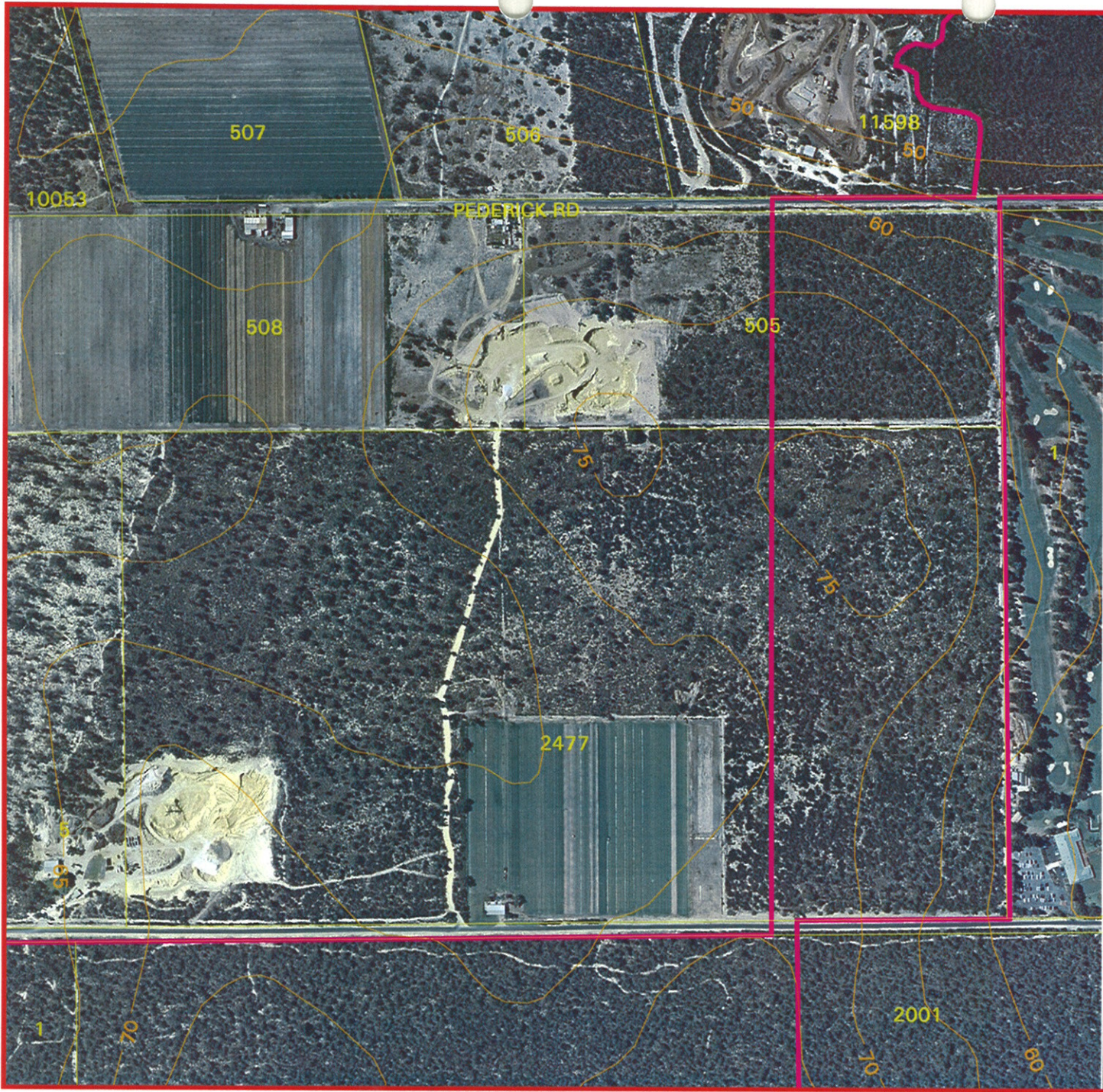


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AUSTRALIAN
PLANNING
COMMISSION



CUSTOMER
FOCUS
WESTERN AUSTRALIA





Bushplan Site 295

Lots 505 & 2477

Ortho-Rectified Aerial Image, Contours, Cadastre

- ▮ Bushplan Sites (boundaries)
- ▮ Cadastre with Lot Numbers
- ▮ Contours - 5m (DOLA)

Paul Sanders

MFP INTERNAL USE ONLY
Prepared By: Andrea Zappacosta
Prepared For: CATHERINE THOMSON
Map Ident: plot991123_1
Date: 23 Nov 1999
Scale 1: 8000

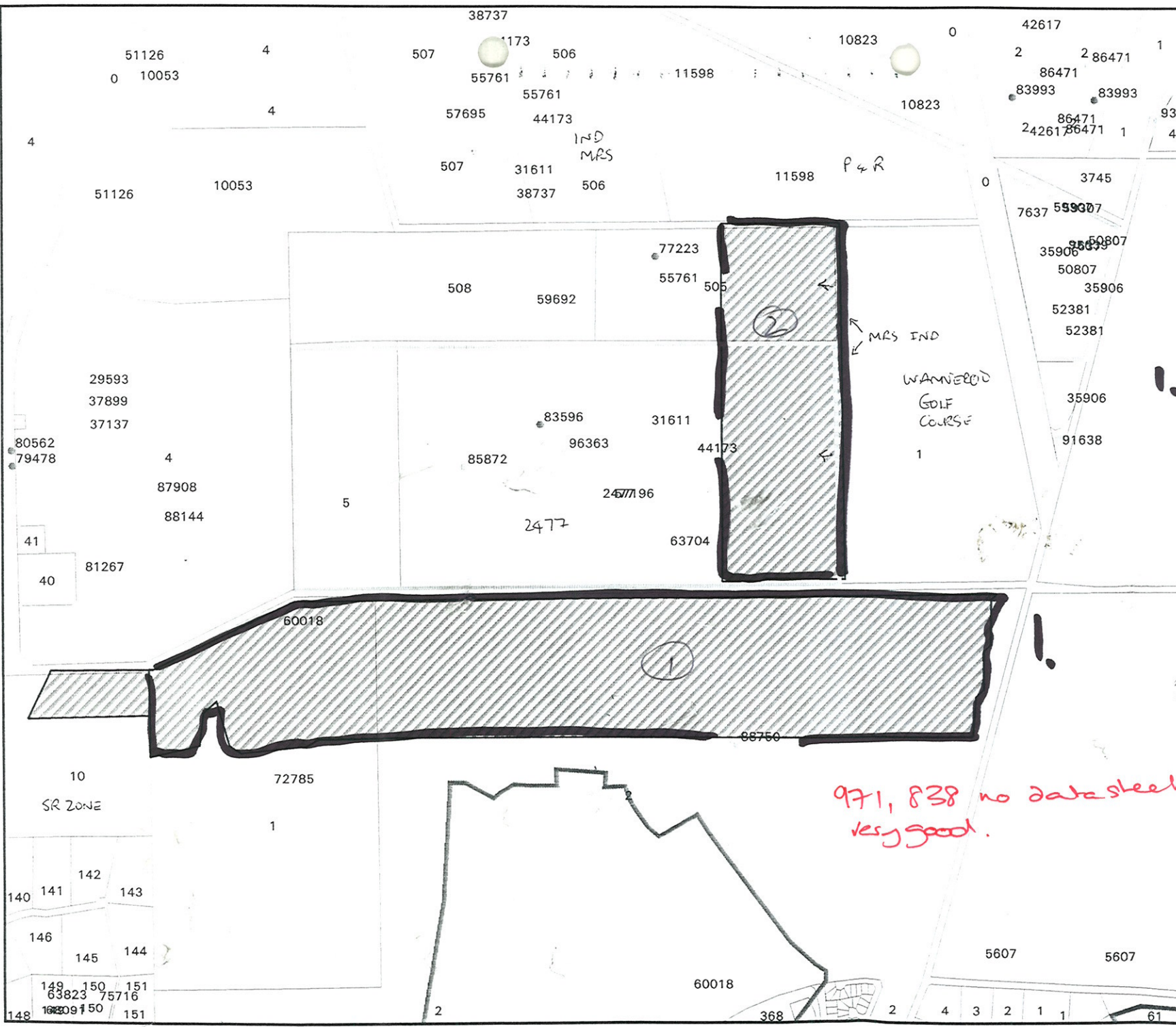
FLYNN DVE

Bushplan Site 295 Lots 505 & 2477 Vegetation Complexes



- Bushplan Sites (boundaries)
- Cadastre with Lot Numbers
- Karrakatta Complex-Central And South
- Pinjar Complex

MFP INTERNAL USE ONLY
Prepared By: Andrea Zappacosta
Prepared For: CATHERINE THOMSON
Map Ident: plot991123_1
Date: 23 Nov 1999
Scale 1: 8000



- APPROVED
- DEFERRED
- REFUSED
- APPROVED
- REFUSED
- UNKNOWN
- Appealed and decided
- Karrakatta Complex -- Central & Sth
- Cadastre with Lot Numbers
- Urban MRS & TPS R20
- Part SHC and part private
- Strong need POS in firms local parks. Limited POS contribution possible. will require reservation if wish to protect.
- Outstanding 'subdiv' approvals.
- 2. Part Ind. Flynn Drive
- Difficult protect anything apart from 20-30m POS Buffer.
- Will need to reserve and acquire.
- Outstanding

971, 838 no data sheets very good.

Map Ident: plot970321_1
 Prepared By: Kieron Beardmore
 Prepared For: Kieron Beardmore
 Date: 21 Mar 97
 Scale 1:10090
 0 250 m
 MFP INTERNAL USE ONLY

WANNEROO

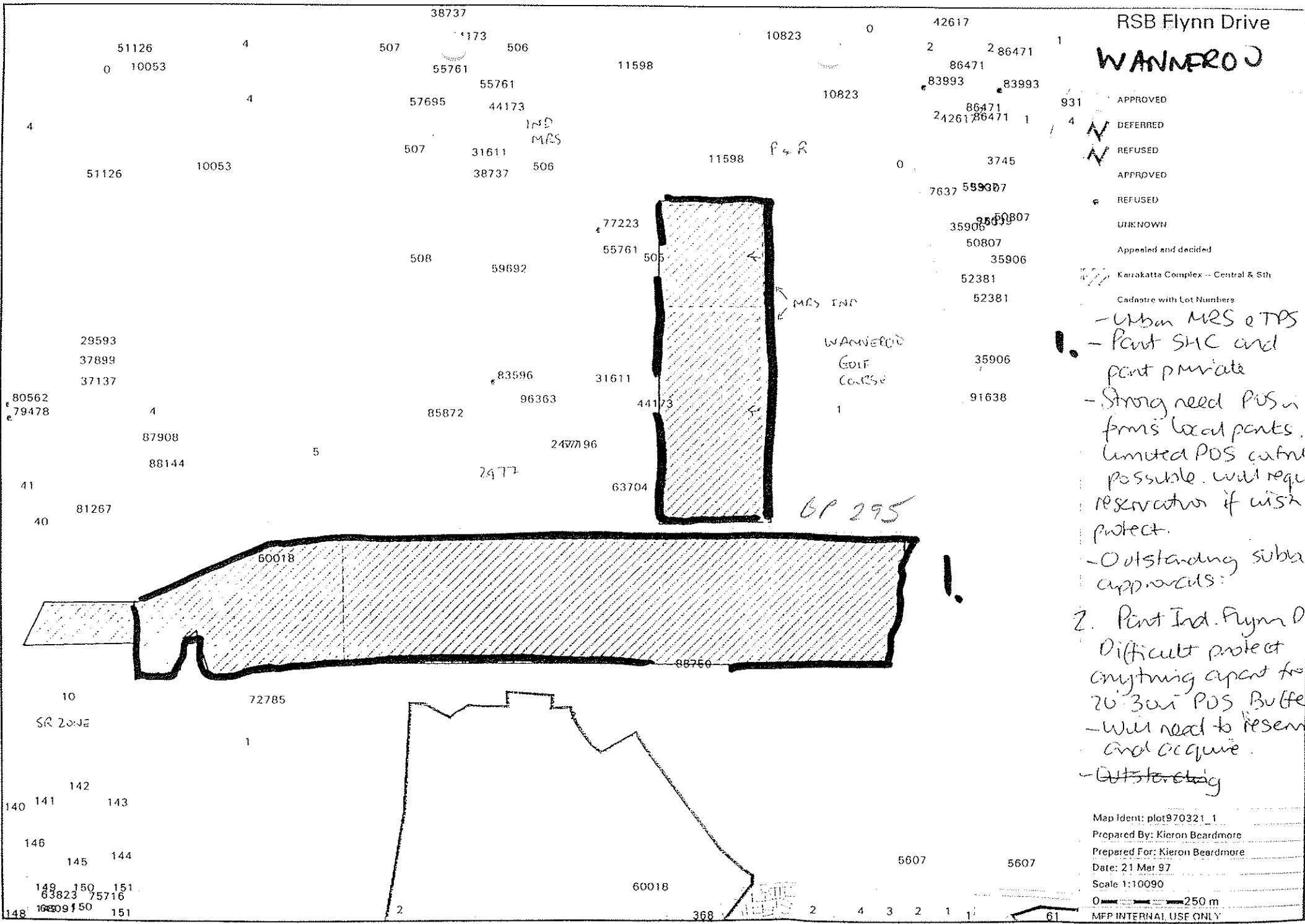
- APPROVED
- DEFERRED
- REFUSED
- APPROVED
- REFUSED
- UNKNOWN

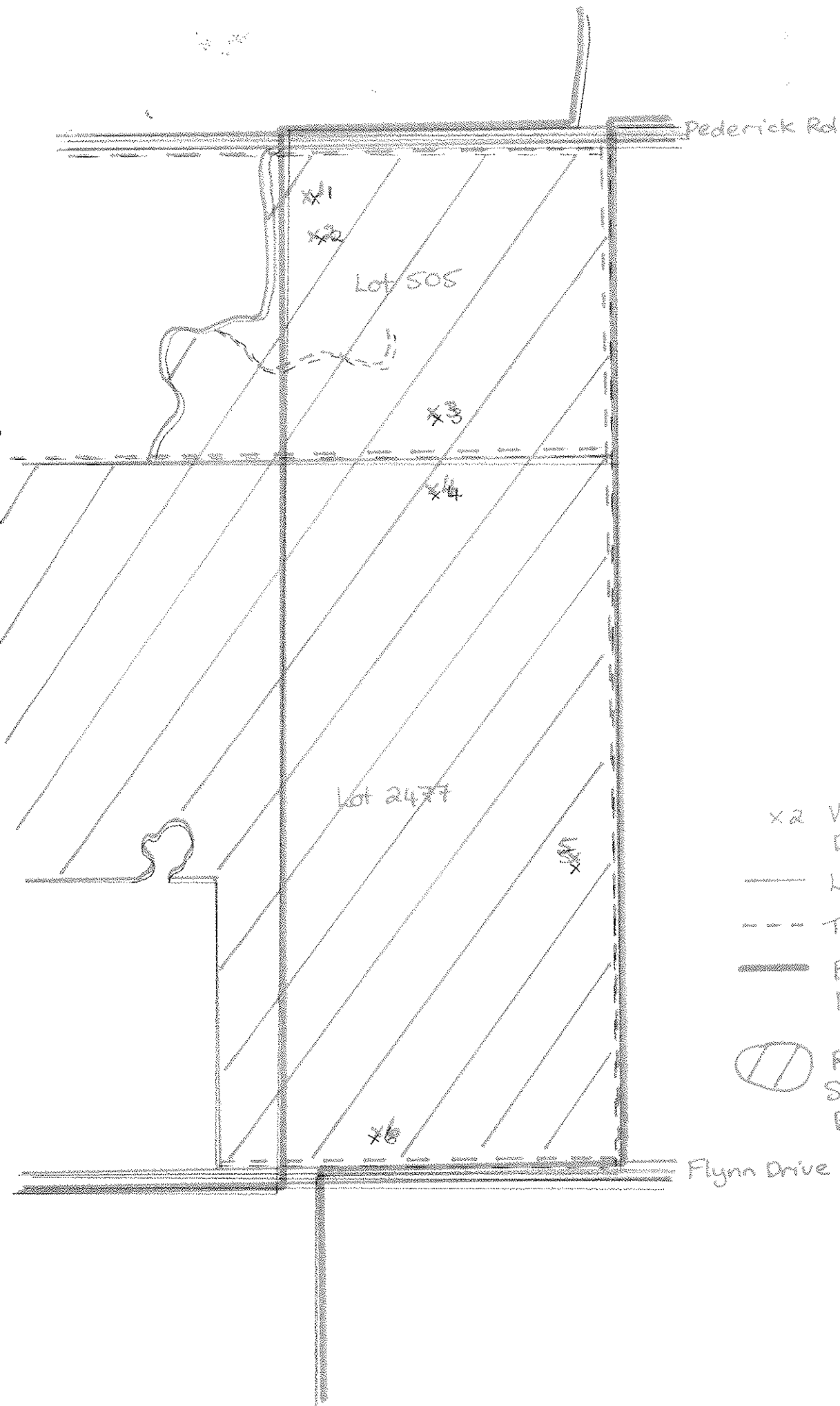
Appealed and decided
 Karakatta Complex -- Central & Sth
 Cadastre with Lot Numbers

- Urban MRS & TPS RZ
- Part SHC and part private
- Strong need POS in firms local parts. limited POS contribution possible. will require reservation if wish to protect.

- Outstanding subsidy approvals:
- 2. Part Ind. Flynn Drive
 Difficult protect anything apart from 20' 3m POS Buffer.
 - will need to reserve and acquire.
 - Outstanding

Map Ident: plot970321_1
 Prepared By: Kieron Beardmore
 Prepared For: Kieron Beardmore
 Date: 21 Mar 97
 Scale 1:10090
 0 250 m
 MFP INTERNAL USE ONLY





- x2 Vegetation Unit Description
- Lot boundary
- - - Track
- Bush Forever Boundary
- (//) Regionally Significant Bushland



Lots 505, 508 & 2477
 Flynn Drive, Neerabup
 BF Site 295
 Aerials 2001

- N Bush Forever 2000 - Site Boundaries
 - N Cadastre with Lot Numbers
 - N Contours - 1m (DOLA)
- Meet with Mr. Trandos
 Site Assess 1 hr.
 Lot 505

Several large original Jarrah beside track

Map Ident: plot010917_2
Prepared By: Emma Bamforth
Prepared For: Karen Clarke
Date: 17 Sep 2001
Scale 1:5000
0 125 m
DPI INTERNAL USE ONLY

BUSHLAND AREA BS 295 (cont) SITES

YES/NO

DATE 5/8/97

RECORDERS BJK

Observations

edge

transects

small

Geographic Location	Latitude	S Longitude	E
Reference Map			

Photograph	Photographer's Name	Photo No
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Transect of landscape units (draw in transect incorporating features listed and any other relevant unit)

dunes
dry/wet flats
sumplands
uplands
type

Soil - surface		sub -soil
Exposed rock	type	% area

FLORA/VEGETATION (list dominant and significant plants below, see over for vege association descriptions)

Eucalypts	<i>E. calophylla</i>	<i>E. wandoo</i>	<i>E. marginata</i>	<i>E. toditanna</i>	<i>E. rudis</i>
	<i>E. decipiens</i>	<i>E. drummondii</i>	<i>E. haematoxylon</i>	<i>E. lanepolei</i>	<i>E. gomphocephala</i>
	<i>E. accedens</i>	<i>E. patens</i>	<i>E. laeliae</i>	<i>E. megacarpa</i>	
Sheoaks	<i>Allocasuarina fraserana</i>	<i>Casuarina obesa</i>			
Banksia	<i>B. attenuata</i>	<i>B. menziesii</i>	<i>B. prionotes</i>	<i>B. illicifolia</i>	<i>B. grandis</i> <i>B. littoralis</i>
Melaleuca	<i>M. preissii</i>	<i>M. raphiophylla</i>	<i>M. lanceolata</i>	<i>M. cuticularis</i>	
Others	<i>Callitris preissii</i>				
Mallees	Eucalypts	<i>E. argutifolia</i>	<i>E. petrensis</i>	<i>E. decurva</i>	<i>E. foecunda</i> <i>E. latens</i>

SIGNIFICANT SPECIES / DOMINANT SPECIES

(see over for vegetation descriptions)

Vegetation Condition - Keighery 1994 (Trudgen 1993) (show range and indicate predominant class)

1 = 'Pristine' (Excellent)

2 = Excellent (Very Good)

3 = Very Good (Good)

4 = Good (Poor)

5 = Degraded (Very Poor)

6 = Completely Degraded

Specific aspects of disturbance

partial clearing

weeds (list):

selective removal of species: timber cutting mowing fire grazing dieback %area

fire frequency:

'enrichment plantings' (list)

animal impact: horse foxes rabbits cats dogs goats pigs overgrazing by native mammals

soil movement: mining dumping rubbish dumping roadworks

changes in water regimes: flooding drainage watering nutrient influx

Tracks: fire breaks walk trails off road vehicle use animal tracks

Service corridors: SEC Main Roads Water Authority. Telecom

Other

VEGETATION (describe each unit of vegetation using dominants and life form/height class and canopy cover according to the Muir/Keisling codes above)

~~E~~ Bank all along. Very florid Low Open Forest
P over Paly trees, Resinops VSP 1-2m 50% over
Delonix wood, but pwd, Erem NP 10-30%, 21m, over
V O Sedreland 1 bys' bark, Schoenus wood and V O Herbs
but occ, with V scattered to 10-30%. Ad cny to 72m.

Excellent to Very Good - edges could grass.
but pwd, Conspicuous minimum

D South end reads over Low Open Forest of
P Mel pwd bank atypical Paly trees 1-2m 75%,
over Dasy/brown/Phala ciliata 30-70%.

Edges Veldt grass. Excellent to Very Good

NOTE Boundary only visible by the top of
the wetland

Fauna comments

Adjacent bushland (refer to aerial photograph)

OTHER COMMENTS

BUSHLAND AREA BS 295 (selected sites) SITES

YES/NO

DATE 5/8/77

RECORDERS WJK

Observations edge transects

Geographic Location	Latitude	S Longitude	E
Reference Map			

Photograph	Photographer's Name	Photo No
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Transect of landscape units (draw in transect incorporating features listed and any other relevant unit)

dunes	
dry/wet flats	
sumplands	
uplands	
type	

Lake Pinjar *A. Dune*

Soil - surface	<i>cream sand</i>	sub -soil	<i>yellow sand</i>
Exposed rock	<i>NA</i> type	% area	

FLORA/VEGETATION (list dominant and significant plants below, see over for vege association descriptions)

Eucalypts	<i>E. calophylla</i>	<i>E. wandoo</i>	<i>E. marginata</i>	<i>(E. todtiana)</i>	<i>E. rudis</i>
	<i>E. decipiens</i>	<i>E. drummondii</i>	<i>E. haematoxylon</i>	<i>E. lanepolei</i>	<i>E. gomphocephala</i>
	<i>E. accedens</i>	<i>E. patens</i>	<i>E. laeliae</i>	<i>E. megacarpa</i>	
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Melaleuca	<i>M. preissii</i>	<i>M. raphiophylla</i>	<i>M. lanceolata</i>	<i>M. cuticularis</i>	
Others	<i>Callitris preissii.</i>	<i>Neogyne</i>			
Mallees	Eucalypts	<i>E. argutifolia</i>	<i>E. petrensis</i>	<i>E. decurva</i>	<i>E. foecunda</i> <i>E. latens</i>
SIGNIFICANT SPECIES / DOMINANT SPECIES					
(see over for vegetation descriptions)					

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Specific aspects of disturbance

partial clearing
weeds (list):
selective removal of species: timber cutting mowing fire grazing dieback %area
fire frequency:
'enrichment plantings' (list)
animal impact: horse foxes rabbits cats dogs goats pigs overgrazing by native mammals
soil movement: mining dumping rubbish dumping roadworks
changes in water regimes: flooding drainage watering nutrient influx
Tracks: fire breaks walk trails off road vehicle use animal tracks
Service corridors: SEC Main Roads Water Authority. Telecom
Other

VEGETATION (describe each unit of vegetation using dominants and life form/height class and canopy cover according to the Muir ^{Keisling} codes above)

A Scattered Euc / tree, Myrt shrub in.
 P1 Bank alt, near Low Woodland over Mac. rind, Jan
 pred Open Shrubland over mixed Open to Closed
 Low Heath over Maco pseudo Ater nit Open
 Sedge/land and Pat acid Open Herb
 Scattered Aden egg patches to 70%
 Species Shrubs: Dal tri, Hib hyp, Rame com, Moca
 hweg, Lys cil, Lame poly, Ato hum, Ac pul.
 Excellent to P, Scattered Glad.
 Note: Hick point see transect, acartsoha Lake Panja
 to NE (on Redbrick Road.)

