BIG ROCK RESERVE
(28665) MANAGEMENT PLAN

Prepared for the Shire of Busselton by
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COMMON ABBREVIATIONS

AgWA:	Agriculture Western Australia
CALM:	Department of Conservation and Land Management
DOLA:	Department of Land Administration
FOR:	Friends of Reserve
SB:	Shire of Busselton
WAPC:	Western Australian Planning Commission

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SUMMARY AND RECOMMENDATIONS

Big Rock Reserve (Reserve 28665) is located 280km south of Perth just west of the Dunsborough town site in Western Australia. It is classified as a C class Reserve vested for the purpose of 'Preservation of Caves and Conservation'. It is currently in the process of being reclassified as an A class Reserve, vested for the purpose of 'Landscape and Fauna Protection'. This Management Plan highlights the ecological significance of Big Rock Reserve and is intended to assist local environmental groups and members of the public to take part in its management.

The objective of this Management Plan is to conserve, protect and enhance the ecological system, natural and cultural characteristics through the management and protection of areas of conservation value; cultural and historical significance; scenic beauty; and scientific interests.

Big Rock Reserve is understood to have cultural significance to the local Bibulmen Mia Aboriginal Corporation. It is likely the Reserve was utilised by Aboriginal people because of the abundance of resources and the Big Rock, which may have served as a meeting place and lookout. The area has wider cultural significance as a heritage site, being one of the last large remnants of this type of native woodland endemic to the region.

Being located on the Leeuwin Naturaliste Ridge, the Reserve represents a rich diversity of remnant vegetation associated with ironstone flats, rocky valleys and sandy rises. The steep slopes have also allowed the formation of two main streams flowing through the Reserve.

The relatively undisturbed state of Big Rock Reserve supports a diverse range of native flora and fauna. A variety of vegetation communities exist, principally Jarrah, Marri and *Banksia* woodlands, influenced by the distinct changes in the physical environment encountered throughout the Reserve. The presence of *Dasypogan hookeri, Calothamnus graniticus var graniticus* and the high diversity of under-storey species sets Big Rock apart from similar conservation Reserves such as Meelup Regional Park. The Reserve has not been subject to extensive flora and fauna surveys, yet preliminary surveys have enabled baseline data to be collected.

The majority of the land in Big Rock Reserve is public open space zoned for recreation with the exception of Location 5073, the Telstra Telecommunications Station, and its access easement. Parts of the Reserve were previously used for gravel extraction and four inactive pits have been left to revegetate. The land east and south of the Reserve is principally zoned for rural residential use while the land north of the Reserve is predominantly zoned for agriculture. The west side is bounded by Caves Road.

Visitors to Big Rock Reserve take advantage of the view offered from the summit of Big Rock. Other current recreational pursuits include bird watching, bush walking, horse riding, trail bike riding and four wheel driving, some of which are impacting on the conservation values of the Reserve. Public amenities that have been recommended in this plan include walk trails, a carpark and the park benches which have been located at sites for public convenience while ensuring ecological resources are not compromised. The recommendations outlined in this management plan promote passive recreational pursuits such as bushwalking and bird watching while minimising the impacts of human use.

Perhaps the most essential part of the management of Big Rock Reserve is to ensure that adequate measures are in place to protect and rehabilitate the biological and physical environments. Important conservation issues facing the Reserve include:

- Uncertainty of extent of dieback infection;
- Potential impacts of introduced fauna on the natural environment;
- Encroachment of weeds from adjacent private properties;
- The risk of a bushfire at the Reserve;
- Water erosion on the steep slopes in cleared areas;
- Uncontrolled recreational access – i.e. motor bikes and horses;
- Unmanaged bush access; and
- The absence of adequate fencing to delineate the Reserve's boundaries.

Big Rock Reserve has the potential to be a valuable resource for the general public owing to its diverse community of flora and fauna endemic to the region; its aesthetic beauty and its cultural significance. The provision of on and off site educational facilities aimed at enhancing peoples' awareness, attitude, and behaviour towards natural resources and land management forms part of the conservation program for Big Rock Reserve.

The establishment of a Friends of Reserve group is recommended to assist the Shire of Busselton in meeting the Reserve's vested purpose and objectives of this Management Plan and to ensure that there is a community focus to the management of the Reserve. Such a group could consist of representatives of various agencies, community groups, and interested members of the public. The Concept Plan designed for Big Rock Reserve (Figure 9.2) may be used to assist in focusing the actions of the Friends of Reserve group.