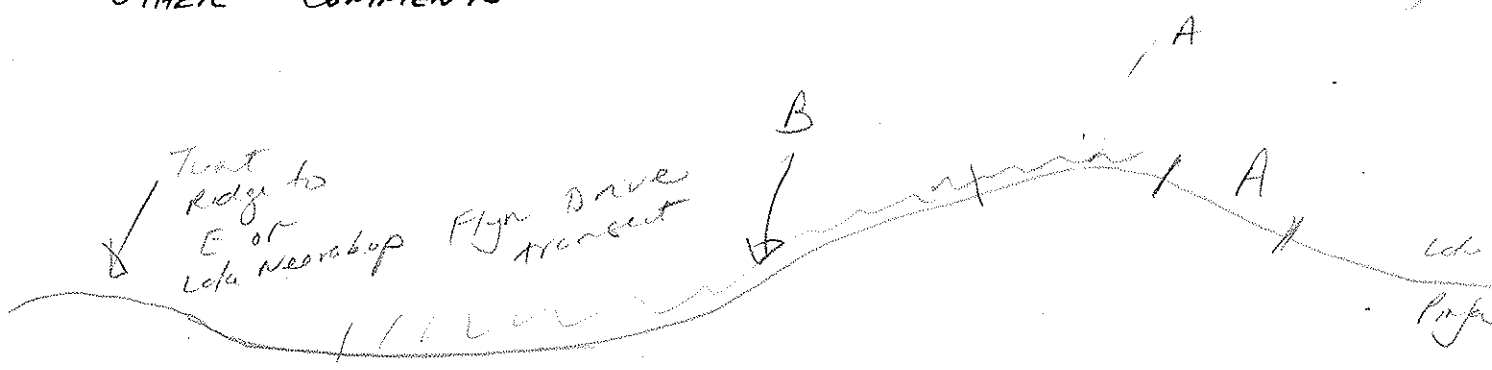
B. Scatted Euc more over Ato fres, Bank alt near Low
 P2/3 Closed Forest to Low Woodland over Aden egg 72m
 scattered clumps to 70% over Mac rind. Jan pred Open
 Shrubland over Hib hyp Shrub Open Low Heath over Maco pseudo
 Very open Sedge/land and D. herbland
 Understorey: Hib hyp, Str let, Dal radi Hib com
 Dal tri, Lame poly, Dasy brach, Pim subp, Erem pande
 Pet lin, Eric spp, Bas end
 Excellent to P - Scatt to 2nd dist
 P4 Woodcutting, P5 track

C Very similar to B but some clearing in past
 (edge inspection only) fenced

Fauna comments

Adjacent bushland (refer to aerial photograph)

OTHER COMMENTS



~~Watercolour Photographs by Gordon~~
BS 295

Zoned Rural, planned Urban/Industrial in
* Flynn's Ave Ind. Structure Plan
MAP

o City of Wanneroo

Richard Pollack & Assoc. - ^{seconded} to Landrap

o Smeck - doing a 2nd report

↳ Analysing comments from final
draft

- Frank Borella. (see parents' out of correspondence)

address to Frank's address directly

Previous events - :

Balcatta - reconstruction

Hocking Rd.

handover - Land Planning

o Development Consultants

Excavation Management Plan.

At Swan Loc 2477

Flynn Drive, Neerabup.

High Quality Brickies Sand

(14.98%)



Lot 2477

Complete 5)
check photos
5) 25, 26

6) Banmenz
Ade cyg
Hibbhyp

4) Xanpres
Hibbhyp
* Ursanth

Styl carn (osum or caridifolium) * Briemax

Patchy tree layer

Drysess
Alexnit
Vertsp
Aca sp (triangle leaf)
Phl cil
Cal flav?

* Pelcap
* Ursanth
* Gladcary
Lyscil
Boss eric
Schinu
Conpend
Philspic

Allfras
Eucmar
Nuyflor
Banatt

Patches Adecyg

~~Ex~~ VG-Ex

On degraded edge

Acaappl?

Ptersp
Contrip

* Romros
* Gladcary

Hyprob
Davnud
Leptere?
Hakrusc

Jacfire
Acaapul

Tracpil
Cyaegu
Stirlat
Borcumb

Calsang
Hibbhyp
Petlin
Macred

Schgran
Conset

Boseri
Xanpre

Add as opps {
Mac aust
* Pelcap
Cal sp
Eucmar
✓ Jackdens -
Acaacyl

Davtri
Conpen

Burumb

Nemcap
Drosmez

Hibbhueg

Calflav

Haemspic

Haem sp
Pat occ

Hyp exs

? current zoning?

Lot 505

- 1) Banatt
- Banmenz
- Allhum
- Hibbhyp
- Patoc
- Mespse

- Nuyflor * Brizmax
- Persac * Ursant
- Cal sp * Glacar
- Conpend
- Coninc
- Haem sp
- Leu sp
- hecflo
- Damlin
- Nevalb
- Calfla
- Davtri
- Scarep
- Hybeal
- Lygimb
- Drylin
- Banilli
- Stirlat
- Pettin
- Euctod
- Pterec
- Dasbrom
- Sowlax
- Davrud
- Hyprob
- Xanpres
- Calnar
- Schinu
- Thyman/pat
- Desfle
- Nemcap

- Burcumb
- Acapul
- Dros men
- Conset
- Boseri
- Triela
- Hibbhveg (large flw)
- Conacu
- Anghum

- 2) Eucmar
- Xanpre
- Banatt
- Banmenz
- Hibbhyp
- Schinu
- Patoc
- Mespse
- Nuyflor
- Petmac
- Macreid
- * Hypplab

- 3) Same dominants as 1) +
- Allfras
- Eucmar
- Nuyflor.

Add as opps {

- Anghum
- Ang mang
- Macrost
- Adecyg
- Jacfor

Nick Trandos 93000 521 Ph
93000 228 Fax

Meeting with Mr Nick Trandos, Lot 502 Pedderick St, Warracrow

report → 6 wks to
Draft P Bush plan came out Mr Nick Trandos

Subm. from Nick - Licence to extract
future Industrial site

Submission - not acknowledged
∴ thought successful

Bush Forever came out
∴ included!

Grant ∴ council land to west
in Bush Forever? - Cottlesloe C.S.

Extraction licence requires fill to
a certain level. ^{might be needed for}
71 x 10⁶ - \$ 2 million fill in sand resource
+ value as industrial estate.

9264 7804 Huia

or will
have to
cart

Compens. * Value at Industrial Zoning
of Sand Resource - fill

Agreement from Planning & Council
re basis for valuing

Council & Land corp. main landowners

Rocla - running sand extraction
Licence between Rocla & Trandos - another
10 years to go.
Annual council approval ^{still} operating at present
Aug 99 expired?

Nick Trandos for 25 yrs
resp. for planning



BS 295

11/14
PB111

Mr Gary Prattley
Chief Executive Officer
Ministry for Planning
409 Wellington Street
PERTH WA 6000

Dear Gary

PERTH'S BUSHPLAN – PARENT SUBMISSION

In the context of the ongoing discussions between our agencies on Bushplan and the formal release of the Bushplan documents, I write to confirm Homeswest's current position in this matter.

1. GENERAL IMPLEMENTATION ISSUES

Homeswest has previously expressed its support for the proposed implementation mechanisms on the basis of achieving a balance between protecting regionally significant bushland of the highest quality and providing certainty for the viable development of urban communities. It is recognised that a whole of government approach is necessary and as such Homeswest supports Recommendation 4 which proposes an inter-agency Memorandum of Understanding (MOU).

It is submitted that such an agreement should be contained to the nominated agencies and framed on the basis of the Ministry for Planning being the lead agency to implement Bushplan. Suggestions that the MOU should cover a broader range of government instrumentalities including Local Government would, in Homeswest's view unduly complicate the implementation process. The finalization of the MOU should be given a high priority.

Homeswest concurs with the Recommendation 5.3 which proposes that a Statement of Planning Policy be developed in consultation with local government to deal with local bushland. Areas of perceived local significance rightfully lie outside of the framework of Bushplan and should become the responsibility of local government in terms of both acquisition and management.

SUBMISSION NO 99



Western Australian Government

STATE HOUSING COMMISSION

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

2. NEGOTIATED PLANNING SOLUTIONS

2.1 Detailed Submissions

During the course of the public advertising period Homeswest has lodged detailed submissions with the Ministry dealing with its holdings/land interests at Leda (Site 349), Parmelia (Site 67) and Forrestdale (Site 253). In each case Homeswest has advanced a compromise option aimed at realising a pragmatic solution which integrates bushland protection with residential structure planning.

2.2 Banjup (Site 296)

Homeswest has previously agreed with the inclusion of this land as a 'negotiated planning solution' in the context that bushland protection objectives are balanced against existing approvals for sand extraction. Consistent with the intent of Recommendation 5.8 of Bushplan, Homeswest considers that, within the scope of its contractual arrangements for sand mining, there is potential for up to 35% of the site to be retained for bushland protection.

2.3 Ellenbrook (Site 23)

A negotiated outcome is being pursued by Ellenbrook Management P/L in the context of planning and environmental approvals.

2.4 Negotiated Outcomes

Homeswest is keen to advance discussions with the Ministry and where appropriate the Bushplan Reference Group, with the aim of reaching negotiated outcomes prior to the finalisation of Bushplan.

3. OTHER AFFECTED LANDS

3.1 Neerabup (Site 95)

As conveyed to you on my letter of 2 July 1998, Homeswest accepts the designation of an area of approximately 45ha as a regional reserve to be acquired under the provisions of the Metropolitan Region Scheme.

3.2 Amarillo (Site 94)

Homeswest accepts the nomination of an area of approximately 316ha along the Serpentine River as a reserve under Bushplan on the understanding that it coincides with the proposed 'Parks and Recreation Reserve' under the relevant statutory region schemes. Pursuant to the Memorandum of Understanding which has recently been agreed to by our agencies, I confirm that Homeswest will progressively cede the affected land free of cost at the time when 'Urban' zoning is finalised over various portions of its Amarillo holding.

Summary of site visit to BS295 -
meeting with
Lot 2477 Flynn Drive, Mr Frank Borrello

Karen Clarke

From: Karen Clarke
Sent: Monday, 13 August 2001 13:57
To: 'Colliver, Huia'
Cc: Sean Collingwood (E-mail)
Subject: RE: Site Visit out to 295 (Trandos and Borello)

14/1/2000

Hi Huia,

I wasn't her on Friday so couldn't ring you then. 18 or 19th September in the morning is fine by me. What about Mr Borello? A visit by Sean, Sally and I is fine but I need to know who we are dealing with exactly due to the court case with Trandos. It may be other people have to be present for legal reasons.

Karen Clarke
Catherine Thomson, Bridget Hyder-Griffiths and I met with Mr Borello on site on 14 January 2000. We were sent to talk to Mr Borello but while on site he asked that we look at the bushland on his property (Lot 2477 Eastern portion) and determine whether it was regionally significant. As we hadn't scheduled a site assessment we only had time to drive along the fire breaks on the edge of his bushland. However, I advised him verbally that the condition and type of vegetation present did meet the criteria for regional significance and that a more detailed assessment would confirm that. We agreed to return later in the afternoon to conduct a detailed assessment if we had time after our next scheduled landowner meeting (Bush Forever Site 2 at Bullsbrook). Unfortunately a cold front came in that afternoon and severe thunderstorms stopped us returning later that day. I understand that consequently Catherine advised Mr Borello that we wouldn't need to return to his site to conduct further work as Bronwen and I were sure that his bushland was regionally significant from existing information and my brief inspection of the site. However, from things he said on the day I visited, I don't think he will be prepared to accept our advice without a detailed assessment and even then he is likely to challenge it. As it wasn't an ultra urgent issue for the Bush Forever Office at the time it wasn't pursued any further.

Cheers, Karen.

NB: Excavation Management Plan & Woolly Bee Project Preliminary Report provided by Mr Borrello.

-----Original Message-----

From: Colliver, Huia [mailto:Huia.Colliver@planning.wa.gov.au]
Sent: Friday, 10 August 2001 15:57
To: Karen Clarke (E-mail); Collingwood, Sean
Subject: Site Visit out to 295 (Trandos and Borello)

Hi Karen and Sean

I have spoken with Nick Trandos who is happy for us to come out on either the 18th or 19th of september 2001. He would prefer for us to come out in the morning.

Karen, Sean has mentioned that it may be worth while just you and Sally and him going out. That way a whole bunch of us aren't trooping out there stirring the pot as it were.

Which day would suit you guys better??

Cheers

Huia

**EAST OF JOONDALUP
URBAN DEVELOPMENT PROJECT**

**PUBLIC
ENVIRONMENTAL
REVIEW**

HOMESWEST



YATALA NOMINEES PTY LTD

R&I BANK



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3.2.2 Vegetation and Flora

3.2.2.1 Regional Perspective

The site is located in a region for which vegetation has been classified in a general scheme by Beard (1979) as part of the Spearwood Vegetation System. The principal component of the vegetation is *Eucalyptus* woodland with transition to the north of Wanneroo into *Banksia* low woodland in which Eucalypts are gradually isolated into smaller and more open stands.

The Spearwood Vegetation System is described in overall terms as a Tuart (*Eucalyptus gomphocephala*)-Jarrah (*Eucalyptus marginata*) woodland association. The distribution of the various component vegetation types is primarily a function of surface soil type, depth and moisture regime. Tuart, Jarrah and *Banksia* are found on deeper, well-drained sands and Flooded Gum (*Eucalyptus rudis*) and Paperbark (*Melaleuca preissiana*) are found associated with wetter soils.

More detailed regional vegetation maps presented in DCE (1980) classify the site's remaining vegetation as Karrakatta Complex - Central and South. This vegetation complex is generally described as predominantly an open forest of Tuart-Jarrah-Marri (*Eucalyptus calophylla*) with a mid-stratum of *Banksia spp.* On the deeper sands of the Karrakatta Central and South Complex, the Tuarts are replaced by Jarrah.

Vegetation within the northern part of the site is typical of Karrakatta Central and South Complex which have developed on deeper sands. The upper stratum is dominated by *Eucalyptus marginata* whilst the mid-level stratum consists of a variable mixture of *Banksia menziesii*, *B. attenuata* and *B. ilicifolia*. The understorey is generally species rich and is locally variable in height, density and species composition according to the depth of soil, moisture content, aspect and upper storey canopy coverage.

3.2.2.2 Local Perspective

Site surveys were conducted to examine the variations in structure and floristic composition that occur throughout the site and to assess the vegetation's present condition. The results of survey are shown on Figure 8 and are described below.

1. Uncleared Northern Portion

Three generalised vegetation types occur within the uncleared northern portion (Figure 8) of the site. These are Jarrah-*Banksia* woodland, *Banksia* woodland and *Melaleuca* dampland. Jarrah-*Banksia* woodland and *Banksia* woodland occur through most of this uncleared component and there is a small area of *Melaleuca* dampland adjacent to Pinjar Road in the south-eastern corner of the site. The Jarrah-*Banksia* and *Banksia* woodlands occur in a mosaic pattern, with gradients in physical stature and species composition occurring between recognisable areas of each type. The pattern of distribution makes mapping of the individual vegetation types of questionable value. However where compositions are discrete and recognisable, the site's vegetation types may be described as follows:

(a) *Banksia* Woodland

Dominant Species: *Banksia attenuata* and *Banksia menziesii*

Associated Species: *Eucalyptus marginata*, *Eucalyptus todtiana*, *Allocasuarina fraseriana*, *Gastrolobium ilicifolium*, *Xanthorrhoea preisii*, *Adenanthos cygnorum*, *Lysinema ciliatum*, *Leucopogon pulchella*, *Hibbertia hypericoides*, *Calothamnus sanguineus*, *Hypocalymma robustum*, *Acacia pulchella*, *Stirlingia latifolia*, *Allocasuarina humilis*, *Conospermum stoechadis*.

(b) Jarrah-*Banksia* Woodland

Dominant Species: *Eucalyptus marginata*, *Banksia attenuata*, *Banksia menziesii*.

Associated Species: *Allocasuarina fraseriana*, *Acacia saligna*, *Acacia pulchella*, *Acacia xanthina*, *Hibbertia hypericoides*, *Hypocalymma robustum*, *Jacksonia sternbergiana*, *Xanthorrhoea preisii*, *Banksia ilicifolia*.

(c) *Melaleuca* Dampland

Dominant Species: *Melaleuca preissiana*, *Eucalyptus rudis*, *Banksia ilicifolia*.

Associated Species: *Patersonia occidentalis*, *Macrozamia reidleyi* and sedges.

The vegetation within the northern section of the site, particularly within the central region, is predominantly in good condition. However, there is a network of sand tracks which traverse

the site and lead to areas where woodcutting or illegal rubbish dumping has occurred. Degraded vegetation is mainly restricted to near the perimeter of the block, adjacent to the local sealed roads. The vegetation does not appear to have been burnt in the recent past.

A series of site traverses were carried out on foot to indicate whether dieback is present within the site. This investigative work focussed on a search for affected individuals of indicator species, including *Banksia grandis* and *Macrozamia riedlei*, in susceptible areas such as along the edges of tracks and trails. No obvious signs of dieback infection were recorded. It is acknowledged that this visual methodology is not entirely definitive, however it is nonetheless indicative of the status of the site.

2. Southern Portion

The southern part of the site has been almost completely cleared for grazing, and there are only three relatively small areas of vegetation remaining (Figure 8). Two of these areas are distinguishable as the *Banksia* woodland vegetation type described in (1) above, although previous landuse has significantly altered their floristic character. The third area of remnant vegetation, located on low-lying land in the south east corner of the site (on the north west corner of the Pinjar Road - Clarkson Road intersection), is lower slope vegetation associated with the small wetland that occurs in the south-west quadrant of the Clarkson Road - Pinjar Road intersection. This remnant stand is classified as *Melaleuca* dampland vegetation type and exhibits the same dominant species as described in (1c) above. The associated species include:

Regelia ciliata, *Hypocalymma angustifolium*, *Scholtzia involucrata*, *Astartea fascicularis*, *Burtonia scabra*, *Platytheca galioides*, and *Patersonia occidentalis*.

The remaining parts of the southern section of the site have been variably replanted with *Eucalyptus* species and now have an open parkland configuration of replanted trees, regrowth thickets and individual specimens of the former vegetation. A profusion of pasture grasses and exotic weeds have become established and "bare" ground occurs where limestone is shallow or outcrops.

The remnant patches of native vegetation within the southern section are generally in very poor condition, having been grazed and significantly trampled by stock. Understorey regrowth has occurred within the *Banksia* woodland remnants, however these areas appear to have much lower floristic diversity than corresponding areas in the northern portion of the site, and are significantly affected by weed invasion.

The *Melaleuca* dampland remnant is also in poor condition due to stock damage and also appears to have been frequently burnt.

3.2.2.3 Rare and Restricted Flora

The site's flora was investigated with specific regard to gazetted rare, geographically restricted or poorly collected species. These investigations involved the following:

- (i) Review of the floristic data base for gazetted rare species developed by CALM's Metropolitan Branch. No records of known occurrences of gazetted rare species within the site were found.
- (ii) The potential for the occurrence of gazetted rare species was assessed from a regional appraisal conducted for the Gnangara Mound area by the Water Authority of Western Australia (1986). This work identified 13 species of vascular plant for the Gnangara Mound that were gazetted rare, geographically restricted or poorly collected. Habitat and geographical distribution data for these species was assessed in terms of the potential for populations to exist within the site. The results are as follows:
 - Seven of the species have been recorded in wetland habitat. These are:
 - *Conospermum huegelii*
 - *Darwinia* sp. A. (D. aff. *neildiana*)
 - *Eremaea purpurea*
 - *Lycopodium serpentinum*
 - *Restio stenostachya*
 - *Stylidium utricularioides*
 - *Thelymitra* sp. A. (Th. aff. *carnea*)
 - Searches for these species within the sites very limited areas of dampland were conducted during August 1989. No populations were located. There is a small possibility that a hybrid orchid of interest (*Thelymitra* sp.) could occur in the dampland areas, however recent lowering of the water table (see Figure 7) may now preclude its existence in this locality.
 - Four of the thirteen species have been recorded from *Banksia* woodland, and two from open woodland or scrub vegetation. These species are as follows:

- *Conostephium minus*
- *Lysinema elegans*
- *Stachysteman axillaris*
- *Tetralthea pilifera*
- *Cartonema philydroides*
- *Lhotskya brevifolia*

Based on the recorded soil type preferences and distributions of these species, it is unlikely that *Lhotskya brevifolia* or *Lysinema elegans* would occur within the Spearwood Sand soils of this site. There is a small possibility that *Cartonema philydroides*, *Conostephium minus*, *S. axillaris* or *T. pilifera* may occur on the site, however these species were not observed during the flora survey work carried out during August 1989.

3.2.3 Fauna

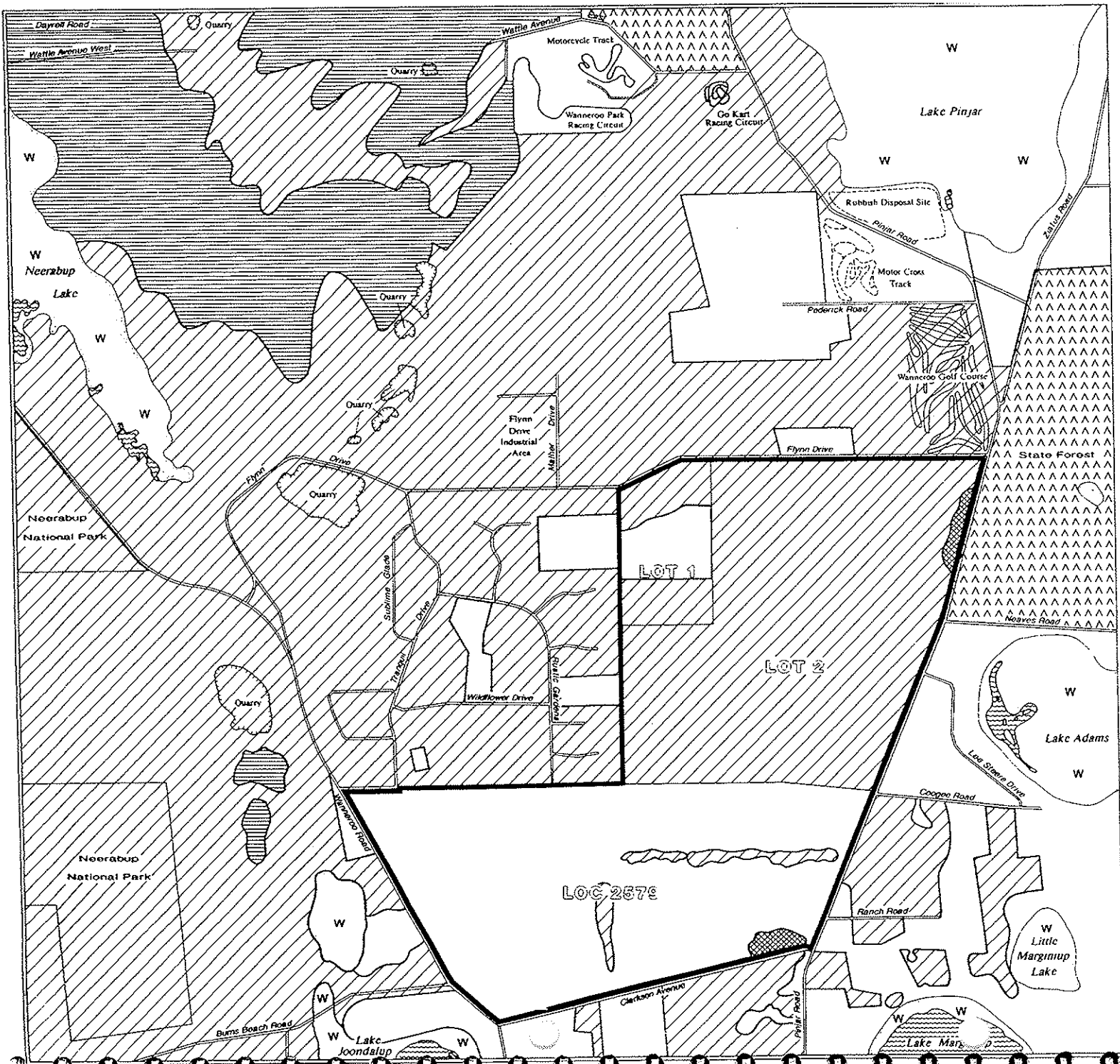
The Western Australian Museum (WAM) conducted an extensive regional survey of vertebrates of the Northern Swan Coastal Plain in 1978. This survey is the most comprehensive of its kind ever carried out for the area, and included 315 man-days and 25,729 trap nights.

The areas chosen for study sampled the major geomorphic elements and representatives of the majority of vegetation formations recorded on the Plain. Reserves were preferentially chosen for sampling within the study area as they were generally large, relatively undisturbed and consequently most likely to contain fauna.







The terrestrial areas surveyed included, from north to south:

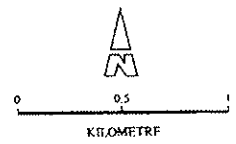
- Moore River National Park
- Gingin Proposed Reserve
- Melaleuca Park
- Twin Swamps Reserve
- Yanchep National Park, and
- Neerabup National Park/Burns Beach.

The intensive effort incorporated into the WAM survey could not be exceeded (or equalled) for the current study. Therefore, a limited fauna survey of the site, including traverses throughout the significant habitat types, was conducted to observe fauna species and to



LEGEND

-  Jarrah-Banksia and Banksia Woodland
-  Heath
-  Wetlands
-  Dampland
-  Cleared
-  Pine



**EAST OF JOONDALUP
URBAN DEVELOPMENT PROJECT**

VEGETATION TYPES

Figure 8

identify and evaluate available habitats. The information gathered was subsequently correlated to results of the WAM survey, to indicate the fauna species likely to occur given the prevailing habitat types available. Although the present site was not specifically incorporated into the Museum's study, *Banksia* woodland habitat typical of the site was closely examined. Spatially, the Neerabup National Park (Reserve No. A27575), vested in the National Parks and Nature Conservation Authority, is very close to the site, and additionally contains several of the formations common on the Spearwood Dune System (WAM, 1978). During the WAM survey, trap lines were set adjacent to the site on the Reserve immediately north of Burns Beach Road. Trapping effort for this Reserve was 5008 trapnights, using Elliot, breakback, cage and pit traps.

While the vegetation complexes contained within the Park are not identical to those within the subject site they are very similar, and Neerabup National Park contains a larger extent of wet or dampland areas. Nonetheless, the resultant database is indicative of the range of vertebrates which may inhabit similar habitats within the site.

3.2.3.1 Mammals

A literature review and search of Western Australian Museum records by Kitchener *et al.* (1978) concerning the presence of native mammal species on the Northern Swan Coastal Plain concluded that 33 species had previously been recorded with certainty, and an additional four species had been recorded but were of doubtful origin. Six introduced mammal species were also recorded. During the 1978 WAM survey however, only 12 native mammal species were recorded, with 6 introduced species.

Table 2 lists the mammal species recorded from the Northern Swan Coastal Plain from historical records, museum records, and the WAM survey. The majority of species inhabit heath, shrubland or woodland habitats. Some species, such as the Southern Brown Bandicoot and Water Rat require or prefer habitat containing areas of open water.

Neerabup National Park, adjacent to the subject site, recorded two species of native mammal, the Western Grey Kangaroo (*Macropus fuliginosus*) and the Western Brush or Black-Glove Wallaby (*M. irma*). The kangaroo *M. fuliginosus* was the only mammal confirmed on-site during the present study.

The presence of the Black-Glove Wallaby adjacent to the study site by the WAM survey is significant, as the Department of Conservation and Land Management consider it may be a declining species. It is not, however, a gazetted rare or endangered animal.

WESTERN AUSTRALIAN MUSEUM

Department of Terrestrial Invertebrates: Entomology

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Date: 13 December 1996

Mr Frank Borello
8 Newington Place
Kingsley WA 6026

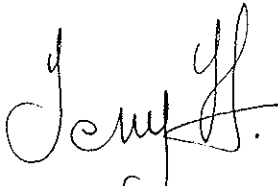
Dear Frank,

Re: Woolly Bee Project Preliminary Report

Enclosed herewith is a copy of this report for your information. The report was written specifically for Eclipse Resources who had funded the study and, being 'preliminary', does not contain any acknowledgements. A final report, should it become possible later, will certainly include an acknowledgement of your support by allowing me access to your family's block on Flynn Drive.

I'll keep you posted on the outcome of this summer's work which will be very limited in view of the non-renewal of the study grant.

Cheers from



Terry Houston (Dr)
Curator of Insects

WOOLLY BUSH BEE PROJECT

PRELIMINARY REPORT

**WORK UNDERTAKEN
DURING SUMMER OF 1995-96**

Terry Houston

Western Australian Museum

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1. Synopsis of Main Findings

- * The known geographic range of *Hylaeus globuliferus* was extended northwards significantly (by about 160 km). Specimens were collected from several localities in the vicinity of Eneabba and Jurien. Previously, no specimens had been recorded north of the Moore River.
- * New locality records of the species were established in the Great Southern Region, narrowing the gap somewhat between northern and southern collection localities.
- * *Adenanthos cygnorum* (Common Woolly Bush) was the only plant species observed to be visited by the bees in areas around and north of Perth but at more southerly localities (Great Southern Region), *Adenanthos flavidiflora* (dwarf woolly bush) was the observed forage plant. None of the bees was observed to visit flowers of *Grevillea cagiana* which were available to them at some of the collection sites (several previous collection records exist for this plant).
- * Males established territories on the tips of woolly bush only in the Perth to Moore River Region. No territorial behaviour was observed in more northerly areas (no males were encountered in the Great Southern).
- * On extremely hot days in northern localities, foraging activity appeared to be restricted to late afternoon and evening.
- * The species is probably secure in conservation reserves although populations of the bees and their food plants seemed particularly low in Dongolocking Nature Reserve.
- * In some reserves (e.g. Melaleuca Conservation Park), woolly bush is confined largely to the edges of tracks and is absent from the bulk of the reserves.
- * Large tracts of woolly bushes bearing fresh flowers were surveyed without sightings of the bees in several conservation reserves, so the presence of the forage plant is not a reliable predictor of the presence of the bee.

2. Appointment of Assistant

An appointment of a temporary part-time technician to assist in the field and laboratory was made in January.

Appointee: Mr Craig Boase

Background: 18 years old (at appointment), member of the WA Insect Study Society, experienced in the collection and mounting of insect specimens, has been studying at Curtin University of Technology for his Certificate of Laboratory Practices. Has done voluntary work for Department of Conservation and Land Management.

Term of employment: 10 January - 21 March (a total of 40 days worked).

3. Fieldwork Undertaken

a) Objectives

to determine the overall geographic range of the bee, particularly to see how far northwards it occurred and whether it occurred in remnant bushlands between Perth and previously recorded localities in south-coastal reserves and the Great Southern region,

to establish in which conservation reserves the bee occurs,

to observe the habits of the bees, particularly in relation to forage plant preferences and mating behaviour.

b) Selection of study areas

Attention was directed to areas harbouring populations of common woolly bush. The selection of areas to visit was based on personal experience, advice received from reserve officers within the Department of Conservation and Land Management and a map of recorded localities in E.C. Nelson's "Revision of the genus *Adenanthos*", 1978.

Before fieldwork funded by Eclipse Resources was undertaken, woolly bushes were surveyed for bee activity by TFH at the following times and places while engaged in Museum-funded field studies of other insects (***) = *H. globuliferus* sighted):

11 and 15 November, Flynn Drive, Neerabup
 22-25 November, 15-26 km north of Eneabba
 25-27 November, Pinjarrega Lake Nature Reserve (SW of Coorow)
 11 December, Flynn Drive, Neerabup *** (First sightings for season)
 17-18 December, Pinjarrega Lake Nature Reserve (SW of Coorow)
 19-20 December, 15-22 km N of Eneabba
 29 December, Flynn Drive, Neerabup ***

Fieldwork funded by Eclipse Resources was undertaken at the following times and places:

11 January, Flynn Drive, Neerabup, and Melaleuca Conservation Park ***

12 January, Melaleuca Conservation Park ***

18-26 January, Perth-Geraldton region conservation reserves: Watheroo National Park - Pinjarrega Lake Nature Reserve - Hill River Nature Reserve and areas south thereof *** - South Eneabba Nature Reserve - crown lands 15-25 km N of Eneabba *** - Yandanogo Nature Reserve - Burma Road Nature Reserve - Robb Road crown lands - Tathra National Park *** - Moore River National Park ***

7 February, Flynn Drive ***

9 February, Forrestdale Lake, Thompsons Lake and The Spectacles Nature Reserves.

16-22 February, Perth-Newdegate region conservation reserves: Boyagin Rock Nature Reserve - Tutanning Nature Reserve - Dragon Rocks Nature Reserve *** - Tarin Rock Nature Reserve *** - Dongolocking Nature Reserve *** - Dryandra State Forest.

8 March, Flynn Drive, Neerabup *** (last sightings for season).

c) Survey techniques

Earlier experience in the Wanneroo area had shown that males of *H. globuliferus* habitually perched on the tips of certain woolly bushes between the hours of 11 am and 1 pm (and sometimes earlier and later as well). At such times, the males were easily spotted. Guided by this experience, areas of woolly bush habitat were always surveyed during the middle hours of the days although patrols were made at other times as well. These patrols were made both on foot and by vehicle at very slow speeds. The latter method allowed many kilometres of potential habitat along roads and tracks to be surveyed.

Wherever possible, intense searches of woolly bushes bearing fresh flowers were made each morning and evening as well as in the middle hours to ascertain the foraging patterns of females.

d) Results

(i) Geographic distribution

Specimens of *Hylaeus globuliferus* were encountered at the following localities during the 1995/96 field season (in order from south to north):

Tarin Rock Nature Reserve, approx. 15 km NE of Kukerin

Dongolocking Nature Reserve, approx. 28 km NNW of Dumbleyung

Dragon Rocks Nature Reserve, approx. 33 km N of Newdegate

Flynn Drive, Neerabup (30 km N of Perth GPO)

Melaleuca Conservation Park (N of Gnangara pine plantation)

Moore River National Park, approx. 35 km NNW of Gin Gin

Private land (owned by operators of Cooljarloo mineral sands mine), Cairn Road, approx. 17 km ESE of Jurien

Hill River Nature Reserve (15 km E of Jurien)

Tathra National Park, 22 km E of Eneabba

Crown land, 15-25 km N of Eneabba and W of Brand Highway

Maps 1 and 2 show collection localities for *Hylaeus globuliferus* over the summer of 1995/96 in relation to previous records.

New localities established for *H. globuliferus* were all those north of the Moore River including Tathra National Park, 15-25 km north of Eneabba, Hill River Nature Reserve and Cairn Road (south of Hill River). These records extend the known range of the bee over 160 km northwards.

New localities established south and east of Perth were Dragon Rocks, Tarin Rock and Dongolocking Nature Reserves. These records extend the known range of southern populations over 100 km westwards and 40 km northwards.

(ii) Material Collected

A total of 48 specimens of *H. globuliferus* (20 females and 28 males) were collected over the summer.

In addition, while in the field, the opportunity was taken to collect other insects of interest as well as our target bee. Over 1,000 specimens were collected, preserved, labelled and accessioned into the Museum entomology collection (see more in Section 7).

(iii) Biological Observations

Forage Plants and Foraging

While a variety of flower species were available to the bees at each of the localities where we observed them, they were not seen to visit anything other than *Adenanthos* species. North of Perth, *A. cygnorum* was the only forage plant recorded. Flowers of the tall shrub *A. strictus* were closely inspected in Watheroo National Park and Pinjarrega Lake Nature Reserve but no *globuliferus* sightings were made.

During our 16-23 February field trip, almost all common woolly bush shrubs inspected at several localities (including Boyagin Rock, Tutanning and Dongolocking Nature Reserves, and Dryandra State Forest) had nothing but dried off flowers (clearly a result of the sustained heatwave being experienced at the time and the lack of precipitation). There would have been no food to attract or sustain *H. globuliferus*, even if they existed in these areas.

Only one other forage plant was recorded for the species: all specimens observed/collected in southern wheatbelt localities (Dragon Rocks, Tarin Rock and Dongolocking Nature Reserves) were at flowers of the dwarf woolly bush, *A. flavidiflora*.

One previously recorded forage plant, the red tooth-brush grevillea, *Grevillea cagiana*, was flowering in some of the *globuliferus* collection areas in Dragon Rocks and Tarin Rock Nature Reserves. However, no sightings of *globuliferus* were made on these plants.

Numerous observations were made of females biting open unopened corolla tubes of *Adenanthos* and removing the pollen from the style end and anthers. They were also observed thrusting their heads deep into the corolla tubes, obviously taking nectar.

Male Behaviour

Observations made over this past summer suggest that male mate-seeking behaviour may not be consistent throughout the range of the species or, alternatively, it is markedly affected by wind and/or high temperatures.

In January, when males were engaging in stem-tip perching in the Perth to Moore River region, no males were observed on stem tips in populations further north. Possibly the lack of stem-tip perching was associated with strong winds and high temperatures prevailing at that time. A blustery easterly wind persisted through most of our northern fieldtrip and air temperatures were very hot (Western Flora Caravan Park north of Eneabba recorded a maximum of 48°C on one of the days). The wind had almost subsided by the time we reached Moore River National Park where we found males perching on stem tips as usual.

Those males sighted during our time north of Moore River were all flitting about among the lower foliage of woolly bushes.

Both sexes were found active about flowers of woolly bush from about 11 am to 5.45 pm in the Jurien-Eneabba region in January. However, on some very hot days, the bulk of specimens were sighted late in the afternoon, suggesting that the bees may avoid foraging or mate-seeking in the extreme temperatures of midday.

No males were observed at all in southern localities this past summer.

4. The Search For Nesting Sites

a) Methodology

All species studied so far in the subfamily Hylaeinae (to which *Hylaeus globuliferus* belongs) are known to use existing burrows, tunnels or other hollows in which to make their nests. Most often they make nests in hollow pithy plant stems or in abandoned burrows of boring insects in dead wood. Some are known to use the shafts of burrowing wasps and other bees in the soil. A few use abandoned nests of mud wasps.

Consequently, the search for nesting sites of *H. globuliferus* in the summer of 1994/95 was focused initially on dead plant stems and borer holes in stems, branches, tree trunks and logs. Holes were cut open or inspected with reflected sunlight to look for the tell-tale silvery lining characteristic of *Hylaeus* nests. While a few nests of tiny, unidentified *Hylaeus* species were found, none were of *H. globuliferus*.

The additional technique of 'trap-nesting' was tried. Trap-nesting involves deployment of artificial nesting sites (drilled pieces of wood) that have the potential to attract nesting females. These can be checked at intervals, are easily removable and, if used for nesting, can easily be split lengthwise to reveal the brood cells.

For this study, 10cm long sections of 2 cm x 2 cm pine battens were drilled with 6.5 mm diameter holes (somewhat greater than the widths of the female bees). In the summer of 1994/95) about 50 were affixed to shrub stems, tree trunks, stumps etc. in close proximity to bushes where females had been encountered working flowers. Several trap nests were occupied by resin bees of the family Megachilidae but none by *H. globuliferus*.

Because of the above results and the sighting of several individuals of *globuliferus* close to the ground, the possibility had to be entertained that the bees nested in the ground. Consequently, 100 trap-nests were implanted in the soil in clearings among woolly bushes on the Borello block, Flynn Drive, Neerabup, on 7 February 1996.

The trap-nests were collected up again on 24 May and inspected for insect occupants in the laboratory.

b) Results

Nine traps were found with their bores closed by silvery membranes of the kind made by *Hylaeus* bees to seal off nest chambers. Two of these trap-nests were split open revealing in one a series of brood cells containing unidentified larvae and in the other a series of brood cells containing the bodies of three adults of *Hylaeus elegans*, a common native bee known to nest in ground burrows. It may be that all nine traps contain nests of the same species but, until the occupants are reared through to the adults (probably in December), there is no surety what species is involved.

This has proved to be the case.
J.F.

5. Conclusions

Hylaeus globuliferus evidently specializes in flowers of *Adenanthos* species.

Given the recent records of *Hylaeus globuliferus*, the species appears to be reasonably secure from a conservation point of view, occurring in numbers of conservation reserves over a very wide area of southern Western Australia.

Despite its wide distribution and the abundance of its preferred forage plants in certain areas, the species seems to be patchily distributed and occurs in low population densities.

The presence of forage plants in an area does not guarantee presence of the bee, as large areas of seemingly suitable habitat were surveyed with nil results.

As well, the staple forage plant (common woolly bush) is not as abundant in some reserves as a cursory examination might suggest, the bushes being common along the disturbed margins of tracks but absent from the body of the reserves.

Possible population differences in male behaviour require confirmation. No males were observed to perch on woolly bush stem tips in areas north of the Moore River. No males were observed at all late in the season in areas south-east of Perth. These differences could have been due to weather conditions.

6. Further Work Proposed

In the summer of 1996/97, the southern extremity of the geographic range of the species will be surveyed in greater detail. *Hylaeus globuliferus* has been recorded from southern coastal localities ("King George Sound" and Fitzgerald River National Park) but the eastern limit of its range could possibly extend to Cape Arid.

Some reserves visited this past summer will be visited again next summer *en route* to the south coast. Dryandra State Forest and Tutanning Reserve, for example, have substantial amounts of common woolly bush but no sightings of the bee were obtained there, quite likely because of drought conditions and the lack of fresh flower. These reserves need to be visited earlier in the season when fresh flowers are present.

Trap-nests, too, will need to be deployed earlier next summer (in early December) so they will be available to the first females seeking new nesting sites.

A collection of males will be made from the Wanneroo area at the peak of the activity season (January) in order to obtain sufficient antennal tissue for chemical analysis of the antennal gland secretion.

7. Spin-offs from Fieldwork

Some little known, particularly scarce or currently undescribed species of insects were turned up at various locations where *Hylaeus globuliferus* was sought. Specimens of these species have been made available to relevant specialists within and outside Australia for description and naming or recording.

They included the following:

Native bees - several species (including a new species of ? *Leioproctus* from Melaleuca Park specializing in *Persoonia* flowers; possibly represents a new genus or subgenus; sent to Ms Glynn Maynard, Australian National Insect Collection, Canberra)

Parasitic wasps (Gasteruptiidae) - at least one new species of *Aulacofoenus* from Tutanning Reserve (sent to Mr John Jennings, University of Adelaide)

Sun moths (Castniidae) - an undescribed species of *Synemon* from Dragon Rocks and Dongolocking Reserve; second known collection and the first with reliable data (examined by Dr Ebbe Nielsen, Australian National Insect Collection, Canberra)

Flower beetle (Scarabaeidae: Cetoniinae) - possibly a new species near *Pseudoclitria rugosa*

Tiger beetles (scarce *Nickerlea sloanei* from Dongolocking Reserve; referred to Mr Dan Sumlin, San Antonio, Texas)

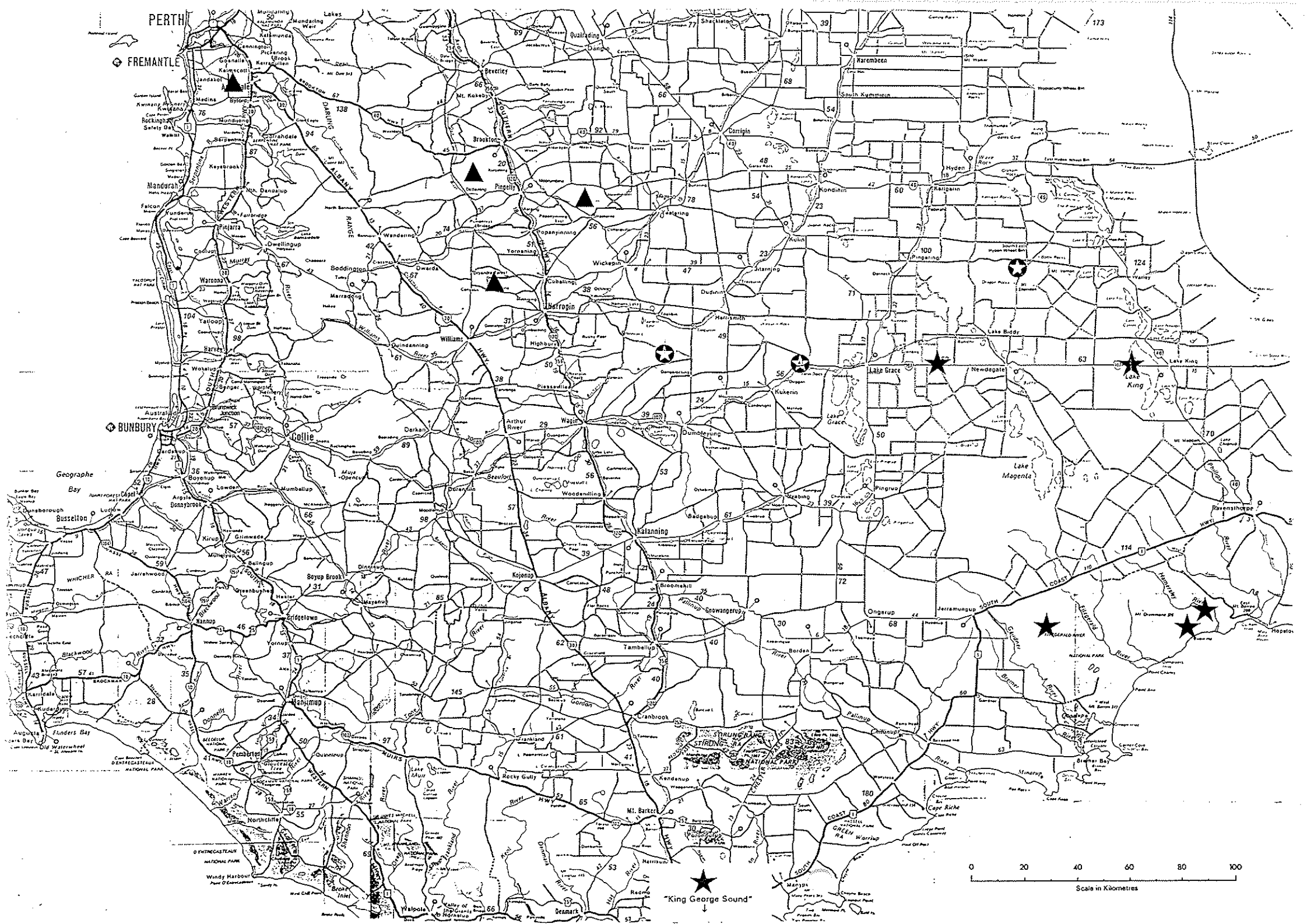
Cicadas (scarce species of sandgrinders, *Arenopsaltria*, some undescribed; sent to Mr Max Moulds, Australian Museum, Sydney)

The full value of the collections made this summer will not be realized until all specimens reach the hands of relevant specialists. Only those specimens which I thought might interest current workers have been sent out for identification and assessment.

**MAPS OF KNOWN OCCURRENCES
OF *HYLAEUS GLOBULIFERUS***

LEGEND

- ★ Record existing prior to summer of 1995/96
- ⊛ New record from summer of 1995/96
- ▲ Extensive common woolly bush habitat searched with nil result in summer of 1995/96



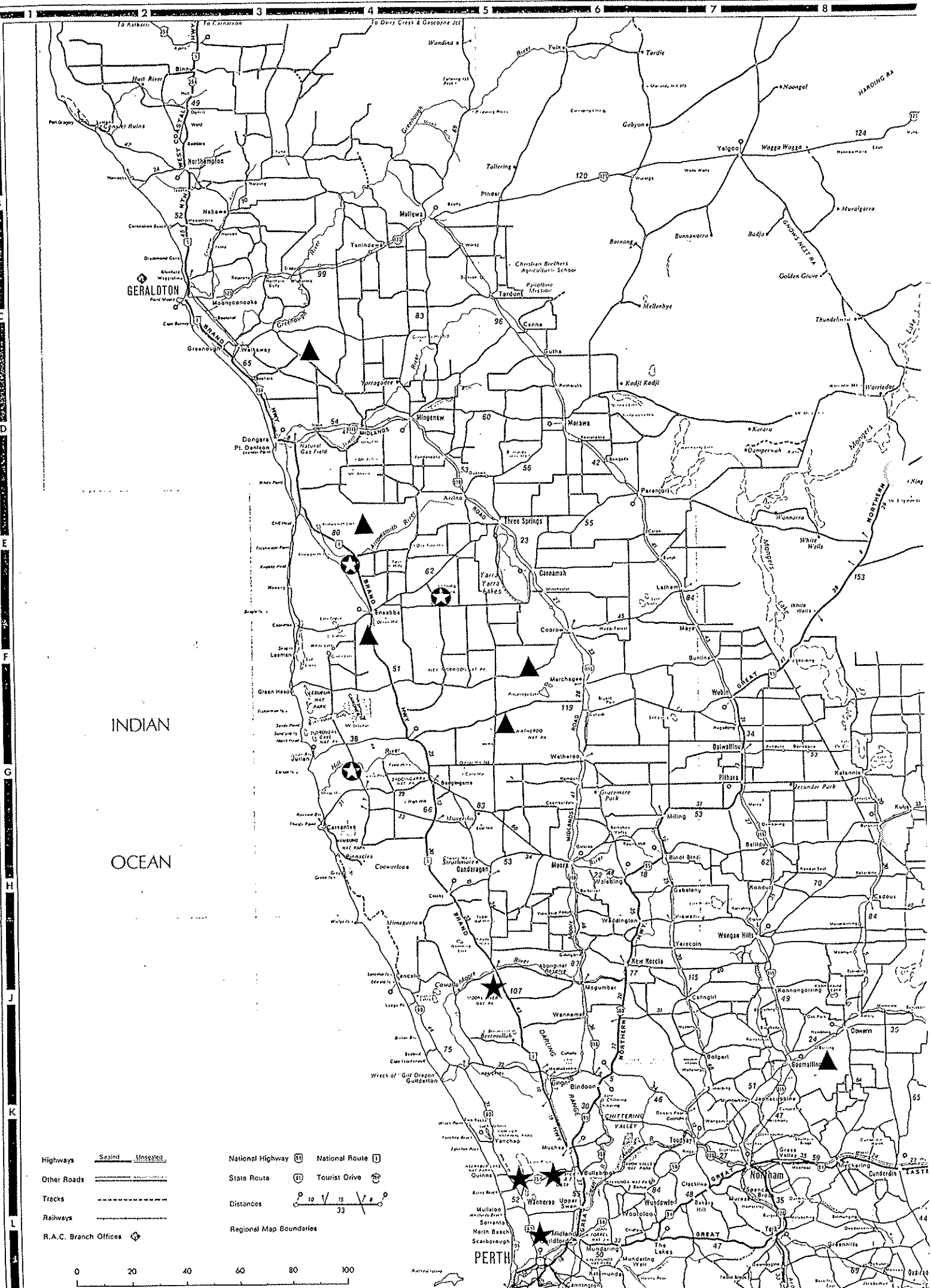
PERTH

FREMANTLE

BUNBURY

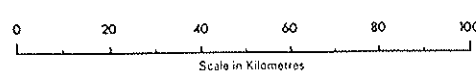
"King George Sound"

0 20 40 60 80 100
Scale in Kilometres



INDIAN
OCEAN

- Highways Sealed Unsealed
- Other Roads
- Tracks
- Railways
- R.A.C. Branch Offices
- National Highway 11 National Route 11
- State Route 11 Tourist Drive 11
- Distances
0
10
20
30
40
50
60
70
80
90
100
- Regional Map Boundaries



from file TP 96.005
(227 74)

BS 295 SP.N

**FLYNN DRIVE INDUSTRIAL AREA
DISTRICT STRUCTURE PLAN**

Prepared for

**CITY OF WANNEROO, LANDCORP, BORRELLO,
COCKBURN CEMENT, TRANDOS AND SUSAC**

Prepared by
Richard Pawluk & Associates
Masterplan Consultants
in association with
Sinclair Knight Merz
McDonald Hales & Associates
Herring Storer Acoustics

December 1995

mature indicating earlier clearing. In some areas of low woodland scattered jarrah were stunted indicating marginal soil suitability. **Plan 7** illustrates the diversity of vegetative associations and should be read in conjunction with **Appendix 3 - Photographic Record of Vegetative Associations of the Flynn Drive Industrial Estate**.