RECOMMENDATIONS

In each of the following chapters for this Management Plan, formal recommendations have been provided to allocate responsible authorities tasks that will ideally assist in achieving the objectives of this Management Plan. The prioritised recommendations are grouped in subheadings, for example: **Aboriginal Significance,** and are numbered corresponding to the subsection they occur in, such as **2.2a** for Subsection 2.2.

Each recommendation is assigned with at least one responsible authority for implementation, for example; **Shire of Busselton (SB), Friends of Reserve group (FOR), Department of Conservation and Land Management (CALM).** It should be noted that responsbility allocated to a Friends of Reserve group is not a statutory obligation and should be used as a guide only. Assistance from the Shire of Busselton with most of these activities would be expected.

Target dates are included for each recommendation as a guide for implementation. These dates are based on the implementation of this Management Plan commencing 2000 and are required within three years i.e. **2001, 2002, and 2003.** Numerous recommendations require ongoing attention and are intended to be continued for the life of the Reserve, or until review deems them unnecessary.

RECOMMENDATION	RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
HISTORICAL PERSPECTIVE **Aboriginal History and Significance**			
2.2a Approach the Bibulmen Mia Corporation and the Gnuranen Aboriginal Corporation to be actively involved in the management of Big Rock Reserve.	SB FOR	Medium	2002
Non-Aboriginal History and Significance			
2.3a Approach the Busselton Historical Society to conduct a search of their records for possible involvement of the Big Rock Reserve area in the development of the region since colonisation.	FOR	Low	2003
2.3b Approach the Busselton Museum to assist in recognising Big Rock Reserve as a 'heritage site for the benefit of present and future generations'	FOR	Low	2003
PHYSICAL ENVIRONMENT **Topography and Erosion**			
3.4a Any future construction of walk trails and firebreaks should avoid areas of steep slopes to minimise erosion within the Reserve.	SB	High	2001 – ongoing
3.4b Establish rehabilitation programs for the areas illustrated in Figure 9.2 that have been degraded by erosion processes.	SB FOR	High	2001 – ongoing
3.4c As a part of formalising the walk trails, investigate the need for drainage management along these trails.	SB	Medium	2002
THE BIOLOGICAL ENVIRONMENT **Native Flora**			
4.1a To promote opportunities for scientific research within the Reserve.	SB FOR	Medium	2003 – ongoing
4.1b Undertaken active revegetation of highly disturbed areas of the Reserve including the four disused gravel extraction sites.	SB FOR	High	2001 – 2002
4.1c Encourage nature regeneration in marginally disturbed areas of the Reserve by utilising direct seeding techniques.	FOR	Medium	2003 – ongoing
Exotic Plants			
4.2a In areas where weeds have dominated the under-storey, a rehabilitation program is recommended to allow the local flora to regenerate.	FOR	Medium	2002 – ongoing
4.2b Encourage private landowners to undertake weed control and plant local native species in their gardens.	SB FOR Landowner	Medium	2003 – ongoing
4.2c Monitor the invasion of weeds around the walk trails and the firebreaks to reduce their spread and introduction into the Reserve.	FOR	Low	2003 – ongoing

RECOMMENDATION	RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
4.2d Implement the following weed control measures to reduce the population of weed species in the Reserve: ❑ Spot spraying of Arum lilies in large stands, hand removal of individuals and stands along water courses. ❑ Spot spraying of Watsonia or hand removal near water courses. ❑ Hand removal of Apple of Sodom, Bridal Creeper, and African Love Grass. ❑ Herbicide wipe to control Flatweed.	SB FOR	Medium	2002 – ongoing
Dieback			
4.3a Conduct a dieback survey throughout the Reserve to identify where dieback exists.	SB	High	2001
4.3b Monitor the spread of dieback where it exists and prohibit all activities in these areas.	SB	High	2001 – ongoing
4.3c Identify dieback – free areas in the Reserve and minimise activity in these areas.	SB	High	2001 – ongoing
4.3d Determine the effectiveness and the cost of managing quarantine areas and implementing a hygiene program for the area.	SB	High	2001 – ongoing
4.3e Source information on the use of fungicides for application in the management area.	SB	High	2001
Native Fauna			
4.4a Establish a local database to record bird sightings within the Reserve.	FOR	Low	2003 – ongoing
4.4b Locate walk trails and rest sites for bird watching.	FOR	Low	2003
4.4c Establish a local database to identify frog populations in the Reserve through a monitoring program.	FOR GeoCatch	Low	2003 – ongoing
4.4d Conduct a fauna trapping program during summer to establish a database of the fauna within the Reserve.	FOR	Low	2003 – ongoing
4.4e Establish vegetation corridors to allow safe fauna movement away from and into the Reserve.	FOR	Low	2003 – ongoing
4.4f Vehicle access in the Reserve be restricted to Shire employees or contracted workers, fire control and emergency vehicles.	SB	High	2001
Introduced Fauna			
4.5a Implement a rabbit and fox baiting program to reduce the number of feral animals in the Reserve.	SB AgWA	Medium	2002 – ongoing
4.5b Encourage the neighbouring properties to sterilise their domestic cats.	SB FOR	Medium	2002 – ongoing
LAND USE AND RESERVE **Surrounding Land Use and Management Implications**			
5.5a Provide information to surrounding properties requesting landholders to respect and value Big Rock Reserve by maintaining their required firebreaks and fence lines, controlling weed and pest infestations, and preventing their household pets from straying into the Reserve.	SB	High	2001 – ongoing