Areas of shrubland occur in the south east corner of the estate dominated by Woolly bush (*Adenanthos cygnorum*). Heathlands in the west and central regions contain a diverse assemblage of sclerophyllous species. Grasslands have been created by clearing, throughout which native species are re-establishing.

The fringing vegetation of Lake Neerabup is an open *Eucalyptus* woodland with occasional *Melaleuca*, *Typha* and various grasses are present along the margins.

Clearing of large tracts of native vegetation in this area may have a significant effect on the levels of groundwater in the area. Groundwater recharge will increase as water is no longer consumed by the evapotranspiration processes of the vegetation. This could have effects on:

- the water level and function of Lake Neerabup which is to the west of the development and in the direction of groundwater flow; and
- overall drainage patterns in the area.

The proposed extraction of groundwater for use by industry may offset the increased recharge from clearing of natural vegetation. (**Refer Section 7.1.5**)

Rare Flora

A search of the Department of Conservation and Land Management (CALM) Declared Rare Flora database and the WA Herbarium specimen database for priority species showed no recorded rare flora in the area.

7.1.3 Rare Fauna and Habitat

A database search was conducted by the WA Museum to identify the existence of rare fauna within the study area. The search showed that no rare mammals or reptiles have been sighted. However a rare native bee *Hylaeus globuliferus* has recently been recorded in the area. The recordings were made by the Curator of Insects at the WA Museum, in bushland bound by Flynn Drive to the south, the Wanneroo golf club and Pinjar Road to the east, Mather Drive to the west and Pederick Street to the north, on Lots 2477, 505 and 508. The feature of the bushland which makes it a unique habitat for the bee is the presence of abundant woolly bush *Adenanthos cygnorum* upon which the bee is dependent for pollen and nectar. Common Woolly bush is not tolerant to fire and regenerates only from seed flowering in its second year or later. Its distribution extends from Shark Bay to Albany, however its greatest abundance is in the metropolitan area (Nelson, 1978). Due to urban expansion and its lack of tolerance to fire the extent of Woolly bush habitat in the metropolitan area has diminished. The population of *Hylaeus globuliferus* in the study area is the only one known at present where significant numbers of the bee have been recorded (Pers. comm., WA Museum, 1995).

H. globuliferus is not presently listed as "Threatened Fauna" but has been proposed as an addition to the Schedule of Declared Threatened Fauna with the Department of

Conservation and Land Management. Due to its present status as being poorly studied it is likely that the inclusion of *Hylaeus globuliferus* on the Schedule is imminent.

Similarly a sun moth *Synemon gratiosa* which was noted in the area has also been proposed as an addition to the Schedule of Declared Threatened Fauna. No formal survey has been

conducted on the moth however it has been recorded in bushland between Flynn Drive and Pederick Road in March 1995, the same area as the rare bee. The distribution of the rare moth is believed to be confined to the Swan Coastal Plain however its habitat is less well known. Within the Flynn Drive Industrial Estate it is associated with open patches of shrubland (Pers. comm. WA Museum, 1995).

Lot 508 is substantially cleared for horticulture and therefore supports little or no *A. cygnorum* (Woolly bush) habitat. Lot 505 (to the east of Lot 508) is less cleared and has an open *Banksia* woodland with an understorey of *A. cygnorum* and *Xanthorrhoea* (Blackboy) in its eastern half. Lot 2477 is open Jarrah woodland with dense shrubland of Woolly bush.

7.1.4 Groundwater

The eastern border of the proposed Flynn Drive Industrial Estate abuts the western boundary of the Gnangara Mound Policy area, which is protected under the *Environmental Protection (Gnangara Mound Crown Land) Policy 1992* (WAWA 1993a) and the *Environmental Protection (Gnangara Mound Private Land Groundwater) Policy 1993* (WAWA 1993b). Groundwater movement in the area is predominantly from east to west (Select Committee on Metropolitan Development and Groundwater Supplies, 1994). Therefore the proposed industrial estate should not have a significant effect on the groundwater mound.

Following discussions with the Water Authority of Western Australia it was established that there is no groundwater pollution control in the area and industrial activities are not controlled. The Water Authority also advised that the expansion of the boundaries of the Gnangara Mound Policy Area to include the proposed industrial estate was "extremely unlikely" (Pers. comm., WAWA, 1995). The Department of Environmental Protection commented that there were no particular groundwater issues that they would like addressed for the proposed industrial estate (Pers. comm., DEP, 1995) as each new development would be subject to the usual assessment processes as part of the works approval application.

As the types of industry to be located within the estate are yet to be determined certain questions will need to be addressed in the planning of each development. Particular issues will need to be addressed such as:

- the potential for groundwater pollution from accidental spillage;
- how the risk of groundwater pollution will be limited; and
- the clearing of remnant vegetation and potential for rising groundwater and their effects on Neerabup Lake and overall drainage patterns.

The potential for clearing of natural vegetation to raise groundwater levels is discussed in **Section 7.1.2**. Stormwater will be disposed by local soakage and may also make a significant contribution to groundwater levels. A new water supply strategy being prepared by WAWA involves the use of individual supply bores to reduce

**BUSH FOREVER VEGETATION
& FLORA ASSESSMENT**

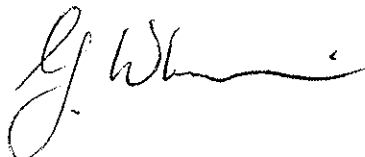
**PART BUSH FOREVER SITE 295 -
LOT 505 PEDERICK ROAD, NEERABUP**

Karen Clarke¹, Sally Madden² and Bronwen Keighery¹

¹Department of Environmental Protection (DEP) and

²Department for Planning and Infrastructure (DPI)

October 2001

A handwritten signature in black ink, appearing to read 'G. Whelan', is positioned below the date. The signature is fluid and cursive, with a long horizontal stroke at the end.

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

SUMMARY

The bushland on Lot 505 is regionally significant and has high conservation value as it:

- is representative of the Karrakatta Complex - Central and South which is poorly conserved in Bush Forever and as such can be considered poorly protected
- is in Excellent to Very Good condition
- is most likely representative of floristic community types poorly conserved on the Swan Coastal Plain (FCT 23a only occurs in the Perth Metropolitan Region and is an unusual occurrence on the Karrakatta Complex - Central and South and FCT 20a is a Threatened Ecological Community) and,
- forms part of a significant east-west/north-south linkage through a range of plant communities in Site 295 and also connects Site 295 through to Site 382 (Lake Pinjar and Adjacent Bushland, Pinjar).

As a consequence no adjustment of the Bush Forever boundary is necessary.

BACKGROUND

Bush Forever Site 295 encompasses regionally significant bushland of three vegetation complexes, the Cottesloe Complex – Central and South, Karrakatta Complex - Central and South and the Pinjar Complex. These complexes occur from west to east across the Site respectively. The Site contains both vegetated uplands and vegetated wetlands. The Site Description (Appendix 1) summarises the conservation values of this Bush Forever Site (Government of Western Australia 2000b).

The bushland at the eastern end of Lot 505 Pederick Rd, Neerabup (Figure 1) is part of Bush Forever Site 295. This bushland has previously been identified as containing regionally significant remnant bushland (Government of Western Australia 2000a&b) and is all mapped as Karrakatta Complex - Central and South (Hedde *et al.* 1980). The area of the Karrakatta Complex - Central and South proposed for protection under Bush Forever is 8% (Government of Western Australia 2000a). Based on international criteria for conservation, Bush Forever aims to protect 'at least 10% of the original extent' of each of the Hedde *et al.* (1980) vegetation complexes (Government of Western Australia 2000a).

Bush Forever Site 295 forms part of a regionally significant fragmented bushland/wetland linkage (see Map 7, Government of Western Australia 2000a). The bushland on Lot 505 is an integral part of this linkage as it connects the bushland within Site 295 both north to south and east to west. It also connects the bushland in Site 295 to the adjacent bushland to the north in Bush Forever Site 382 - Lake Pinjar and Adjacent Bushland, Pinjar.

METHODOLOGY

A field inspection of Lot 505 Pederick Rd, Neerabup was made by Karen Clarke (DEP), Sally Madden and Emma Bamforth (DPI) on 18/9/2001. Approximately one hour was spent traversing the bushland by vehicle and on foot. Each unit of vegetation was described using the standard procedures documented in Bush Forever (Government of Western Australia 2000b). Appendix 2 contains the Lot Survey Sheets and field sheets recorded for Lot 505. Condition ratings were based on Keighery (1994).

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

RESULTS

The bushland on Lot 505 Pederick Rd, Neerabup consists of vegetated upland of *Banksia attenuata* and *Banksia menziesii* Low Woodland with scattered *Allocasuarina fraseriana*, *Eucalyptus marginata* and *Nuytsia floribunda* over patches of *Allocasuarina humilis* Tall Shrubland and *Hibbertia hypericoides* Open Low Heath over *Patersonia occidentalis* Very Open Herbland and *Mesomelaena pseudostygia* Very Open Sedgeland (Units 1 & 3, Map 2, Appendix 2). Localised clearing in the past has created small, more open areas of *Eucalyptus marginata* Open Woodland over *B. menziesii* and *B. attenuata* Low Open Woodland (Unit 2, Map 2, Appendix 2). These vegetation units have previously been described for this particular Site (see Appendices 1 & 2).

The bushland is in Excellent to Very Good condition. It is relatively intact with only localised disturbance associated with the bordering firebreaks, minor tracks and localised historical clearing. Timber cutting has occurred in the past. Fire has not passed through the bushland for over 5 years. Few weed species are present in the bushland and those present are non-aggressive species occurring at a low density.

Significant flora recorded during the site inspection were: *Cyathochaeta equitans* and *Conospermum incurvum*.

DISCUSSION

The site inspection of 18 September 2001 confirms that the bushland present on Lot 505 Pederick Rd, Neerabup within Bush Forever Site 295 (Map 1), is regionally significant. The bushland is in Excellent to Very Good condition and representative of the vegetation found on the eastern side of the Spearwood Dune System, which is part of the variation found within the Karrakatta Complex - Central and South. This lot is near the boundary between the Karrakatta Complex- Central and South, Pinjar Complex (associated with wetlands) and to the east the Bassendean Complex - Central and South (Hedde *et al.* 1980). The floristic composition recorded (Appendix 3) indicates that the bushland is most likely representative of regional Floristic Community Type (FCT) 23a – Central *Banksia attenuata* - *Banksia menziesii* woodlands or FCT 20a - *Banksia attenuata* woodlands over species rich dense shrublands, as defined by Gibson *et al.* (1994) and Government of Western Australia (2000b). Both FCT 23a and 20a are in Supergroup 3 - Uplands Centred on Bassendean Dunes and Dandaragan Plateau. FCT 23a only occurs in the Perth Metropolitan Region and has not been previously recorded on the Karrakatta Complex - Central and South. FCT 20a is a threatened ecological community (English and Blyth 1997) and has been recorded in several other Bush Forever Sites representative of the Karrakatta Complex - Central and South (Government of Western Australia 2000b). A more detailed vegetation and flora survey based on sampling of 10 x 10 m floristic plots in spring and multivariate statistical analysis, would be required to determine exactly which floristic community type/s was present.

It should be noted that the western boundary of Bush Forever Site 295 on Lot 505 does not include the full extent of the regionally significant bushland on this lot. Bushland of the type and quality described in this report extends west beyond the Bush Forever boundary (see Figures 1 & 2) and would be a suitable addition to the Site if it were not constrained by zoning for industry. Given this, no adjustment of the Bush Forever boundary is proposed but the possibility of achieving conservation of additional area could be considered through planning processes.

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

REFERENCES

References not listed can be found in Government of Western Australia (2000b)

Government of Western Australia 2000a. *Bush Forever. Volume 1 Policies, Principles and Processes*, Western Australian Planning Commission, Perth, Western Australia.

Government of Western Australia 2000b. *Bush Forever. Volume 2 - Directory of Bush Forever Sites*. Department of Environmental Protection, Perth, Western Australia.

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

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APPENDIX 1: SITE DESCRIPTION

(from *Bush Forever* Volume 2, for Site Map see *Bush Forever* Volume 1)

FLYNN DRIVE BUSHLAND, NEERABUP

Boundary Definition: bushland (part taken to zoning)/management boundary (Part Site, part Lots 1, 2001 Flynn Dr, subject to Ministerial Condition No. 280, 21 August 1992.)

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 295

Area (ha): bushland 112.6

Map no. 21

Map sheet series ref. no. 2034-I SW

Other Names: not known

Local Authorities (Suburb): Shire of Wanneroo (Neerabup, Carramar, Cockman)

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)

Spearwood Dunes

Sands derived from Tamala Limestone (Qts: S7)

Lagoonal and Estuarine Deposits (within the Spearwood Dunes)

Lagoonal and Estuarine Deposits (Vasse) (Qhg: S4)

VEGETATION AND FLORA

Vegetation Complexes

Spearwood Dunes

Karrakatta Complex — Central and South

Cottesloe Complex — Central and South

Wetlands

Pinjar Complex

Floristic Community Types: *not sampled, types inferred

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau

22 *Banksia ilicifolia* woodlands

*23a Central *Banksia attenuata* — *B. menziesii* woodlands

Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes

*28 Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands

WETLANDS

Wetland Types: sumpland

Natural Wetland Groups

Bassendean Dunes

Pinjar (B.1)

Gnangara (B.2)

Wetland Management Objectives: Conservation (2ha)

Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated uplands, vegetated wetlands

Vegetation and Flora: limited survey (DEP 1996 (Pinj 12), DEP 1998, DEP 1999, part Site — Bowman Bishaw Gorham 1992b, WAWA 1995)

Structural Units: mapping (part Site — Bowman Bishaw Gorham 1992b, WAWA 1995)

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

Uplands — Sands derived from Tamala Limestone: Low Woodland to Low Open Forest dominated by *Banksia attenuata* and *B. menziesii* with scattered to co-dominant *Eucalyptus todtiana*, *E. marginata*, *Nuytsia floribunda* and *Allocasuarina fraseriana*; *Adenanthos cygnorum* Tall Closed Scrub to Tall Shrubland; *Hibbertia hypericoides*, *Daviesia triflora* and *Leucopogon conostephioides* Open to Closed Low Heath

Wetlands: not known

Scattered Native Plants: not assessed

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

Total Flora: not known

Significant Flora: *Conostephium minus* (4); *Boronia purdieana*

Fauna: Location for rare native bee (*Hylaeus globuliferus*) (Pawluk, Richard and Associates 1995)

Linkage: adjacent bushland to the north (Site 382, across road); part of a regionally significant fragmented bushland/wetland linkage (Part A, Map 7)

Other Special Attributes: recommended for protection in the study of City of Wanneroo bushland (Trudgen 1996)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

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

Recommendation: Part A: Site with Some Existing Protection; Existing Parks and Recreation Reserve. Part B: Strategic Negotiated Planning Solution. Part C: Other Government Land Mechanism. Part D: Urban Negotiated Planning Solution (see Table 3, Volume 1).

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

APPENDIX 2: LOT SURVEY AND FIELD RECORDING SHEETS

BUSH FOREVER SITE

LOT SURVEY SHEET 1 - BOUNDARY/VEGETATION UNIT VERIFICATION

Use Survey Sheet 1 for each Lot inspected

BUSH FOREVER SITE: No. 295 - Flynn Drive Bushland, Neerabup

LOT INSPECTED: 505 Pederick Rd, Neerabup

DATE TRIP: 18-09-01 **RECORDERS:** Karen Clarke, Sally Madden & Emma Bamforth

BOUNDARY (<i>Compare boundary observed with mapped boundary. Tick appropriate response</i>)	
<input checked="" type="checkbox"/>	MATCHES CURRENT BOUNDARY
<input type="checkbox"/>	CHANGES RECOMMENDED (OUTLINE EACH CHANGE BELOW AND NUMBER AND DRAW EACH CHANGE ON THE MAP)

VEGETATION UNITS (<i>Compare units observed with Bush Forever Site description units. Tick appropriate response</i>)	
<input checked="" type="checkbox"/>	MATCHES DESCRIBED UNITS
<input type="checkbox"/>	ADDITIONAL VEGETATION UNITS DESCRIBED

Change 1	Lot /Lot	Photo No
Rationale for change		

Change 2	Lot /Lot	Photo No
Rationale for change		

Change 3	Lot /Lot	Photo No
Rationale for change		

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

**BUSH FOREVER SITE
LOT SURVEY SHEET 2 –VEGETATION UNITS**

For each vegetation unit observed describe

- each layer in the unit according to height and cover
- dominant species
- associated significant species
- condition of each unit.

Indicate location of sample/description point for each unit/s described on the map.

Unit 1						
Trees and/or Mallees: <i>Banksia attenuata</i> and <i>Banksia menziesii</i> Low Woodland						
Shrubs: Patches of <i>Allocasuarina humilis</i> Tall Shrubland over <i>Hibbertia hypericoides</i> Open Low Heath						
Herbs: <i>Patersonia occidentalis</i> Very Open Herbland						
Sedges: <i>Mesomelaena pseudostygia</i> Very Open Sedgeland						
Grasses:						
Significant Flora						
<i>Cyathochaeta equitans</i> , <i>Conospermum incurvum</i>						
Vegetation Condition	1	2	→ 3	4	5	6
Comment: Excellent to Very Good, some scattered non-aggressive weeds present, minor disturbance from past human activities (tracks, timber cutting).						

Unit 2						
Trees and/or Mallees: <i>Eucalyptus marginata</i> Open Woodland over <i>B. menziesii</i> and <i>B. attenuata</i> Low Open Woodland						
Shrubs: <i>H. hypericoides</i> and <i>Scholtzia involucrata</i> Low Shrubland with scattered <i>Xanthorrhoea preissii</i>						
Herbs: <i>P. occidentalis</i> Very Open Herbland						
Sedges: <i>M. pseudostygia</i> Open Sedgeland						
Grasses:						
Significant Flora						
Vegetation Condition	1	2	3	4	5	6
Comment: Very Good, original Jarrah (<i>E. marginata</i>) trees logged in past, coppiced regrowth now present, old track into area, previous clearing/grazing?, past rabbit activity evident.						

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

Unit 3						
Trees and/or Mallees: <i>Banksia attenuata</i> and <i>Banksia menziesii</i> Low Woodland with scattered <i>Allocasuarina fraseriana</i> , <i>Eucalyptus marginata</i> and <i>Nuytsia floribunda</i>						
Shrubs: Patches of <i>Allocasuarina humilis</i> Tall Shrubland over <i>Hibbertia hypericoides</i> Open Low Heath						
Herbs: <i>Patersonia occidentalis</i> Very Open Herbland						
Sedges: <i>Mesomelaena pseudostygia</i> Very Open Sedgeland						
Grasses:						
Significant Flora						
Vegetation Condition	1	2	→	3	4	5 6
Comment: Excellent to Very Good, some scattered non-aggressive weeds present, minor disturbance from past human activities (tracks, timber cutting).						

GENERAL CONDITION of LOT

Vegetation Condition - Keighery 1994 (Trudgen 1993) <i>Indicate range and % in each class</i>	
1 = 'Pristine' (Excellent)	
2 = Excellent (Very Good)	Excellent to Very Good >95%
3 = Very Good (Good)	Very Good <5%
4 = Good (Poor)	
5 = Degraded (Very Poor)	
6 = Completely Degraded	

Disturbance Describe observed disturbance eg partial clearing, weeds, soil movement, changes in water regimes etc.

Previous clearing/grazing? in small patches, minor tracks, scattered non-aggressive weeds, rabbit activity


OTHER COMMENTS

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA BS 295 Lot 505 SITE NUMBER 2
 DATE TRIP 18/9/01 RECORDERS K. Clarke, S. Madden
 DATE TRIP _____ RECORDERS _____
 DATE TRIP _____ RECORDERS _____
 BOTANIST _____

1. LOCATION of the QUADRAT From 'Bushland Plant Survey' written by B. Keighery (1994) and published by Wildflower Society of WA (Inc.), PO 1 64 Nedlands WA 6008.

Mud Map Draw a sketch of the location of the site below.

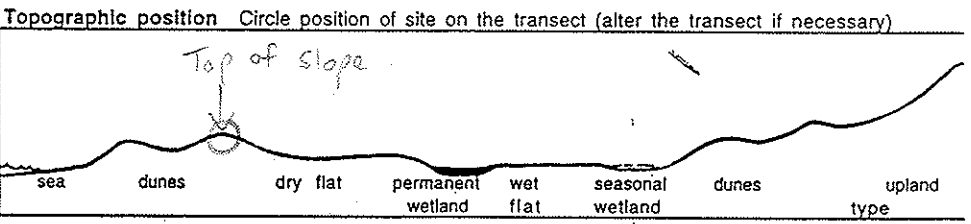


See sketch map

Road Location Pedderick Rd

Geographic Location Latitude _____ S Longitude _____ E Altitude _____
 Reference Map _____

Photograph Photographer's Name _____ Photo No 21



2. SITE DATA Circle the correct response.












Slope flat gentle steep Aspect N NE E SE S SW W NW

Surface Soil Sand Colour Light fawn
 Exposed rock type _____ % surface _____

Sub-surface Soil Sand Colour Yellow
 Rock type _____ depth to rock _____

Drainage well mod poor depth water _____ cm Wet all year winter/spring

Litter Depth 2-10 % cover _____ cm Bare Ground 30-70 % cover _____

LIFE FORM	TREES			MALLEES	
	over 30m	10 - 30m	under 10m	over 8m	under 8m
					30m 10m
COVER CLASS (%)		2-100%	2-10%		
DOMINANT SPECIES		<u>Eucalypt</u> <u>(patches of Eucalypt)</u>	<u>Banana</u>		
LIFE FORM	SHRUBS (<u>Xanpres under Sarah</u>)		SHRUBS		
	over 2m	2m - 1m	under 1m		
			2m 1m		
COVER CLASS (%)			10-30%		
DOMINANT SPECIES			<u>Hibbys</u> <u>Shrub</u>		
LIFE FORM	GRASSES	HERBS	SEDGES	OTHER	
				1m	
COVER CLASS (%)		2-10%	10-30%		
DOMINANT SPECIES		<u>Poa</u>	<u>Mesopoda</u>		

4. VEGETATION CONDITION

1	'PRISTINE'		COMMENTS <u>NR</u> Patches of low shrubland where trees cleared. Old Rabbit burrow, old large tree trunks on ground. Historical clearing/grazing?
2	EXCELLENT		
3	VERY GOOD	<input checked="" type="checkbox"/>	
4	GOOD		
5	DEGRADED		

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA BS295 Lot 505 SITE NUMBER 1
 DATE TRIP 18/9/01 RECORDERS K. Clarke, S. Madden
 DATE TRIP _____ RECORDERS _____
 DATE TRIP _____ RECORDERS _____
 BOTANIST _____

1. LOCATION of the QUADRAT

Mud Map Draw a sketch of the location of the site below.

From 'Bushland Plant Survey' written B. Keighery (1994) and published by Wildflower Society of WA (Inc.), PO 1 64 Nedlands WA 6008.



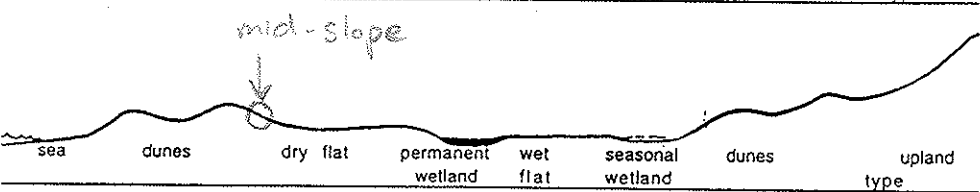
see sketch map

Road Location Padarick Rd, Neerabup

Geographic Location Latitude _____ S Longitude _____ E Altitude _____
 Reference Map _____

Photograph _____ Photographer's Name _____ Photo No 19920

Topographic position Circle position of site on the transect (alter the transect if necessary)



2. SITE DATA Circle the correct response.

Slope flat gentle steep Aspect N NE E SE S SW W NW
 Surface Soil Sand Colour Light fawn
 Exposed rock _____ type _____ % surface _____
 Sub-surface Soil Sand Colour Yellow
 Rock _____ type _____ depth to rock _____
 Drainage well mod poor depth water _____ cm Wet all year _____ winter/spring _____
 Litter 70-100 % cover _____ Bare Ground 2-10 % cover _____
 Depth 1-2 cm

patchy

LIFE FORM	TREES			MALLEES	
	over 30m	10 - 30m	under 10m	over 8m	under 8m
COVER CLASS (%)			<u>10-30%</u>		
DOMINANT SPECIES			<u>Banatt</u> <u>Bennett</u>		
LIFE FORM	SHRUBS		SHRUBS		
	over 2m	2m - 1m	under 1m		
COVER CLASS (%)	<u>10-30% in patches</u>		<u>30-70%</u>		
DOMINANT SPECIES	<u>All hum</u>		<u>Hibbys</u>		
LIFE FORM	GRASSES	HERBS	SERGES	OTHER	
COVER CLASS (%)		<u>2-10%</u>	<u>2-10%</u>		
DOMINANT SPECIES		<u>Potace</u>	<u>Mes pseudo</u>		

4. VEGETATION CONDITION

		COMMENTS
1	'PRISTINE'	
2	EXCELLENT	<u>Ex → VG, only a few weeds present, some tracks, Kangaroo trails & droppings present.</u>
3	VERY GOOD	
4	GOOD	
5	DEGRADED	

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA BS 295 Lot 505 SITE NUMBER 3
 DATE TRIP 18/9/01 RECORDERS K. Clarke, S. Madden
 DATE TRIP _____ RECORDERS _____
 DATE TRIP _____ RECORDERS _____
 BOTANIST _____

1. LOCATION of the QUADRAT

From 'Bushland Plant Survey' written B. Keighery (1994) and published by Wildflower Society of WA (Inc.), PO 1 64 Nedlands WA 6008.

Mud Map Draw a sketch of the location of the site below.

▲ N

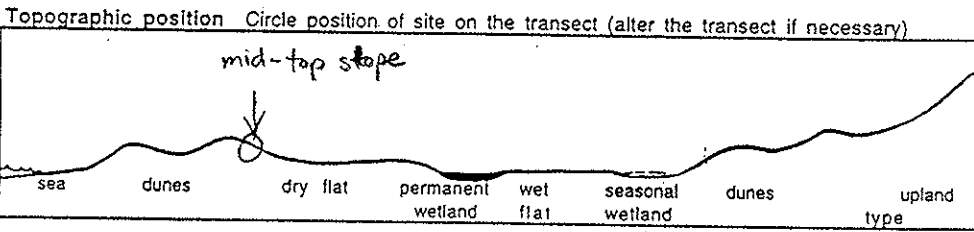
same Community Structure as Site 1 except occ. Allfas & Eucmar, Myrtles

see sketch map

Road Location Pedderick Rd

Geographic Location Latitude _____ S Longitude _____ E Altitude _____
 Reference Map _____

Photograph _____ Photographer's Name _____ Photo No 122 923



2. SITE DATA Circle the correct response.

Slope flat gentle steep Aspect N NE E SE S SW W NW

Surface Soil Sand Colour Light fawn
 Exposed rock _____ type _____ % surface _____

Sub-surface Soil Sand Colour Yellow
 Rock _____ type _____ depth to rock _____

Drainage well mod poor depth water _____ cm Wet all year winter/spring

Litter _____ % cover _____
 Depth _____ cm Bare Ground _____ % cover _____

LIFE FORM	TREES			MALLEES		30m
	over 30m	10 - 30m	under 10m	over 8m	under 8m	
COVER CLASS (%)						
DOMINANT SPECIES						
LIFE FORM	SHRUBS		SHRUBS			2m
	over 2m	2m - 1m	under 1m			
COVER CLASS (%)						
DOMINANT SPECIES						
LIFE FORM	GRASSES	HERBS	SERGES	OTHER		1m
COVER CLASS (%)						
DOMINANT SPECIES						

4. VEGETATION CONDITION

1 'PRISTINE'		COMMENTS <u>Ex - VG</u>
2 EXCELLENT	<u>I</u>	
3 VERY GOOD		
4 GOOD		
5 DEGRADED		

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

**APPENDIX 3: SPECIES LIST FOR LOT 505 PEDERICK RD &
LOT 2477 FLYNN DRIVE, NEERABUP**

Family: Anthericaceae	
	<i>Sowerbaea laxiflora</i>
	<i>Thysanotus manglesianus</i>
	<i>Thysanotus</i> sp.
	<i>Tricoryne</i> sp.
Family: Apiaceae	
	<i>Trachymene pilosa</i>
Family: Asteraceae	
	* <i>Hypochaeris glabra</i>
	* <i>Ursinia anthemoides</i>
Family: Casuarinaceae	
	<i>Allocasuarina fraseriana</i>
	<i>Allocasuarina humilis</i>
Family: Colchicaceae	
	<i>Burchardia umbellata</i>
Family: Cyperaceae	
	<i>Cyathochaeta equitans</i>
	<i>Mesomelaena pseudostygia</i>
	<i>Schoenus grandiflorus</i>
Family: Dasypogonaceae	
	<i>Calectasia narragara</i>
	<i>Dasypogon bromeliifolius</i>
	<i>Lomandra sericea</i>
Family: Dilleniaceae	
	<i>Hibbertia huegelii</i>
	<i>Hibbertia hypericoides</i>
	<i>Hibbertia subvaginata</i>
Family: Droseraceae	
	<i>Drosera erythrorhiza</i>
	<i>Drosera menziesii</i>
	<i>Drosera menziesii</i> spp. <i>penicillaris</i>
	<i>Drosera paleacea</i>
Family: Epacridaceae	
	<i>Conostephium pendulum</i>
	<i>Conostephium preissii</i>
	<i>Leucopogon conostephioides</i>
	<i>Leucopogon sprengelioides</i>
	<i>Lysinema ciliatum</i>

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

Family: Geraniaceae	
	<i>*Pelargonium capitatum</i>
Family: Goodeniaceae	
	<i>Dampiera linearis</i>
	<i>Leschenaultia floribunda</i>
	<i>Scaevola repens</i>
Family: Haemodoraceae	
	<i>Anigozanthos humilis</i>
	<i>Anigozanthos manglesii</i>
	<i>Conostylis aculeata</i>
	<i>Conostylis juncea</i>
	<i>Conostylis setigera</i>
	<i>Haemodorum</i> sp.
	<i>Haemodorum spicatum</i>
	<i>Phlebocarya ciliata</i>
Family: Iridaceae	
	<i>*Gladiolus caryophyllaceus</i>
	<i>Patersonia occidentalis</i>
	<i>*Romulea rosea</i>
Family: Loranthaceae	
	<i>Nuytsia floribunda</i>
Family: Mimosaceae	
	<i>Acacia applanata</i>
	<i>Acacia cyclops</i>
	<i>Acacia huegelii</i>
	<i>Acacia pulchella</i>
	<i>Acacia sessilis</i>
Family: Molluginaceae	
	<i>Macarthuria australis</i>
Family: Myrtaceae	
	<i>Calothamnus sanguineus</i>
	<i>Calytrix flavescens</i>
	<i>Eucalyptus marginata</i>
	<i>Eucalyptus todtiana</i>
	<i>Hypocalymma robustum</i>
	<i>Leptospermum erubescens</i>
	<i>Scholtzia involucrata</i>
	<i>Verticordia nitens</i>
Family: Orchidaceae	
	<i>Caladenia arenicola</i> ms
	<i>Caladenia flava</i>
	<i>Caladenia</i> sp.
	<i>Elythranthera brunonis</i>

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

	<i>Pterostylis recurva</i>
	<i>Pterostylis</i> sp.
Family: Papilionaceae	
	<i>Bossiaea eriocarpa</i>
	<i>Daviesia nudiflora</i>
	<i>Daviesia triflora</i>
	<i>Hovea trisperma</i>
	<i>Jacksonia floribunda</i>
	<i>Jacksonia furcellata</i>
	<i>Nemcia capitata</i>
	* <i>Trifolium campestre</i>
Family: Poaceae	
	* <i>Briza maxima</i>
	* <i>Ehrharta calycina</i>
	<i>Neurachne alopecuroides</i>
Family: Proteaceae	
	<i>Adenanthos cygnorum</i>
	<i>Banksia attenuata</i>
	<i>Banksia ilicifolia</i>
	<i>Banksia menziesii</i>
	<i>Conospermum incurvum</i>
	<i>Conospermum triplinervium</i>
	<i>Dryandra lindleyana</i>
	<i>Dryandra sessilis</i>
	<i>Hakea ruscifolia</i>
	<i>Hakea trifurcata</i>
	<i>Persoonia saccata</i>
	<i>Petrophile linearis</i>
	<i>Petrophile macrostachya</i>
	<i>Stirlingia latifolia</i>
	<i>Synaphea spinulosa</i>
Family: Restionaceae	
	<i>Alexgeorgea nitens</i>
	<i>Desmocladius flexuosus</i>
	<i>Hypolaena exsulca</i>
	<i>Lyginia imberbis</i>
Family: Rutaceae	
	<i>Philotheca spicata</i>
Family: Stylidiaceae	
	<i>Stylidium brunonianum</i>
	<i>Stylidium carnosum</i>

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 505 Pederick Rd, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

Family: Thymeliaceae	
	<i>Pimelea sulphurea</i>
Family: Violaceae	
	<i>Hybanthus calycinus</i>
Family: Xanthorrhoeaceae	
	<i>Xanthorrhoea preissii</i>
Family: Zamiaceae	
	<i>Macrozamia riedlei</i>



Lots 505 & 2477
Flynn Drive, Neerabup
BF Site 295
Aerials 2001



-  Bush Forever 2000 - Site Boundaries
-  Cadastre with Lot Numbers

Figure 1

For Reference Purposes Only


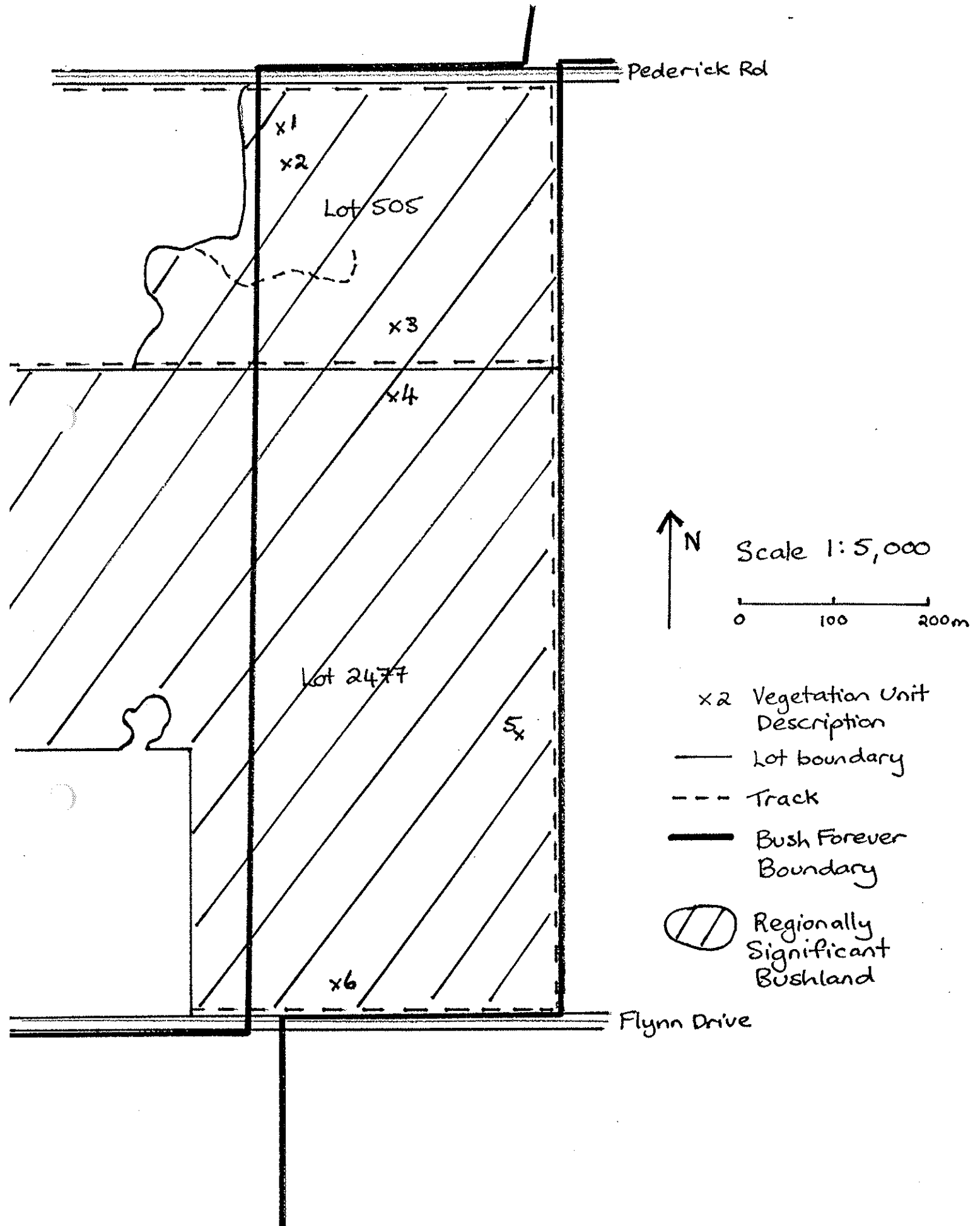
Map Ident: plot010917_2
 Prepared By: Emma Bamforth
 Prepared For: Botanical Report
 Date: 26 Oct 2001
 Scale 1:5000
 0  125 m
 DPI INTERNAL USE ONLY

Figure 2: Location of Vegetation Units Described on 18 October 2001 in Bush Forever Site 295 on Lot 505 Pederick Road and Lot 2477 Flynn Drive, Neerabup.



**BUSH FOREVER VEGETATION
& FLORA ASSESSMENT**

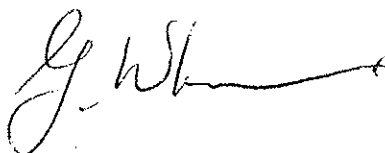
**PART BUSH FOREVER SITE 295 -
LOT 2477 FLYNN DRIVE, NEERABUP**

Karen Clarke¹, Sally Madden² and Bronwen Keighery¹

¹Department of Environmental Protection (DEP) and

²Department for Planning and Infrastructure (DPI)

October 2001

A handwritten signature in black ink, appearing to read 'G. Whelan', with a long horizontal stroke extending to the right.

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

SUMMARY

The bushland on Lot 2477 is regionally significant and has high conservation value as it:

- is representative of the Karrakatta Complex - Central and South which is poorly conserved in Bush Forever and as such can be considered poorly protected
- is in Very Good to Excellent condition
- is most likely representative of floristic community types poorly conserved on the Swan Coastal Plain (FCT 23a only occurs in the Perth Metropolitan Region and is an unusual occurrence on the Karrakatta Complex - Central and South and FCT 20a is a Threatened Ecological Community) and,
- forms part of a significant east-west/north-south linkage through a range of plant communities in Site 295 and also connects Site 295 through to Site 382 (Lake Pinjar and Adjacent Bushland, Pinjar).

As a consequence no adjustment of the Bush Forever boundary is necessary.

BACKGROUND

Bush Forever Site 295 encompasses regionally significant bushland of three vegetation complexes, the Cottesloe Complex – Central and South, Karrakatta Complex - Central and South and the Pinjar Complex. These complexes occur from west to east across the Site respectively. The Site contains both vegetated uplands and vegetated wetlands. The Site Description (Appendix 1) summarises the conservation values of this Bush Forever Site (Government of Western Australia 2000b).

The bushland at the eastern end of Lot 2477 Flynn Drive, Neerabup (Figure 1) is part of Bush Forever Site 295. This bushland has previously been identified as containing regionally significant remnant bushland (Government of Western Australia 2000a&b) and is all mapped as Karrakatta Complex - Central and South (Hedde *et al.* 1980). The area of the Karrakatta Complex - Central and South proposed for protection under Bush Forever is 8% (Government of Western Australia 2000a). Based on international criteria for conservation, Bush Forever aims to protect 'at least 10% of the original extent' of each of the Hedde *et al.* (1980) vegetation complexes (Government of Western Australia 2000a).

Bush Forever Site 295 forms part of a regionally significant fragmented bushland/wetland linkage (see Map 7, Government of Western Australia 2000a). The bushland on Lot 2477 is an integral part of this linkage as it connects the bushland within Site 295 both north to south and east to west. It also connects the bushland in Site 295 to the adjacent bushland to the north in Bush Forever Site 382 - Lake Pinjar and Adjacent Bushland, Pinjar.

METHODOLOGY

A field inspection of Lot 2477 Flynn Drive, Neerabup was made by Karen Clarke (DEP), Sally Madden and Emma Bamforth (DPI) on 18/9/2001. Approximately one hour was spent traversing the bushland by vehicle and on foot. Each unit of vegetation was described using the standard procedures documented in Bush Forever (Government of Western Australia 2000b). Appendix 2 contains the Lot Survey Sheets and field sheets recorded for Lot 2477. Condition ratings were based on Keighery (1994).

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

RESULTS

The bushland on Lot 2477 Flynn Drive, Neerabup consists of vegetated upland of *Banksia attenuata* and *Banksia menziesii* Low Woodland with scattered *Allocasuarina fraseriana*, *Eucalyptus marginata*, *Nuytsia floribunda* and *Eucalyptus todtiana* over *Hibbertia hypericoides* Open Low Heath over *Patersonia occidentalis* Very Open Herbland and *Mesomelaena pseudostygia* Very Open Sedgeland (Unit 5, Map 2, Appendix 2). At some stage in the past the bushland on this lot has been cleared and then regenerated. This regrowth is of a high quality over most of the area of Lot 2477 included in Bush Forever Site 295. At least 80% is in Very Good to Excellent condition (Appendix 2) and representative of the original structure and floristics expected prior to clearing. In less than 20% of the area, primarily located near the edges, regeneration has been less complete (Units 4 & 6, Map 2, Appendix 2) and the bushland is currently in Very Good to Good condition. The latter areas consist of scattered *Allocasuarina fraseriana*, *Eucalyptus marginata*, *Nuytsia floribunda* and *Banksia attenuata* over *Xanthorrhoea preissii* Shrubland over *Hibbertia hypericoides* Open Low Heath with occasional patches of *Adenanthos cygnorum* over **Ursinia anthemoides* Very Open Herbland (Unit 4, Map 2, Appendix 2) and *Banksia menziesii* Low Open Woodland over *Adenanthos cygnorum* Tall Shrubland over *Hibbertia hypericoides* Low Shrubland over **Briza maxima* Very Open Grassland (Unit 6, Map 2, Appendix 2). All these vegetation units are consistent with those previously described for this Site (see Appendices 1 & 2). Fire has not passed through the bushland for over 5 years. The weed species present within the bushland are non-aggressive species occurring at a low to moderate density.

Significant flora recorded during the site inspection were: *Cyathochaeta equitans*, *Conospermum incurvum*, *C. triplinervium* and *Verticordia nitens*. These species have not been previously recorded for Site 295 (see Appendix 1).

DISCUSSION

The site inspection of 18 September 2001 confirms that the bushland present on Lot 2477 Flynn Drive, Neerabup within Bush Forever Site 295 (Map 1), is regionally significant. The bushland is in Very Good to Excellent condition and representative of the vegetation found on the eastern side of the Spearwood Dune System, which is part of the variation found within the Karrakatta Complex - Central and South. This lot is near the boundary between the Karrakatta Complex- Central and South, Pinjar Complex (associated with wetlands) and to the east the Bassendean Complex - Central and South (Hedde *et al.* 1980). The floristic composition recorded (Appendix 3) indicates that the bushland is most likely representative of regional Floristic Community Type (FCT) 23a – Central *Banksia attenuata* - *Banksia menziesii* woodlands or FCT 20a - *Banksia attenuata* woodlands over species rich dense shrublands, as defined by Gibson *et al.* (1994) and Government of Western Australia (2000b). Both FCT 23a and 20a are in Supergroup 3 - Uplands Centred on Bassendean Dunes and Dandaragan Plateau. FCT 23a only occurs in the Perth Metropolitan Region and has not been previously recorded on the Karrakatta Complex - Central and South. FCT 20a is a threatened ecological community (English and Blyth 1997) and has been recorded in several other Bush Forever Sites representative of the Karrakatta Complex - Central and South (Government of Western Australia 2000b). A more detailed vegetation and flora survey based on sampling of 10 x 10 m floristic plots in spring and multivariate statistical analysis, would be required to determine exactly which floristic community type/s was present.

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

It should be noted that the western boundary of Bush Forever Site 295 on Lot 2477 does not include the full extent of the regionally significant bushland on this lot. Bushland of the type and quality described in this report extends west beyond the Bush Forever boundary (see Figures 1 & 2) and would be a suitable addition to the Site if it were not constrained by zoning for industry. Given this, no adjustment of the Bush Forever boundary is proposed but the possibility of achieving conservation of additional area could be considered through planning processes.

REFERENCES

References not listed can be found in Government of Western Australia (2000b)

Government of Western Australia 2000a. *Bush Forever. Volume 1 Policies, Principles and Processes*. Western Australian Planning Commission, Perth, Western Australia.

Government of Western Australia 2000b. *Bush Forever. Volume 2 - Directory of Bush Forever Sites*. Department of Environmental Protection, Perth, Western Australia.

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

APPENDIX 1: SITE DESCRIPTION

(from *Bush Forever* Volume 2 Government of WA 2000, for Site Map see Volume 1)

FLYNN DRIVE BUSHLAND, NEERABUP

Boundary Definition: bushland (part taken to zoning)/management boundary (Part Site, part Lots 1, 2001 Flynn Dr, subject to Ministerial Condition No. 280, 21 August 1992.)

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 295

Area (ha): bushland 112.6

Map no. 21

Map sheet series ref. no. 2034-I SW

Other Names: not known

Local Authorities (Suburb): Shire of Wanneroo (Neerabup, Carramar, Cockman)

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)

Spearwood Dunes

Sands derived from Tamala Limestone (Qts: S7)

Lagoonal and Estuarine Deposits (within the Spearwood Dunes)

Lagoonal and Estuarine Deposits (Vasse) (Qhg: S4)

VEGETATION AND FLORA

Vegetation Complexes

Spearwood Dunes

Karrakatta Complex — Central and South

Cottesloe Complex — Central and South

Wetlands

Pinjar Complex

Floristic Community Types: *not sampled, types inferred

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau

22 *Banksia ilicifolia* woodlands

*23a Central *Banksia attenuata* — *B. menziesii* woodlands

Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes

*28 Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands

WETLANDS

Wetland Types: sumpland

Natural Wetland Groups

Bassendean Dunes

Pinjar (B.1)

Gnangara (B.2)

Wetland Management Objectives: Conservation (2ha)

Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated uplands, vegetated wetlands

Vegetation and Flora: limited survey (DEP 1996 (Pinj 12), DEP 1998, DEP 1999, part Site — Bowman Bishaw Gorham 1992b, WAWA 1995)

Structural Units: mapping (part Site — Bowman Bishaw Gorham 1992b, WAWA 1995)

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

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Uplands — Sands derived from Tamala Limestone: Low Woodland to Low Open Forest dominated by *Banksia attenuata* and *B. menziesii* with scattered to co-dominant *Eucalyptus todtiana*, *E. marginata*, *Nuytsia floribunda* and *Allocasuarina fraseriana*; *Adenanthos cygnorum* Tall Closed Scrub to Tall Shrubland; *Hibbertia hypericoides*, *Daviesia triflora* and *Leucopogon conostephioides* Open to Closed Low Heath

Wetlands: not known

Scattered Native Plants: not assessed

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

Total Flora: not known

Significant Flora: *Conostephium minus* (4); *Boronia purdieana*

Fauna: Location for rare native bee (*Hylaeus globuliferus*) (Pawluk, Richard and Associates 1995)

Linkage: adjacent bushland to the north (Site 382, across road); part of a regionally significant fragmented bushland/wetland linkage (Part A, Map 7)

Other Special Attributes: recommended for protection in the study of City of Wanneroo bushland (Trudgen 1996)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

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

Recommendation: Part A: Site with Some Existing Protection; Existing Parks and Recreation Reserve. Part B: Strategic Negotiated Planning Solution. Part C: Other Government Land Mechanism. Part D: Urban Negotiated Planning Solution (see Table 3, Volume 1).

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.
 K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

APPENDIX 2: LOT SURVEY AND FIELD RECORDING SHEETS

BUSH FOREVER SITE
LOT SURVEY SHEET 1 - BOUNDARY/VEGETATION UNIT VERIFICATION
Use Survey Sheet 1 for each Lot inspected

BUSH FOREVER SITE: No. 295 - Flynn Drive Bushland, Neerabup
LOT INSPECTED: 2477 Flynn Drive, Neerabup
DATE TRIP: 18-09-01 **RECORDERS:** Karen Clarke, Sally Madden & Emma Bamforth

BOUNDARY (*Compare boundary observed with mapped boundary. Tick appropriate response*)

MATCHES CURRENT BOUNDARY

CHANGES RECOMMENDED (OUTLINE EACH CHANGE BELOW AND NUMBER AND DRAW EACH CHANGE ON THE MAP)

VEGETATION UNITS (*Compare units observed with Bush Forever Site description units. Tick appropriate response*)

MATCHES DESCRIBED UNITS

ADDITIONAL VEGETATION UNITS DESCRIBED

Change 1	Lot /Lot	Photo No
Rationale for change		

Change 2	Lot /Lot	Photo No
Rationale for change		

Change 3	Lot /Lot	Photo No
Rationale for change		

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

**BUSH FOREVER SITE
LOT SURVEY SHEET 2 –VEGETATION UNITS**

For each vegetation unit observed describe

- each layer in the unit according to height and cover
- dominant species
- associated significant species
- condition of each unit.

Indicate location of sample/description point for each unit/s described on the map.

Unit 4						
Trees and/or Mallees: Scattered <i>Allocasuarina fraseriana</i> , <i>Eucalyptus marginata</i> , <i>Nuytsia floribunda</i> and <i>Banksia attenuata</i>						
Shrubs: <i>Xanthorrhoea preissii</i> Shrubland over <i>Hibbertia hypericoides</i> Open Low Heath with occasional patches of <i>Adenanthos cygnorum</i>						
Herbs: * <i>Ursinia anthemoides</i> Very Open Herbland						
Sedges:						
Grasses:						
Significant Flora						
<i>Cyathochaeta equitans</i> , <i>Conospermum incurvum</i>						
Vegetation Condition	1	2	3	→ 4	5	6
Comment: Very Good to Good, regrowth from historical clearing; tree, sedge and herb layer significantly reduced, non-aggressive weeds present.						

Unit 5						
Trees and/or Mallees: <i>Banksia attenuata</i> and <i>Banksia menziesii</i> Low Woodland with scattered <i>Allocasuarina fraseriana</i> , <i>Eucalyptus marginata</i> , <i>Nuytsia floribunda</i> and <i>Eucalyptus todtiana</i>						
Shrubs: <i>Hibbertia hypericoides</i> Open Low Heath						
Herbs: <i>Patersonia occidentalis</i> Very Open Herbland						
Sedges: <i>Mesomelaena pseudostygia</i> Very Open Sedgeland						
Grasses:						
Significant Flora						
<i>Verticordia nitens</i>						
Vegetation Condition	1	2	← 3	4	5	6
Comment: Very Good to Excellent, regrowth from historical clearing, all structural layers re-established, non-aggressive weeds present.						

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

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Unit 6						
Trees and/or Mallees: <i>Banksia menziesii</i> Low Open Woodland						
Shrubs: <i>Adenanthos cygnorum</i> Tall Shrubland over <i>Hibbertia hypericoides</i> Low Shrubland						
Herbs:						
Sedges:						
Grasses: * <i>Briza maxima</i> Very Open Grassland						
Significant Flora						
<i>Conospermum triplinervium</i> located near SE corner of Lot 2477 on edge of bushland.						
Vegetation Condition	1	2	3	→ 4	5	6
Comment: Very Good to Good, regrowth from historical clearing dominated by <i>Adenanthos cygnorum</i> , herb and sedge layer reduced, weedy grass layer and some aggressive weeds present edges along fire-break.						

GENERAL CONDITION of LOT

Vegetation Condition - Keighery 1994 (Trudgen 1993) <i>Indicate range and % in each class</i>	
1 = Pristine' (Excellent)	
2 = Excellent (Very Good)	Very Good to Excellent >80%
3 = Very Good (Good)	Very Good to Good <20%
4 = Good (Poor)	
5 = Degraded (Very Poor)	
6 = Completely Degraded	

Disturbance Describe observed disturbance eg partial clearing, weeds, soil movement, changes in water regimes etc.

High quality regrowth from historical clearing, only non-aggressive weeds present in bushland, rabbit activity

OTHER COMMENTS

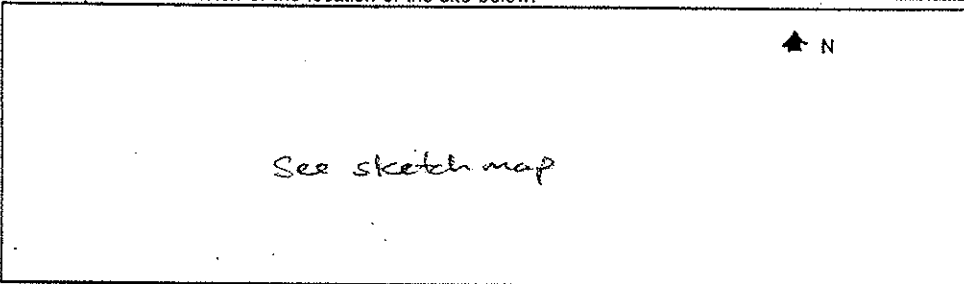
BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pen only

BUSHLAND AREA BS295 Lot 2477 SITE NUMBER 4
 DATE TRIP 18/9/01 RECORDERS K. Clarice, S. Madden
 DATE TRIP _____ RECORDERS _____
 DATE TRIP _____ RECORDERS _____
 BOTANIST _____

From 'Bushland Plant Survey' written
 B. Keighery (1994) and published by
 Wildflower Society of WA (Inc.), PO 1
 64 Nedlands WA 6008.

1. LOCATION of the QUADRAT

Mud Map Draw a sketch of the location of the site below.



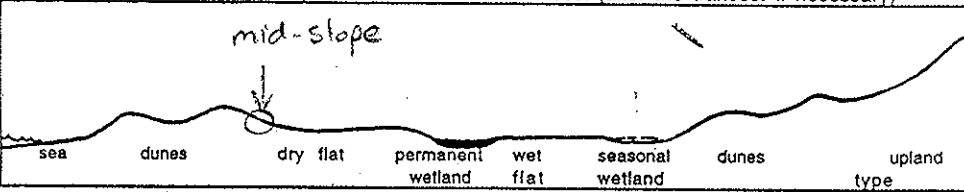
Road Location Flynn Drive / Pedderick Rd

Geographic Location Latitude _____ S Longitude _____ E Altitude _____

Reference Map _____

Photograph _____ Photographer's Name _____ Photo No 26

Topographic position Circle position of site on the transect (alter the transect if necessary)



2. SITE DATA Circle the correct response.

Slope flat gentle steep Aspect N NE E SE S SW W NW

Surface Soil Sand Colour light grey
 Exposed rock _____ type _____ % surface _____

Sub-surface Soil Sand Colour pale orange-yellow
 Rock _____ type _____ depth to rock _____

Drainage well mod poor depth water _____ cm Wet all year winter/spring

Litter 2-10 % cover _____ Bare Ground 30-40 % cover _____
 Depth < 1 cm

LIFE FORM	TREES		MALLEES		30m 10m
	over 30m	10 - 30m	under 10m	over 8m under 8m	
COVER CLASS (%)					
DOMINANT SPECIES					

LIFE FORM	SHRUBS over 2m	2m - 1m	SHRUBS under 1m	2m 1m
COVER CLASS (%)		<u>10-30%</u>	<u>30-70%</u>	
DOMINANT SPECIES		<u>Xanpres</u>	<u>Hibbyp</u>	

LIFE FORM	GRASSES	HERBS	SEDGES	OTHER	1m
COVER CLASS (%)		<u>2-10%</u>			
DOMINANT SPECIES		<u>* UFS anth</u>			

4. VEGETATION CONDITION

	COMMENTS
1 'PRISTINE'	
2 EXCELLENT	<u>VG → G</u> Past clearing - non-agg weeds
3 VERY GOOD	<u>I</u> herb & sedge layer signif. altered / 1st
4 GOOD	tree layer reduced.
5 DEGRADED	

* Significant bird species observed
 Malurus splendens - Splendid Wren
 (Code 3 - habitat specialist with a reduced range on the SCP)

BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA BS 295 Lot 2477 SITE NUMBER 5
 DATE TRIP 18/9/01 RECORDERS K. Clarke S. Madden
 DATE TRIP _____ RECORDERS _____
 DATE TRIP _____ RECORDERS _____
 BOTANIST _____

1. LOCATION of the QUADRAT

From 'Bushland Plant Survey' written B. Keighery (1994) and published by Wildflower Society of WA (Inc.), PO 1 64 Nedlands WA 6008.

Mud Map Draw a sketch of the location of the site below.

▲ N

Same as Site 3 on Lot 505 except more open patches of shrubland in places & Eucalypt also present

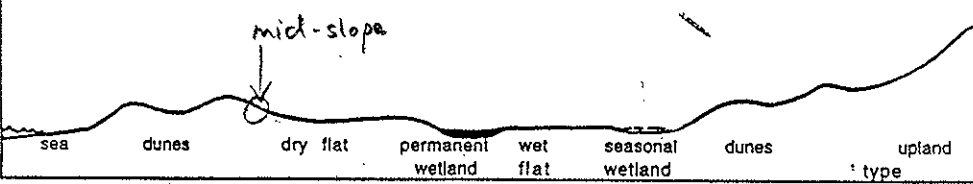
see sketch map

Road Location Flynn Ave / Pedderick Rd

Geographic Location Latitude _____ S Longitude _____ E Altitude _____
 Reference Map _____

Photograph _____ Photographer's Name _____ Photo No 26

Topographic position Circle position of site on the transect (alter the transect if necessary)



2. SITE DATA Circle the correct response.

Slope flat gentle steep Aspect N NE E SE S SW W NW

Surface Soil Sand Colour Light grey
 Exposed rock type _____ % surface _____

Sub-surface Soil sand Colour Pale yellow-orange
 Rock type _____ depth to rock _____

Drainage well mod poor depth water cm Wet all year winter/spring

Litter Depth _____ % cover _____ Bare Ground _____ % cover _____

LIFE FORM	TREES		MALLEES		30m
	over 30m	10 - 30m	under 10m	over 8m	
COVER CLASS (%)					
DOMINANT SPECIES					
LIFE FORM	SHRUBS		SHRUBS		2m
	over 2m	2m - 1m	under 1m		
COVER CLASS (%)					
DOMINANT SPECIES					
LIFE FORM	GRASSES	HERBS	SEDGES	OTHER	
COVER CLASS (%)					
DOMINANT SPECIES					

4. VEGETATION CONDITION

1 'PRISTINE'	COMMENTS
2 EXCELLENT	VG → Ex, regrowth from past clearing but all structural layers re-established only non-aggressive weed spp. present
3 VERY GOOD	
4 GOOD	
5 DEGRADED	

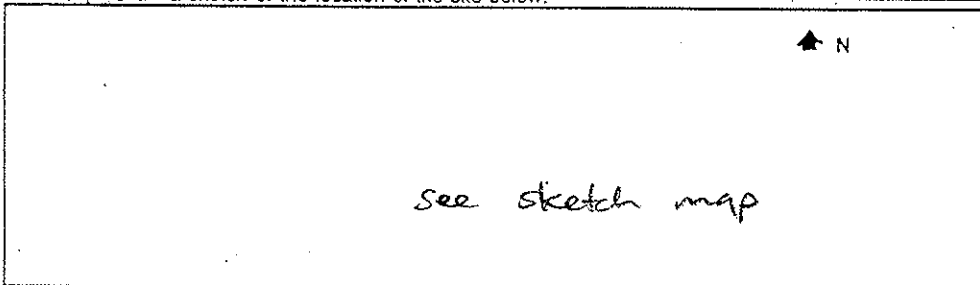
BUSHLAND PLANT SURVEY RECORDING SHEET 1- use pencil only

BUSHLAND AREA BS295 Lot 2477 SITE NUMBER 6
 DATE TRIP 18/9/01 RECORDERS K. Clarke, S. Madden
 DATE TRIP _____ RECORDERS _____
 DATE TRIP _____ RECORDERS _____
 BOTANIST _____

1. LOCATION of the QUADRAT

From 'Bushland Plant Survey' written B. Keighery (1994) and published by Wildflower Society of WA (Inc.), PO 1 64 Nedlands WA 6008.

Mud Map Draw a sketch of the location of the site below.

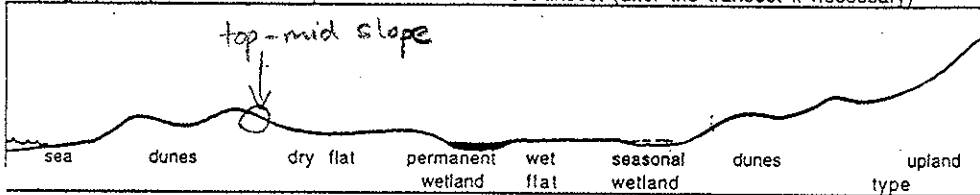


Road Location Flynn Dve

Geographic Location Latitude _____ S Longitude _____ E Altitude _____
 Reference Map _____

Photograph _____ Photographer's Name _____ Photo No 27

Topographic position Circle position of site on the transect (alter the transect if necessary)



2. SITE DATA Circle the correct response.

Slope flat gentle steep Aspect N NE E SE S SW W NW

Surface Soil type Sand Colour Light Grey
 Exposed rock _____ % surface _____

Sub-surface Soil type Sand Colour Cream-yellow
 Rock _____ depth to rock _____

Drainage well mod poor depth water _____ cm Wet all year winter/spring

Litter Depth 2-10 % cover _____ Bare Ground 30-10 % cover _____
 cm

LIFE FORM	TREES		MALLEES		30m 10m
	over 30m	- 30m	under 10m	over 8m under 8m	
COVER CLASS (%)			<u>2-10%</u>		
DOMINANT SPECIES			<u>Banmanz</u>		
LIFE FORM	SHRUBS		SHRUBS		2m 1m
	over 2m	2m - 1m	under 1m		
COVER CLASS (%)	<u>30-70%</u>		<u>10-30%</u>		
DOMINANT SPECIES	<u>Adecyg</u>		<u>Hibbysp</u>		
LIFE FORM	GRASSES	HERBS	SEDGES	OTHER	
	1m				
COVER CLASS (%)	<u>2-10%</u>				
DOMINANT SPECIES	<u>Brizmax</u>				

4. VEGETATION CONDITION

1 'PRISTINE'		COMMENTS <u>VG-G, Regrowth dominated by Adecyg</u>
2 EXCELLENT		
3 VERY GOOD	<u>I</u>	
4 GOOD		
5 DEGRADED		

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

**APPENDIX 3: SPECIES LIST FOR LOT 505 PEDERICK RD &
LOT 2477 FLYNN DRIVE, NEERABUP**

Family: Anthericaceae	
	<i>Sowerbaea laxiflora</i>
	<i>Thysanotus manglesianus</i>
	<i>Thysanotus</i> sp.
	<i>Tricoryne</i> sp.
Family: Apiaceae	
	<i>Trachymene pilosa</i>
Family: Asteraceae	
	* <i>Hypochaeris glabra</i>
	* <i>Ursinia anthemoides</i>
Family: Casuarinaceae	
	<i>Allocasuarina fraseriana</i>
	<i>Allocasuarina humilis</i>
Family: Colchicaceae	
	<i>Burchardia umbellata</i>
Family: Cyperaceae	
	<i>Cyathochaeta equitans</i>
	<i>Mesomelaena pseudostygia</i>
	<i>Schoenus grandiflorus</i>
Family: Dasypogonaceae	
	<i>Calectasia narragara</i>
	<i>Dasypogon bromeliifolius</i>
	<i>Lomandra sericea</i>
Family: Dilleniaceae	
	<i>Hibbertia huegelii</i>
	<i>Hibbertia hypericoides</i>
	<i>Hibbertia subvaginata</i>
Family: Droseraceae	
	<i>Drosera erythrorhiza</i>
	<i>Drosera menziesii</i>
	<i>Drosera menziesii</i> spp. <i>penicillaris</i>
	<i>Drosera paleacea</i>
Family: Epacridaceae	
	<i>Conostephium pendulum</i>
	<i>Conostephium preissii</i>
	<i>Leucopogon conostephioides</i>
	<i>Leucopogon sprengelioides</i>
	<i>Lysinema ciliatum</i>

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

Family: Geraniaceae	
	<i>*Pelargonium capitatum</i>
Family: Goodeniaceae	
	<i>Dampiera linearis</i>
	<i>Leschenaultia floribunda</i>
	<i>Scaevola repens</i>
Family: Haemodoraceae	
	<i>Anigozanthos humilis</i>
	<i>Anigozanthos manglesii</i>
	<i>Conostylis aculeata</i>
	<i>Conostylis juncea</i>
	<i>Conostylis setigera</i>
	<i>Haemodorum sp.</i>
	<i>Haemodorum spicatum</i>
	<i>Phlebocarya ciliata</i>
Family: Iridaceae	
	<i>*Gladiolus caryophyllaceus</i>
	<i>Patersonia occidentalis</i>
	<i>*Romulea rosea</i>
Family: Loranthaceae	
	<i>Nuytsia floribunda</i>
Family: Mimosaceae	
	<i>Acacia applanata</i>
	<i>Acacia cyclops</i>
	<i>Acacia huegelii</i>
	<i>Acacia pulchella</i>
	<i>Acacia sessilis</i>
Family: Molluginaceae	
	<i>Macarthuria australis</i>
Family: Myrtaceae	
	<i>Calothamnus sanguineus</i>
	<i>Calytrix flavescens</i>
	<i>Eucalyptus marginata</i>
	<i>Eucalyptus todtiana</i>
	<i>Hypocalymma robustum</i>
	<i>Leptospermum erubescens</i>
	<i>Scholtzia involucrata</i>
	<i>Verticordia nitens</i>
Family: Orchidaceae	
	<i>Caladenia arenicola ms</i>
	<i>Caladenia flava</i>
	<i>Caladenia sp.</i>

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

	<i>Elythranthera brunonis</i>
	<i>Pterostylis recurva</i>
	<i>Pterostylis</i> sp.
Family: Papilionaceae	
	<i>Bossiaea eriocarpa</i>
	<i>Daviesia nudiflora</i>
	<i>Daviesia triflora</i>
	<i>Hovea trisperma</i>
	<i>Jacksonia floribunda</i>
	<i>Jacksonia furcellata</i>
	<i>Nemcia capitata</i>
	* <i>Trifolium campestre</i>
Family: Poaceae	
	* <i>Briza maxima</i>
	* <i>Ehrharta calycina</i>
	<i>Neurachne alopecuroides</i>
Family: Proteaceae	
	<i>Adenanthos cygnorum</i>
	<i>Banksia attenuata</i>
	<i>Banksia ilicifolia</i>
	<i>Banksia menziesii</i>
	<i>Conospermum incurvum</i>
	<i>Conospermum triplinervium</i>
	<i>Dryandra lindleyana</i>
	<i>Dryandra sessilis</i>
	<i>Hakea ruscifolia</i>
	<i>Hakea trifurcata</i>
	<i>Persoonia saccata</i>
	<i>Petrophile linearis</i>
	<i>Petrophile macrostachya</i>
	<i>Stirlingia latifolia</i>
	<i>Synaphea spinulosa</i>
Family: Restionaceae	
	<i>Alexgeorgea nitens</i>
	<i>Desmocladius flexuosus</i>
	<i>Hypolaena exsulca</i>
	<i>Lyginia imberbis</i>
Family: Rutaceae	
	<i>Philothea spicata</i>
Family: Stylidiaceae	
	<i>Stylidium brunonianum</i>
	<i>Stylidium carnosum</i>

Bush Forever Vegetation & Flora Assessment: Part Site 295, Lot 2477 Flynn Drive, Neerabup.

K. Clarke¹, S. Madden² & B. Keighery¹, ¹Department of Environmental Protection & ²Department for Planning and Infrastructure, October 2001.

Family: Thymeliaceae	
	<i>Pimelea sulphurea</i>
Family: Violaceae	
	<i>Hybanthus calycinus</i>
Family: Xanthorrhoeaceae	
	<i>Xanthorrhoea preissii</i>
Family: Zamiaceae	
	<i>Macrozamia riedlei</i>



Lots 505 & 2477
Flynn Drive, Neerabup
BF Site 295
Aerials 2001



-  Bush Forever 2000 - Site Boundaries
-  Cadastre with Lot Numbers

Figure 1

For Reference Purposes Only

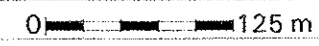
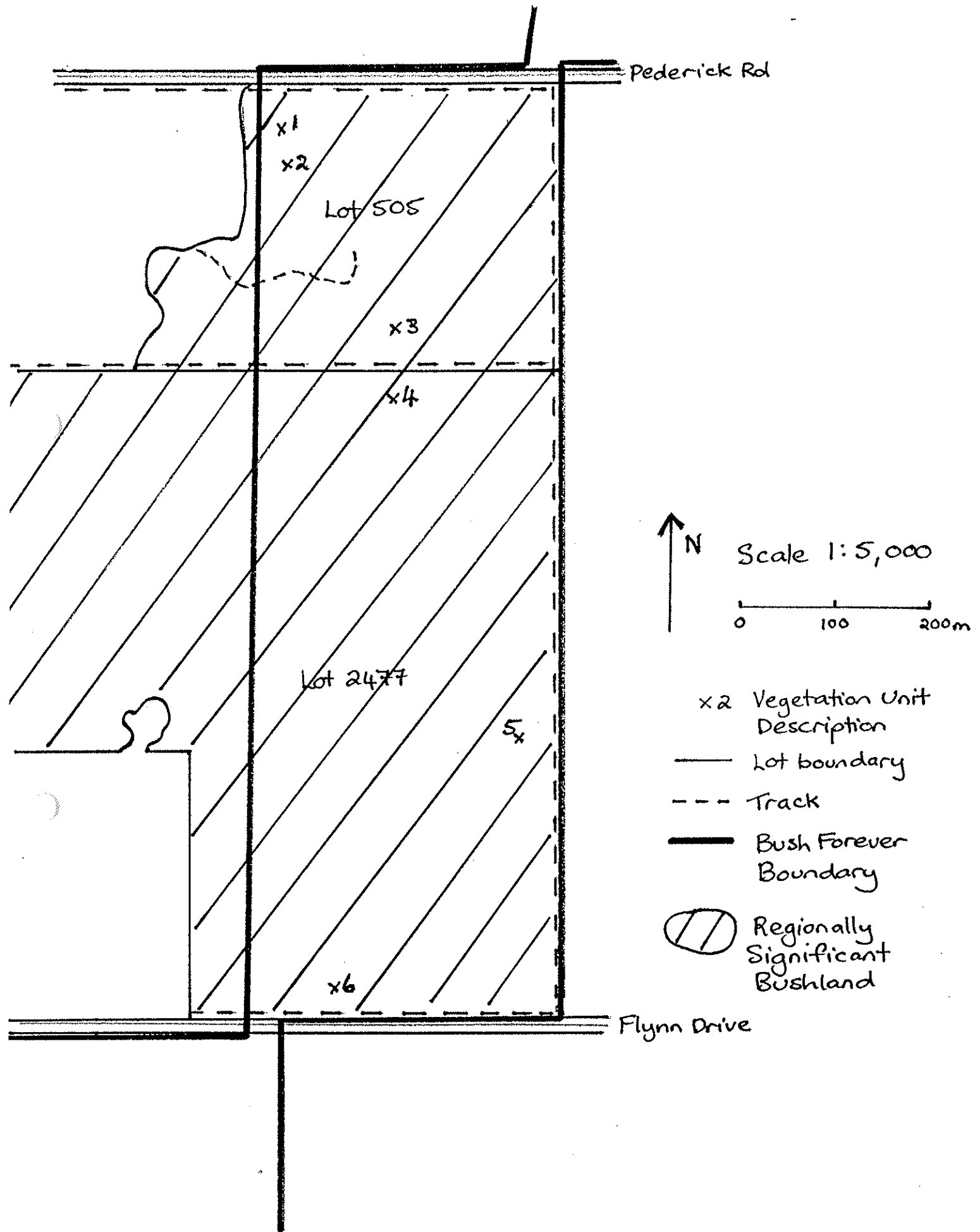
Map Ident: plot010917_2
 Prepared By: Emma Bamforth
 Prepared For: Botanical Report
 Date: 26 Oct 2001
 Scale 1:5000

 DPI INTERNAL USE ONLY

Figure 2: Location of Vegetation Units Described on 18 October 2001 in Bush Forever Site 295 on Lot 505 Pederick Road and Lot 2477 Flynn Drive, Neerabup.



**DRAFT PERTH'S BUSHPLAN -
ASSESSMENT OF
POSSIBLE ADDITIONAL BUSHLAND AREAS**

LOT 10 FLYNN DRIVE BUSHLAND, NEERABUP

Department of Environmental Protection
B. Keighery
November 1999

J. Keighery 24/11/99

BUSHLAND LOT 10 FLYNN DRIVE, NEERABUP

Department of Environmental Protection
Conservation Branch - B. Keighery November 1999

SUMMARY

The bushland on Lot 10 Flynn Drive is Low Woodland to Low Open Forest dominated by *Banksia attenuata* and *Allocasuarina fraseriana* with scattered to co-dominant *Eucalyptus marginata* and generally in Excellent condition typical of the western Karrakatta Complex - Central and South vegetation complex. The bushland is considered to be a typical of floristic community type 28, the typical floristic community type of uplands in the Karrakatta Complex - Central and South vegetation complex which is poorly conserved in the Draft Perth's Bushplan and as such can be considered poorly protected. The bushland meets one of the criteria for identifying regionally significant bushland and as it is adjacent to an existing Bushplan Site retention of the bushland would contribute to the better protection of the Karrakatta Complex - Central and South. As a consequence is worthy of inclusion in Perth's Bushplan.

BACKGROUND

The bushland on Lot 10 Flynn Drive (see Map 1) is adjacent to Bushplan Site 295 - Flynn Drive Bushland (see Appendix 1). This site has not been subject to detailed survey in the past. As this bushland is currently subject to a rezoning proposal and there is a Bushplan Site adjacent to it an assessment of the values of the bushland was requested as part of MfP's consideration of the proposed rezoning. Submissions on the rezoning had drawn attention to its values. As a consequence a field inspection of the site was made by Colma Keating and Bridget Hyder-Griffiths (DEP) on 24/11/99. Approximately one hour was spent traversing the bushland by foot. Being late November many plants had finished flowering.

This report has been prepared from information on the adjacent Bushplan Site and from the area inspection.

SITE COMMENTS

The bushland on Lot 10 Flynn Drive is an upland area of Low Woodland to Low Open Forest dominated by *Banksia attenuata* and *B. menziesii* with scattered to co-dominant *Eucalyptus marginata* and *Allocasuarina fraseriana*; generally in Excellent condition typical of the Karrakatta Complex - Central and South vegetation complex (Hedde *et al.* 1980). The floristic composition of this bushland area indicates that it is typical of floristic community type 28 which is typically associated with this complex north of Perth.

While the Cottesloe Complex — Central and South is mapped in the bushland (see Map 2) there was no change in the plant communities evident in the ground survey. This is not unexpected as the mapping for the vegetation complexes was done at a 1 : 250 000 scale and the location of the change over is actually further to the east.

The bushland is relatively intact with only localised disturbance. There has been sporadic timber cutting has occurred in the distant past and fire has not passed through the bushland for over 5 years. Few weed species are present in the bushland and these are at a low density. It is only the edges that are disturbed.

DETAIL of the SELECTION CRITERIA

Representation of ecological communities:

Vegetation Complexes

This area lies within the Karrakatta Complex - Central and South vegetation complex (Hedde *et al.* 1980) and is representative of this complex on deep sands (limestone may be present at depth). Only 8% of this complex is currently proposed for

BUSHLAND LOT 10 FLYNN DRIVE, NEERABUP

Department of Environmental Protection
Conservation Branch - B. Keighery November 1999

protection under Perth's Bushplan (Government of Western Australia 1998) which falls short of the stated target of at least 10%.

Floristic Community Types

The floristic composition of this bushland area indicates that it is typical of floristic community type 28 Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* woodlands from Supergroup 3 Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes. Average species richness for this type is 55.2 (Gibson *et al.* 1994). This unit is typical of the Karrakatta Complex - Central and South being found in the adjacent BS 295.

Landscape Features: vegetated uplands

Vegetation and Flora: limited survey (DEP 1999)

Structural units

Uplands: Low Woodland to Low Open Forest dominated by *Banksia attenuata* and *Allocasuarina fraseriana* with scattered to co-dominant *Eucalyptus marginata* and over *Xanthorrhoea preissii*, *Stirlingia latifolia* Open Shrubland over *Hibbertia hypericoides* and *Eremaea pauciflora* Open Low Heath over *Mesomelaena stygia* Sedgeland.

Vegetation Condition - Excellent to Very Good

Other Comments

Floristic Community Type 28 is **not** a threatened ecological community (English and Blyth 1997) but it is representative of the Karrakatta Complex - Central and South which is poorly conserved in the Draft Perth's Bushplan and as such can be considered poorly protected. As this bushland is adjacent to an existing Bushplan Site retention of the bushland would contribute to the better protection of the Karrakatta Complex - Central and South.

REFERENCES

References can be found in Draft Perth's Bushplan Volume 2B

Appendix 1: Site Description

FLYNN DRIVE BUSHLAND, NEERABUP

Boundary Definition: bushland (part taken to zoning)/management boundary (Part Bushplan Site, part Lots 1, 2001 Flynn Dr, subject to Ministerial Condition No. 280, 21 August 1992.)

SECTION 1: CADASTRAL INFORMATION

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

Bushplan Site no. 295
sheet series ref. no. 2034-I SW

Map no. 26, 27, 32 **Map**

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)

Spearwood Dunes

Sands derived from Tamala Limestone (Qts: S7)

Lagoonal and Estuarine Deposits (within the Spearwood Dunes)

BUSHLAND LOT 10 FLYNN DRIVE, NEERABUP

Department of Environmental Protection

Conservation Branch - B. Keighery November 1999

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

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

LANDVISION

LAND PLANNING
AND
DEVELOPMENT
CONSULTANTS

*From handover of site
(Frank Barretto)*

EXCAVATION MANAGEMENT PLAN

Pt Swan Loc 2477
FLYNN DRIVE NEERABUP



LANDVISION

EXCAVATION MANAGEMENT PLAN

**Pt Swan Loc 2477
FLYNN DRIVE NEERABUP**

JULY 1995

1.0 INTRODUCTION

1.1 Background & Purpose

The purpose of this report is to describe a proposal for a sand quarry for Swan Location 2477 which is subject of a development application to the City of Wanneroo. A recent report by the Chamber of Commerce & Industry indicated that the available sand resource for the northern metropolitan area was in short supply.

Approved resources of building sands are estimated to be approximately 8 years supply. Whilst reserves of fill sands and concrete sands are substantial, a high proportion of each comes from a single resource in SF65. For example, of the northern metropolitan supplies, 30 M tonnes of 37.3 M tonnes of approved fill sand resources, and 20M tonnes of 24.5M tonnes of approved concrete sand resources are from SF65. This equates to 4 years and 10 years life respectively if the SF65 resources were unavailable.

1.2 Description of the Sand Resource

Pt Swan Location 2477 totals 103.8998 has in area. As such it is one of the few landholdings in this area of a viable size with an available sand resource.

Yellow quartz sand covers the site and has been shown during the drilling of a water bore to extend to depths of up to 35 metres. A shallow layer of leached white sand covers parts of the surface.

Sand of this type is often used for fill sand, however brickie's sand is available at depth when the clay content increases slightly. The sand may also have additional uses that are still being researched.

Two small ridges of sand rise above the general land surface and both of these are to be excavated. Excavation will be limited to the levels required to form a land surface appropriate to the final end uses of the area. This will generally require a sand face of 4-7 metres rising to >7 metres at the two ridges.

Part Swan Location 2477 Flynn Drive is ideally located to augment supplies particularly to the north west corridor. It is 7 kilometres north east of Wanneroo and abuts a major urban expansion area at Neerabup (see Figure 1).

Importantly Part Swan Location 2477 is allocated to future industrial use and sand excavation will enable a final design surface to be created to suit industrial development.

In this respect the surface can be modified to meet the structure plan for the area currently in preparation.

Part of the land has been utilised as a market garden for 13 years, with the remaining land being uncleared Banksia Woodland.

Flynn Drive is to be a major through road linking Wanneroo Road with Bullsbrook to the east. Therefore it makes economic and planning sense to utilise sand from the site while at the same time modifying the land surface to conform with the requirements of Flynn Drive and the proposed industrial site.

The proponents are the Borello family the owners of the land.

1.3 Aims of the Proposal

The aims of the project are to:

- provide for an alternative supply of sand products in the North - Western Metropolitan region to meet future demand as development continues in the area.
- enable the final contours to be brought into line with an end use of Industrial and Mixed business as outlined in the Flynn Drive Industrial area for which planning is currently underway and including the proposed widening of Flynn Drive.

1.4 End Use

The end use of part Swan Loc 2477 is "Industrial and Mixed Business" in the North - West Corridor Structure Plan (Department of Planning and Urban Development).

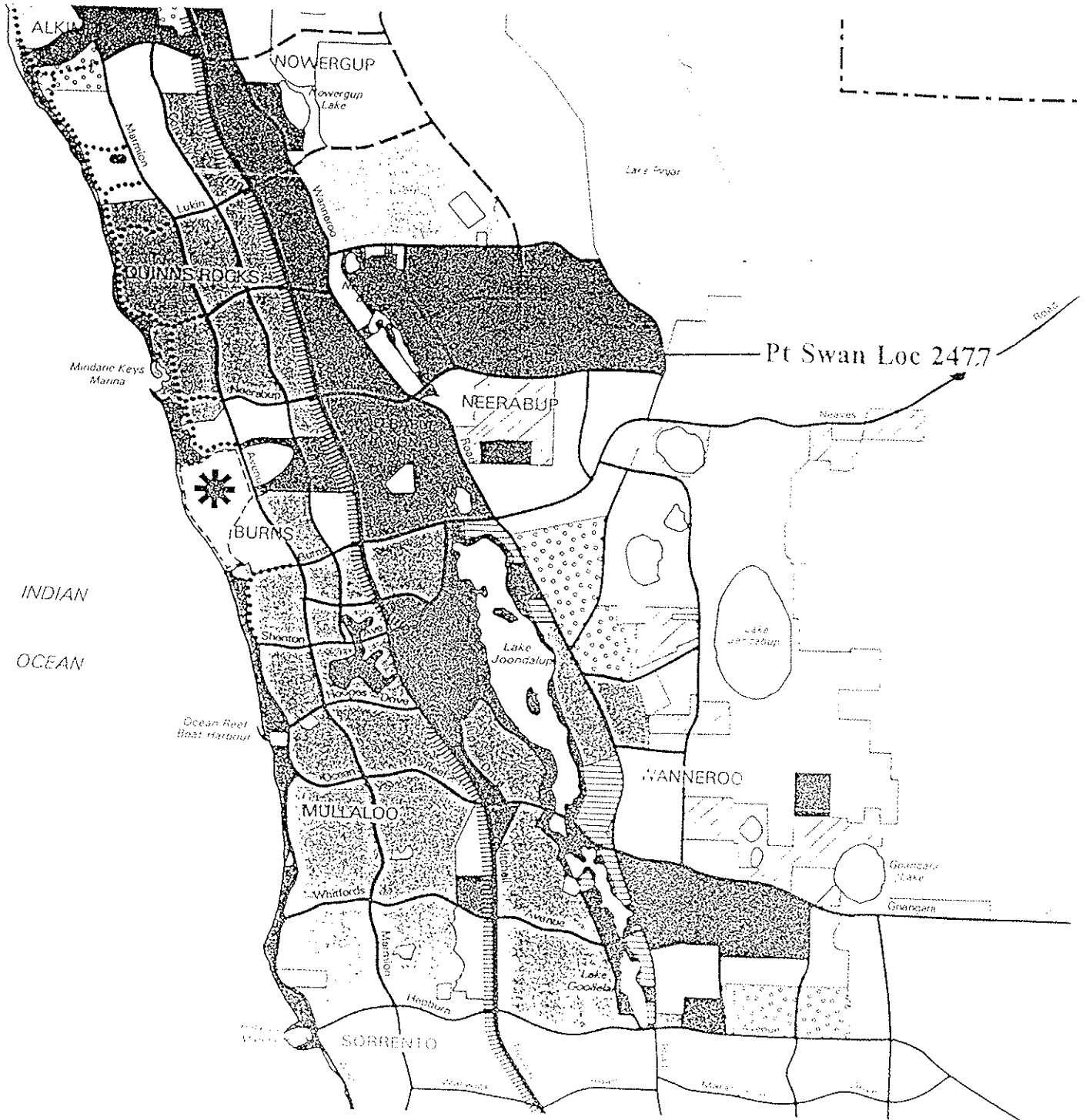
Excavations for the adjoining land indicate a floor level of 61 m AHD. This is consistent with the proposed industrial and mixed business zoning. For Pt Swan Loc 2477 the proponents as a participant in the current structure plan for the Flynn Drive Industrial Area which covers the site are prepared to modify the final surface level to accord with the structure plan when finalised and agreed in order to establish a consistent final land surface.

The end use could be:

- an industrial plant
- part of a small business park development
- a manufacturing site

We propose a slightly undulating surface rising to probable design levels for Flynn Drive. No design levels have been finalised. However the proposed alignment of Flynn Drive will impact on part Loc 2477 and a widening of up to 32 metres at the western end and 9.5 metres at the eastern end is to be excised from Pt Swan Loc 2477.

Figure 1
Location of Swan Loc 2477 Flynn Drive.



2.0 EXISTING ENVIRONMENT

2.1 Climate

The climate of the area is classified as Mediterranean with warm to hot summers and cool wet winters.

Temperatures are recorded at Beenyup, where the maximum temperatures in the hottest and coldest months, January and July are 28.8 degrees C and 17.6 degrees C respectively. In winter the minimum drops to an average of 3.5 degrees C in July.

Rainfall for the area is 722 mm. 87% of the rain falls during the winter months, April to October inclusive. Evaporation exceeds rainfall in all but the four wettest months, May to September.

Wind direction is predominantly from the east in the morning and from the south west in the afternoon during the summer months. Wind speed exceeds 10 kph for 55 % of the time at 9.00 am and 74 % of the time at 3.00 pm.

During the winter months the directions are more variable due to the presence of winter lows.

2.2 Geology and Geomorphology

The elevation of the area grades from 52 metres in the north west corner to 74 metres on two small hills in the north east corner. The central portion of the property is at 60 metres rising gently to the hills in the east and to a small ridge of 70 metres in the central west.

The site is covered by Spearwood Sands and is underlain at depth by Tamala Limestone as revealed by Water Authority of Western Australia Bore SW35.

The Spearwood Sands are thought to have originated by being blown from weathering Tamala Limestone which is widespread along the coastal area of Western Australia. The age of the limestone is late Pleistocene and the Spearwood Dunes are thus assumed to be younger.

2.3 Soils

Soils in the area are shallow, yellow brown, loamy sands. They are generally classified as the Spearwood soils; Uc1.23 (Northcote) and they are nominated as the Karrakatta Landform by some workers. Soil depths are very deep with the sand extending to depths of 35 metres. In places solutions have leached the surface sand to form a podsol with bleached white - grey surface sand. Humus colours the surface sand grey.

2.4 Hydrology

The area has no surface drainage because of the permeable and porous nature of the sand. Drainage is to the water table which comes to the surface as the Neerabup Lake wetlands, 4.5 km to the west and Little Coogee Swamps, 1.5 km to the east. Sub-surface drainage would locally be to the east to the Little Coogee System with a general ground water flow to the west at depth. Estimated maximum groundwater contours (WAWA) are 40 m AHD (west of site) to 44 m AHD (east of site). Minimum separation is approximately 14 metres in the south east corner of the site (ie 58-44).

The site is a proclaimed ground water management area and lies just west of the Wanneroo Underground Water Pollution Control and Public Water Supply Area. Production bores occur 5.5 km to the east.

A licensed bore exists with an allocation for 53 kl/annum and will be used for washing and settling dust.

2.5 Flora

The vegetation of the area is classified as the Spearwood Vegetation System by Beard 1979. This vegetation system extends from Yanchep in the north to Bunbury in the south in the near coastal locations of the Spearwood Soils. Currently the system is not threatened but is being cleared in many areas.

The vegetation of the site is Banksia Woodland, dominated by *Banksia attenuate* and *B. menziesii* with scattered *Jarra*, *E. marginata*, *Allocasuarina fraseriana* and *Nuytsia floribunda*. A rich sclerophyllous understorey of ground covers and shrubs covers the ground. Typical species are *Adenanthos cygnorum*, *Hibbertia hypericoides*, *H. racemosa*, *Xanthorrhoea preissii*, *Macrozamia riedlei*, *Jacksonia furcellata*, *Dryandra nivea*, *Leucopogon* spp, *Stirlingia latifolia*, *Petrophile linearis* and *Eremaeae pauciflora*.

A literature search in Western Australia's Endangered Flora and the East of Joondalup Urban Development Project PER revealed that there are several species which might possibly occur in the area.

Stachystemon axillaris

Lysinema elegans

Tetrateca pilifera

Conostephium minus

All of these have been collected from much wider afield but are predominantly listed because their distributions are poorly known. Their ultimate survival is unlikely to be affected by the area for the proposed sand quarry.

Vegetation of the site was briefly assessed during a site visit on 23 May 1995. The dominant and indicator species of the plant community were noted to determine the community and thus indicate the likely fauna that could be present.

Approximately 30% of the original Banksia Woodland on part Swan Loc 2477 will remain uncleared at the end of sand excavation, and the fate of this will depend on the future land use of the area.

A detailed botanical survey was not carried out because of the;

- The low level of environmental report required.
- The presence of a market garden.
- In the regional context, the area of vegetation to be disturbed by the project involved.
- The presence of similar plant communities in adjacent and nearby areas, to the north.

2.6 Fauna

A definitive faunal survey of a site is a major undertaking, requiring many days / nights of observations, capturing and classification with no certainty that all species will have been recorded at the conclusion. Such a survey is not justified for this proposal because of:

- The level of environmental assessment required.

- The relatively small area of indigenous vegetation involved in a regional context.
- A market garden exists on the site and there is a quarry adjacent to the north.
- Detailed faunal studies have been carried out in the nearby Neerabup National Park and the surrounding areas, (Faunal studies of the Northern Swan Coastal Plain, Western Australian Museum 1978). Fauna was considered in the "East of Joondalup Urban Development Project".
- The likely fauna can be gauged from the nature of the plant community.

The only vertebrates which might occur in the area, and which are currently considered threatened, are the Chuditch, *Dasyurus geoffroii* and the Black Glove Wallaby, *Macropus irma*. The Chuditch is gazetted as rare. The last time the Chuditch was recorded on the northern Swan Coastal Plain was in 1972 and considering the disturbance on part Loc 2477 and the presence of feral animals it is probably extinct from the Neerabup area. The Black Glove Wallaby was recorded in Neerabup National Park and whilst it is not gazetted as rare its numbers are thought to be declining (Faunal Studies of the Northern Swan Coastal Plain, WAM 1978 and Gazetted Rare Fauna, 16th November 1990).

Kitchener et al (Western Australian Museum 1978, "Mammals of the Northern Swan Coastal Plain"), confirm only 12 species of mammal being present. The Chuditch was not recorded and may be extinct in the Neerabup region.

Gazetted birds such as the Peregrine Falcon, *Falco peregrinus*, Carnaby's Black Cockatoo, *Calyptorhynchus funereus latirostris* and Baudin's Black Cockatoo, *C. baudinii* are possible short time visitors. Of these only Carnaby's Cockatoo is a likely visitor, attracted to the flowering *Dryandra sessilis*, (Birds of the Swan Coastal Plain, Rec. WA Museum 1988). Other reports have highlighted the possibility of insects with poorly known or restricted distributions, which will be considered during the preparation of the Flynn Drive Industrial Strategy.

In this respect a native bee (*Hylaeus globuliferus*) is known to inhabit this area particularly the areas of woolly bush.

The proposed strategy plan will allow a research programme to proceed to establish the extent and importance of this habitat.

2.7 Aboriginal Sites

No evidence of aboriginal occupation has been found on the property. In addition the Sites Department of Aboriginal Affairs has no records of any ethnographic or archaeological sites in the area. The archaeological and ethnographic study completed for the East of Joondalup Urban Development did not identify any site in the similar landform adjoining to the south. Known sites are related to the wetlands 4.5 km to the west.

2.8 Current and Proposed Land Use

Part of the site has been used as a market garden. However water allocation limitations prevents a larger area being used for this purpose. Excavation will spread out from this cleared area taking the small rise to the west and the hills in the north east. Market gardens exist to the north.

A sand pit has recently commenced operation, adjoining to the north and limestone quarries have been operating two km to the west for many years.

An existing subdivision of Industrial and Mixed Business lots lies one km to the west. The quarries are required to be finished to design levels which allow for an extension of industrial development over this area.

The Wanneroo Motor Racing Circuit and other motor sports lie to the north and north west.

The land south of Flynn Drive is planned to be developed as urban land and Flynn Drive is to become a major traffic route with a widening required from the subject land.

The adjoining land to the east is a golf course.

3.0 EXCAVATION MANAGEMENT

3.1 Extraction and Processing

It is proposed to extract fill and other sand from Part Swan Loc 2477 over a 10 year period.

Between 50 000 and 100 000 tonnes of sand will be excavated from the proposed excavation each year depending on market demands.

The majority of the sand on Part Swan Loc 2477 is yellow quartz sand with some brickie's sand at depth and some leaching in the surface layer. The grade of sand does vary slightly both horizontally and vertically. This means that if the correct grade of sand for a particular market is not available, two working fronts may have to be used.

Excavation will proceed in a manner that will allow the final surface to be reformed and rehabilitated as the mining front progresses.

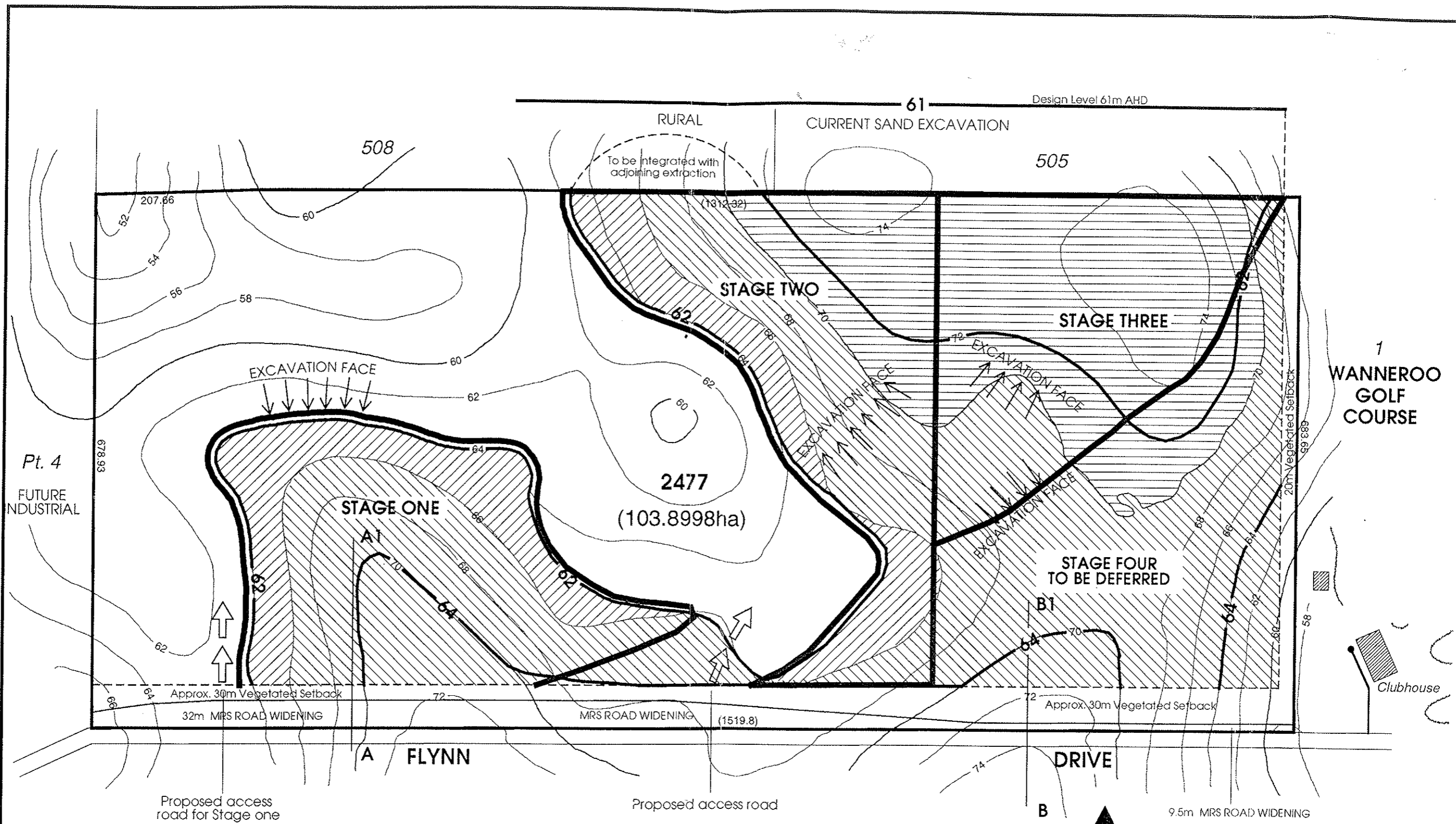
Stage 1 of the proposal is to take sand from the small ridge in the central west of the site with the hill in the north east being worked at a later stage. It may be that a small excavation will have to be opened towards the north east during the time that Stage 1 is being worked, to ensure all sand types are available.

Stages 2 to 4 are located in the eastern part of the property with Stage 2 closest to Flynn Drive and the other stages further to the north (see Fig 2).

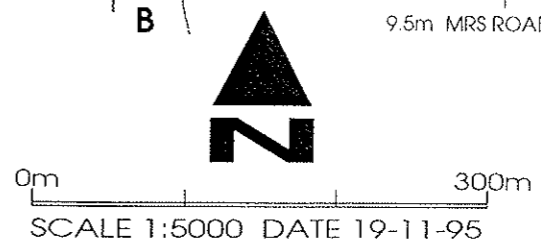
Excavation will commence in the central part of the deposit and work towards the outside. This will leave the maximum amount of vegetation along Flynn Drive at all times and because sand will be excavated from below the level of the buffer zone, maximum screening from Flynn Drive will be retained.

Trees will be planted in the in the buffer zone along Flynn Drive, where there is a lack of sufficient screening vegetation such as in the vicinity of the market garden.

Because of the planned road widening of Flynn Drive which will be 32 metres in the west reducing to 9.5 metres in the east it is proposed that the buffer be 62 metres from the current reserve reducing to 39.5 metres at the eastern end. With the final alignment and widening of Flynn Drive the buffers will reduce to 30 metres (see Fig 3). No clearing of vegetation will occur in the buffer area except where necessary for roadworks, until reconstruction of Flynn Drive occurs.



AMOUNT OF CUT REQUIRED	
	1-3 metres
	4-7 metres
	> 7 metres



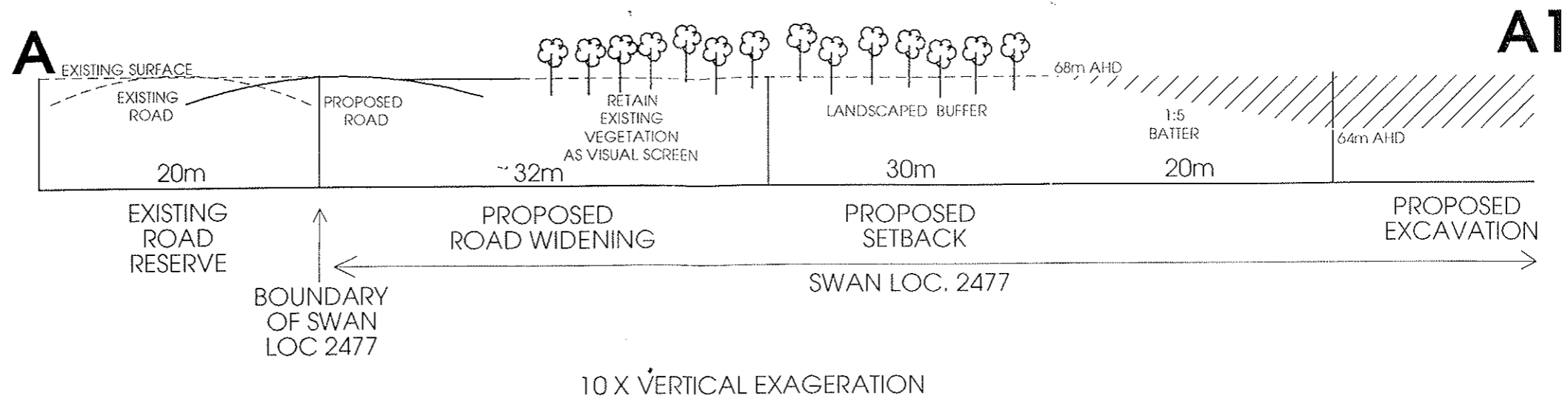
DEVELOPMENT CONCEPT PT. SWAN LOC 2477, FLYNN DRIVE, NEERABUP

PREPARED FOR THE BORRELLO FAMILY

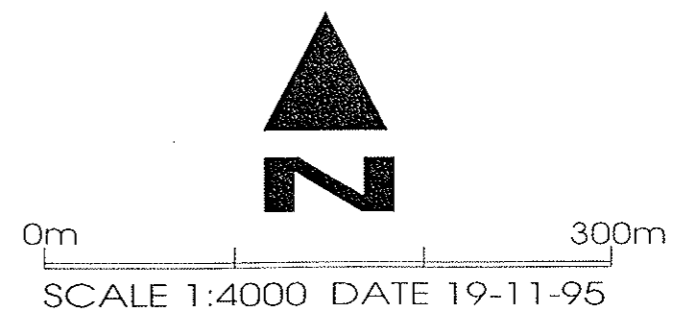
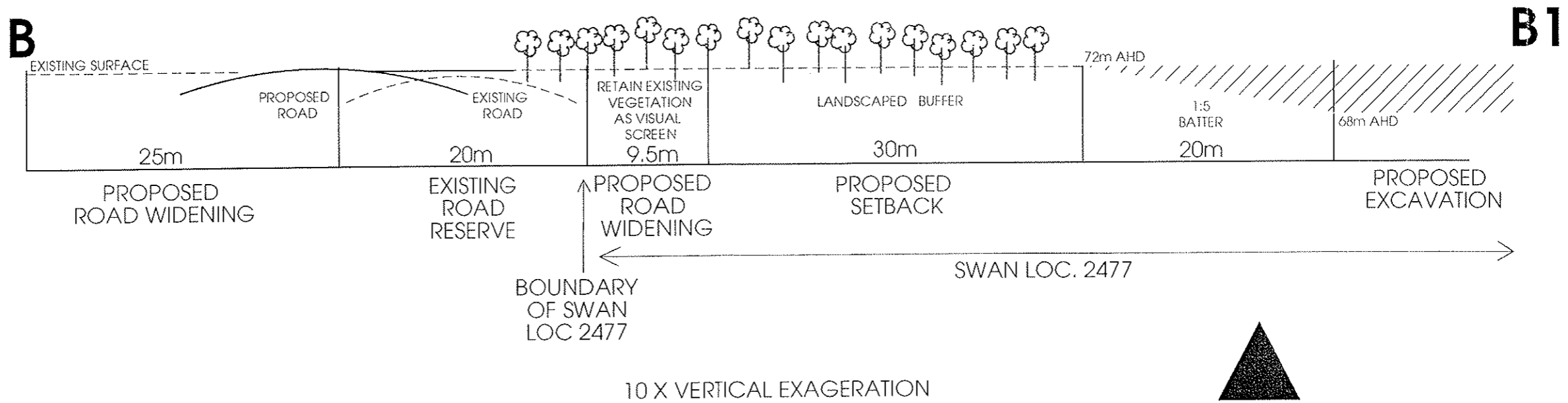


FIGURE 2

CROSS SECTION A - A1



CROSS SECTION B - B1



DEVELOPMENT CONCEPT
PT. SWAN LOC 2477, FLYNN DRIVE, NEERABUP
 PREPARED FOR THE BORRELLO FAMILY



FIGURE 3

At the time of reconstruction of Flynn Drive an application may be made to excavate sand from the buffer zone to bring the elevation into a level consistent with both the final contours of Part Swan Loc 2477 and the modified elevation of Flynn Drive. In addition, as development proceeds on the proposed industrial site, permission may be requested to mine through the 20 metre buffer along the northern side of Part Swan Loc 2477 to produce a consistent land surface through to the sand excavation to the north.

3.2 Site Works

The vegetation will be cleared, followed by removal and stockpiling of the topsoil. Larger logs will be cut and removed for firewood, but smaller fragmental material and topsoil will be transferred directly to an area being rehabilitated. This will reduce stockpiles, maintain the viability of the micro-organisms and seed stores in the soil and assist the rehabilitation program.

Where the level of vegetation is too great it will be formed into piles on an open area of ground and used in rehabilitation.

Where top soil cannot be spread directly, small stockpiles of topsoil and vegetation fragments will have to be created for later use.

Sand will be excavated from a single face where possible. however a two stage excavation of sand may be required if the grade of sand changes significantly with depth. Excavation will use a front end loader loading directly onto trucks.

A portable screening plant may be used on the floor of the pit if required. At this stage there are no plans for a screening plant, but if one was utilised it would have to be licensed by the Environmental Protection Authority.

Excavation of the yellow sand will produce a floor, averaging 62 metres RL. The final floor will undulate with some areas forming gentle dips and others gentle ridges. These undulations will be able to be landscaped into any industrial use for the land and could provide sound screening and buffers. A floor height of 62 metres is 35 metres above the highest known water table. This is compatible with the utilisation and protection of ground water in the area.

Approximately 200 mm of top soil will be spread over the reformed land surface followed by a thin layer of vegetation fragments from an area being cleared. The fragmental vegetation material will be a very important factor in reducing wind erosion of the surface and consequent sand blasting of the new vegetation. In addition the vegetation fragments

and topsoil provide a valuable seed source of indigenous plant species. Rehabilitation will be considered in more detail in Section 4.10 Rehabilitation.

The quarry is expected to have a life of at least 10 years. Stage 1 will consist of working the small ridge in the west and should take between 2 and 4 years to excavate, depending on market demands. Later stages will excavate in the area of the hills in the south east and north east.

The areas closest the Flynn Drive will be excavated first because of the proposed urban areas to the south. By the time these areas are developed sand excavation will have moved to the north east of the property where the distance from urban development (and possibly by that time industrial development) will be greater.

3.3 Machinery and Equipment

A building exists on the site together with a toilet system. This will be maintained and will be used to store equipment and to act as a site office.

The main equipment to be used will be a loader. A screening plant may be used if market demands require a screened product. If a screening plant is to be used a Grinding and Milling Licence from the EPA will be applied for.

A diesel fuel above ground tank will be installed and contained by a bunded enclosure lined with an impermeable liner.

The bore located on the site is licensed and will be retained to provide water for dust suppression.

3.4 Workforce

The workforce will vary depending on the level of operation and market demands but will usually consist of 1 to 3 persons working on site during normal working hours.

3.5 Water Usage

Water for dust suppression will be drawn from the existing licensed bore on the site which will continue to serve the market garden.

3.6 Access and Transport

Access to the working faces will be along an angled access road constructed from Flynn Drive. In Stage 1, the access road will run west from behind the small ridge, whereas in Stage 2 an access road will be constructed near the existing shed on land currently cleared for the market garden. Some trees will be required round the entrance near the shed to further screen the site.

Access roads will be constructed from limestone materials with the first 20 metres being sealed with bitumen to reduce the potential for dust and sand to be carried onto Flynn Drive.

Visibility at each access point is good for all traffic.

Gates will be erected on the access roads and perimeter stranded wire fences maintained. When the site is not occupied the gates will be locked. Warning signs will be erected in accordance with Department of Minerals and Energy and City of Wanneroo requirements.

Transport will be on contractors trucks which have a variety of load capacities depending on their size and whether they use a trailer. Generally load capacities will be between 10 and 35 tonnes per laden truck movement, although small volumes will be sold to the public.

Some times will be busier than others, however an average of 10 to 20 laden truck movements per day can be expected depending on market demand.

3.7 Hours of Operation

Hours of operation applied for in this application are from 7.00 am to 7.00 pm Monday to Friday and Saturday 7.00 am to 5.00 pm. Working longer hours ensures greater efficiency in the use of equipment and thus a reduction in the operating costs. In addition full working hours are required on Saturday to enable clients to be serviced. An increasing number of construction businesses work six days per week. No work is to be conducted on Sundays or on Public Holidays.

At any particular time the hours worked will depend on the market demands.

4.0 ENVIRONMENTAL MANAGEMENT

4.1 Aesthetics

The proposed excavation should not be visible from any residence. The only part of the excavation that may be visible from outside the property, will be some of the higher levels of the excavation that may be visible from Flynn Drive. As the operation will be worked from inside out, and much of the buffer is well vegetated, the proposed excavations will only partly be visible. Where the buffer zone is not thick enough such as in the vicinity of the market garden, trees will be planted to thicken the vegetation screen.

The access roads will run at an angle behind the buffer zone to reduce direct views into the excavation.

Management

The proponents will undertake the methods of rehabilitation outlined in 4.10.

An uncleared buffer zone of 52 metres reducing to 40 metres along Flynn Drive will be maintained. Where necessary further plantings will be made into the buffer zone.

Access roads will be angled for visual relief.

4.2 Noise

The width of the buffer zones, the distance to adjoining land users, the type of adjoining land users and the proposed end use of the property should ensure that noise does not impact on residences. There will be some increase in traffic along Flynn Drive but this is expected to be between 10 and 20 laden trucks per day. Considering Flynn Drive is to be upgraded to a major transport route this increase is minimal.

The method of working from the inside out and the retention of the buffers at higher elevations than the excavation will ensure the noise levels are suppressed. In addition the limited amount of machinery to be used will generate little noise.

The Neighbourhood Noise Level that applies to the area is probably A2. However the EPA has set the following noise levels for dwellings as not unreasonable.

Neighbourhood Noise Level		
Monday-Saturday	0700-1900 hours	50 dBA
Sunday	0700-1900 hours	45 dBA
Monday-Saturday	1900-2200 hours	45 dBA
Everyday	2200-0700 hours	40 dBA

These noise levels could be complied with, even when the adjoining land over the road is developed as urban.

Management

The Proponents will excavate and transport material in the methods described in this document, within the defined hours of the operating licences.

4.3 Dust

Dust will be managed by the watering of the access roads as required during dry periods. In addition Norlig 58 (lignin sulphonate), a surface binding agent for roads may be applied to the limestone roads to reduce maintenance and the necessity for watering if required. Norlig 58 is a by-product from the manufacture of paper and has been approved by the Water Authority for use in water management areas.

Dust should not affect any neighbouring property because of the distances involved and the lack of fines in the sand.

A sprinkler watering system will be used to water the access road or a tanker truck maintained permanently on site, whichever is the most efficient.

Trucks will be wetted down before leaving the site and all trucking contractors will be told to place tarpaulins over their loads in summer.

Dust has the potential to be generated during land clearing and the reinstatement of top soil. Where possible this will be carried out during the wetter months. If dust generated during these operations affects an adjoining property, clearing and reinstatement will be stopped until such time as the wind is more favourable.

Management

The proponent will manage the dust levels by the methods outlined above.

Workers will be supplied with dust masks as needed.

4.4 Water Quality

The area lies within the Wanneroo Underground Water Pollution Control and Public Water Supply Area.

Market gardening and extraction of water has taken place on the property for a number of years with no apparent alteration to the ground water. Water use will in fact be reduced and as there will be no addition of fertilisers or other chemicals, the likelihood of adverse impact on the ground water system from the site will in fact decrease.

The highest known water table is 44 metres AHD. The final land surface will be undulating but will average 62 metres AHD. This final land surface meets the guidelines of the Water Authority and a separation distance of a minimum of 18 metres from the water table is a considerable distance in which to prevent alteration of the ground water system.

Sand excavation is a clean industry that has the potential to release only small amounts of oils and fuels from isolated leakages of machinery. Small leakages such as these are readily broken down by soil bacteria.

Diesel fuel is likely to be stored on site in an above ground tank. This will be installed in a bunded enclosure that is lined with an impermeable liner. Servicing of machines will take place in a concrete floored shed.

No waste will be disposed of on site. Where possible materials will be salvaged and recycled otherwise they will be taken regularly to an approved waste disposal site.

Management

The proponents will protect the water quality of ground water within their lots by the following measures;

Maintaining an average final land surface of 62 metres AHD.

Ensuring that no rubbish or polluting fluids are disposed of on site.

Materials replaced during routine maintenance will be recycled where possible or disposed of at a recognised waste disposal site.

The existing septic system will be maintained to dispose of toilet and ablution sewage.

Any fuel stored on site will be correctly contained and banded.

4.5 Fire Protection

Experience has shown that there is little potential fire risk from sand mining operations of this type. The quarry itself will form a natural firebreak, but in the uncleared areas firebreaks will be maintained.

In addition, if a water tanker is used for dust suppression it will be made available for fire fighting. The loader can be used to clear additional breaks on the property in times of fire.

Management

Firebreaks will be maintained inside all property boundaries as required under local government and Bushfires Board Regulations.

The other measures outlined above will be used for fire suppression.

4.6 Aboriginal Sites

No evidence of aboriginal occupation has been found on the property. In addition the Sites Department of Aboriginal Affairs has no records of any ethnographic or archaeological sites in the area. The archaeological and ethnographic study completed for the East of Joondalup Urban Development did not identify any site in the similar landform adjoining to the south. Known sites are related to the wetlands 4.5 km to the west.

Management

Should any evidence of early aboriginal occupation be uncovered during the extension of the quarry, development will be stopped pending an assessment by a recognised consultant.

If the site is confirmed as a site under the provisions of Section 15 of the Aboriginal Heritage Act 1972-1980 and Amendments, the proponent will comply with the provisions of the Act, relating to development in areas of recognised aboriginal sites.

4.7 Flora

The survival of the flora in the area will be determined by the end use of the property. Currently there are areas of similar vegetation communities remaining uncleared in areas, such as Neerabup National Park and in the Yanchep area. Where possible the mature trees will be retained to be incorporated into the final end use of the area to increase the aesthetics.

Species local to the area will be used in revegetation when available, however many species from the Banksia Woodland are not available either as seed or tube plants. If the top soil is managed appropriately, high levels of species richness and density will be obtained from germination of seed stored in the top soil. The key factor is the direct transference of top soil to an area being rehabilitated.

Management

The protection of indigenous flora in the area will be assisted by the following measures.

Indigenous species will be used in the rehabilitation.

Top soil will be spread directly onto areas to be rehabilitated to maximise the germination of indigenous species.

Rehabilitation will be carried out progressively throughout the life of the project. Landscaping for a future land use will be able to incorporate the rehabilitation and any mature trees which are retained during excavation.

The introduction of weeds will be controlled as outlined in 4.1 1.

4.8 Fauna

In the long term, the survival of fauna in the area will be more related to the future land use of the area, rather than to the operation of the quarry. The site will ultimately be cleared and developed as part of the Flynn Drive Industrial Area.

The more mobile fauna will be displaced to nearby vegetation communities during land clearing, although the loss of some smaller fauna is unavoidable.

If any of the Endangered fauna, Chuditch, *Dasyurus geoffroii* or the threatened Black Glove Wallaby, *Macropus irma* are present they should be able to move to a nearby area when the land is cleared. Neither are likely to currently live in the area.

Gazetted birds such as the Peregrine Falcon, *Falco peregrinus*, Carnaby's Black Cockatoo, *Calyptorhynchus funereus latirostris* and Baudin's Black Cockatoo, *C. baudinii* are possible short time visitors and will migrate elsewhere.

Management

The impact of the quarry on the fauna will be minimised by the following actions.

The land will be cleared slowly over a period of years. As land is cleared, finished sections of the quarry will be progressively rehabilitated.

Indigenous species will be used in the revegetation of buffer zones and where possible mature trees will be retained and landscaped into any future land use.

4.9 Social Impact

Quarrying for limestone and sand has taken place in the area for many years and a sand quarry has recently opened on the adjoining lot to the north. The introduction of another quarry will compensate for any employment lost by the closure of the market garden. Another sand pit will help maintain prices for fill sand and other sand products at the lowest possible levels due to the reduced distances from quarry to markets and competition.

Management

The management of social aspects have been covered in the sections dealing with planning issues.

4.10 Rehabilitation

Rehabilitation of the excavated area will be carried out progressively as the excavation front moves forward.

The aims of the rehabilitation program will be to:

- Restore the land surface to a profile visually consistent with the surrounding land and compatible with likely future land uses.
- Revegetate the land surface with a variety of plant species to hold the sand and provide vegetation, particularly trees that can be incorporated into possible future land uses. For example large mature trees will be retained if possible and planted

along the major roads and buffer zones that will be nominated in the Flynn Drive Industrial Area Structure Plan (in preparation).

Steps to be used in the rehabilitation process:

- During excavation the Banksia Woodland will be cleared. If possible larger logs will be offered to a service organisation for firewood. Otherwise they will be used in the rehabilitation process.
- The top 200 to 300 mm topsoil will be scraped clear and spread directly onto an area to be revegetated. Storage will be avoided where possible because it reduces the viability of soil micro organisms and seed. If the topsoil is to be stored it will be retained in low dumps not exceeding one metre in height. Dumps of this height allow a large proportion of the soil micro flora and soil fauna to remain active.
- In previously cleared areas where weeds are a potential problem, the quality of the top soil will be assessed and the methods outlined under "Weeds" will be used. Decisions on the best methods of handling top soil from previously cleared areas will be made during assessments of individual sites.
- Following excavation the land surface will be reformed as an undulating surface averaging 62 metres in elevation. This surface will be visually compatible with the surrounding land surface and the elevations will be consistent with the proposed changes to Flynn Drive and the levels proposed for the industrial area. The proposed final contours will be modified to incorporate the elevations proposed in the current Flynn Drive Industrial Structure Plan.
- The surface will be spread with 200 to 300 mm of topsoil taken directly from an area being cleared.
- Smaller branches and litter from vegetation being cleared, will be spread directly onto the areas of top soil used in the revegetation process. This will add to the indigenous seed sources and help reduce sand movement.
- The area will be seeded in early Autumn with a mixture of indigenous species known to be successful in the area. All leguminous seed should be scarified or pre-treated by placing in boiling water for one minute to crack the seed coat. To ensure even spreading the seeds will be mixed with either dieback free sawdust or dry potting mix and manually thrown. Care will be taken not to inhale either the sawdust or potting mix because of allergies and bacterial infections. An approved dust mask should be worn when spreading seed. The rate of seeding will be

approximately 500 g to 1,000 g per hectare which will be sufficient to hold the soil and make up for seed lacking in the top soil. A suggested species list is provided.

- Plant the area with indigenous tube plants during June - July at 3 metre spacings. A 10 g tree tablet will be placed next to each plant. Suggested species are listed.
- Over succeeding years the rehabilitation will be assessed to determine the success for the revegetation and establish the requirements for further seeding and planting.

Management

The proponent will rehabilitate the disturbed land surface using the measures outlined above.

4.11 Weeds

Weeds have the potential to affect the indigenous vegetation in the area, however it should be remembered that there are two separate vegetation areas on the property, the area previously used for market garden and Banksia Woodland.

A weed management policy can be instituted relatively easily for areas of Banksia Woodland in which natural top soil will be used for rehabilitation. It should also be noted that it is common for exotic weed species to be present in natural Banksia Woodland where they form a minor part of the community, however following land disturbance such as fire, their impact may increase, giving the impression of a rapid introduction of weeds to the area. These situations can be hard to deal with because any spraying is likely to damage germinating indigenous species.

In Banksia Woodland areas weeds will be prevented by the following methods:

1. No top soil from weed affected areas will be brought into areas to be rehabilitated with Banksia Woodland top soil.
2. Outbreaks of weeds regarded as having a major potential to affect rehabilitation will either be spot sprayed, or buried.

In areas that have been previously cleared for market gardens, weeds will be harder to control. In these areas, seeds of weed species are likely to be very common, but seeds of indigenous species will be rare, in the top soil. The best method to reduce weeds in these areas is to produce a rapid cover of indigenous plant species. Few local species are capable of achieving this because they are not present as seeds in the top soil, they are not

commercially available or are prohibitively expensive, they are not coloniser species and their growth patterns are too slow. In these areas the addition of some non-local indigenous species is preferred.

This means that choices have to be made about the use of top soil from previously cleared and market garden areas. These choices are best made during the excavation and rehabilitation stages when decisions can be made on individual sites and treatments developed as appropriate.

To reduce weeds in previously cleared areas, the following management options are available:

1. Top soil can be buried to prevent the seeds of weed species from germinating. This creates a shortage of top soil for rehabilitation.
2. Top soil can be used for rehabilitation with suitable spraying for perhaps two years to eliminate germinating weeds. Sprays appropriate to particular weed species will be selected because some sprays are environmentally sensitive and may interfere with rehabilitation.
3. Use the existing top soil to produce a cover of indigenous species that will reduce weeds by competition. This cannot be produced by the exclusive use of local species for the reasons mentioned above.

The most satisfactory option is likely to be a combination of methods 2 and 3.

Management

Weeds will be controlled by the methods outlined above

Species to be used in the Seeding Program

The following seeds are recommended for the area. They are selected from local provenance species or species from the Spearwood and Bassendean Systems which are available commercially as seed. For example *Adenanthos cygnorum* (Woolly Bush) is an excellent coloniser but it is unobtainable from seed or tube plants, even though it grows well from seed stored in topsoil. Some other species are slow growing but can be useful additions to areas where seed from topsoil is less successful. If care is taken with top soil management, germination rates are likely to be high enough to reduce the need for seeding.

Species from the Banksia Woodland community on the site are not coloniser species with the exception of *Adenanthos cygnorum*. Therefore coloniser species such as *Acacia saligna* and *A. cyclops* have been included to provide protection against wind erosion.

Other seeds may be substituted depending on availability, provided they are suitable for deep, leached siliceous sands. (L) denotes species to be soaked or scarified.

<i>Acacia cyclops</i>	(L)	Coastal Wattle
<i>Acacia pulchella</i>	(L)	Prickly Moses
<i>A. rostellifera</i>	(L)	
<i>A. saligna</i>	(L)	Golden Wreath Wattle
<i>Allocasuarina fraseriana</i>		Sheoak
<i>Banksia attenuata</i>		
<i>B. menziesii</i>		
<i>Bossiaca eriorcarpa</i>		
<i>Callitris preissii</i>		Rottnest Island Pine
<i>Calothamnus quadrifidus</i>		Netbush
<i>Dryandra scssilis</i>	(L)	Parrot Bush
<i>Eremaea pauciflora</i>		
<i>Eucalyptus calophylla</i>		Marri
<i>E. marginata</i> (sand)		Jarrah
<i>E. todtiana</i>		Prickly Bark
<i>Gompholobium tomentosum</i>		
<i>Hardenbergia comptoniana</i>	(L)	Native Wisteria
<i>Hypocalymma robustum</i>		Swan River Myrtle
<i>Kennedia coccinea</i>	(L)	Coral Pea
<i>K. prostrata</i>	(L)	Running Postman
<i>M. lanceolata</i>		Rottnest Island Titree
<i>Stirlingia latifolia</i>		Blueboy

Indigenous species which can be added to the seed list to help produce a more rapid vegetation cover to help reducing the growth of weeds in previously cleared areas.

Kennedia nigricans	(L)	Black Coral Pea
K. rubicunda	(L)	Dusky Coral Pea
M. lanceolata		Rottnest Island Titree
M. nesophila		Showy Honey Myrtle
E. conferruminata		Bald Island Marlock
E. eremophila		Tall Sand Mallee
E. gomphocephala		Tuart
E. lehmanii		Bushy Yate
E. platypus var heterophylla		Round Leaf Moort
E. todtiana		Pricklybark
E. woodwardii		Lemon Flowered Gum
H. francisiana		Grass Leaf Hakea
Melaleuca armillaris		Bracelet Honey Myrtle
M. incana		Grey Honey Myrtle

Species to be Planted as Tube Plants

Hardened tube shrubs and trees will be selected from the following list. Species listed in the first list are selected from local provenance species or species from the Spearwood and Bassendean Systems that are available commercially as tube plants. Few local species are available as tube plants, and those that are, tend to be slow growing and unsuitable for vegetation screening. The second list is of tree species suitable for screening, such as along road sides.

Species such as *Acacia saligna* and *A. cyclops* have been included because they are coloniser species that have nitrogen fixing capabilities and are capable of providing protection against wind erosion.

Other species may substituted provided they are suited to siliceous sands.

Local Provenance Species

A. cyclops	WA Coastal Wattle
A. saligna	Golden Wreath Wattle
A. fraseriana	Forest Sheoak
C. preissii	Rottnest Island Pine
Calothamnus quadrifidus	Net Bush
Eucalyptus calophylla	Marri
E. marginata (sand)	Jarrah
E. todtiana	Pricklybark
M. lanceolata	Rottnest Island Tree

Fast growing species suited to screening

E. camaldulensis	River Gum (no salt)
E. conferruminata	Bald Island Marlock
E. eremophila	Tall Sand Mallee
E. gomphocephala	Tuart
E. lehmanii	Bushy Yate
E. platypus var heterophylla	Round Leaf Moort
E. torquata	Coral Gum
E. woodwardii	Lemon Flowered Gum
H. francisiana	Grass Leaf Hakea
Melaleuca armillaris	Bracelet Honey Myrtle
M. nesophila	Showy Honey Myrtle

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