RECOMMENDATION	RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
5.5b Change the boundaries of Reserve 12 665, to include the area previously known as Reserve 12 494, and this land be subsequently included in the management of Big Rock Reserve.	SB DOLA	Medium	2002
Access			
5.6a A gate fitted with a lock and a sign stating 'NO UNAUTHORISED VEHICLES" be placed at the western firebreak entrance along Caves Road.	SB	High	2001
5.6b South eastern firebreak entrance along Yungurra Drive be fenced off and a sign stating 'NO ENTRY' be placed at this site.	SB	High	2001
5.6c Provide the Shire of Busselton, the Dunsborough Bushfires Board, the Busselton Volunteer Bushfires Brigade and the SES with a set of keys for the Telstra easement gate on Caves Road.	Telstra	High	2001
Fencing			
5.7a Construct signs informing the public of electric fencing along the southern boundary.	SB	Medium	2002
5.7b Inform the neighbouring landowners of their responsibility to remediate their fence line if damage has occurred on their lot as indicated in Figure 5.2.	SB Landowner	Medium	2002
5.7c Remediate the existing fence line where it is deteriorating within the Reserve boundary as illustrated in Figure 5.2	SB	Low	2001
5.7d Removal of the fence line historically separating the 'Big Rock' from the existing Reserve.	SB	Medium	2002
Future Management Implications			
5.8a Discourage further Telecommunication development on the Reserve unless it can be incorporated within the existing site.	SB	High	2001
RECREATION AND PUBLIC USE			
Existing Recreation Use and Their Impacts			
6.3a Prohibit the Walking of dogs in the Reserve	SB	High	2001
6.3b Monitor the impacts of horse riding in the Reserve over a two year tril period with this use to be reviewed after this period. Horse riders should be encouraged to stay on existing fire tracks in the interim period.	SB	High	2001-2002
6.3c A sign at the entrance of the Reserve be provided, informing the public that the following activities are not permitted in Big Rock Reserve: ❑ Walking of Dogs; ❑ Vehicle Use; and ❑ Camping.	SB	High	2001
Proposed Future Use and Amenities			
6.4a Assess the suitability of Big Rock Place in between Lot 207 and Lot 1042, for the establishment of a small, unsealed, carpark facility with a capacity of four vehicles.	SB	Medium	2002
6.4b Appropriate signage to be erected requesting visitors to take litter home with them for responsible disposal.	SB	Low	2004

RECOMMENDATION		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
6.4c	Construct designated walk trails for public pedestrian access within the Reserve after further investigation into the locations as indicated in Figure 6.1.	SB	Medium	2003
6.4d	Park benches to be provided at locations indicated in Figure 6.1.	SB	Medium	2003
6.4e	Boardwalks to be constructed of treated pine at locations indicated in Figure 6.1.	SB	Low	2004
FIRE MANAGEMENT **Fire and Vegetation**				
7.3a	Liaise with the owner of Lot 1 regarding the remediation of the existing firebreak so it can remain as the firebreak along the boundary for this Lot.	SB	Medium	2002
7.3b	Develop a detailed Fire Management Plan taking into considerable conservation values of the Reserve	SB FOR	High	2001
7.3c	Undertake a cool burn in the restricted area identified in Figure 5.2.	SB	High	2001
7.3d	Establish weeding programs after any cool fire burns to stop weed invasion in control burn areas.	FOR	Medium	2001 – ongoing
EDUCATION AND INFORMATION **On-Site Educational Facilities and Public Information**				
8.3a	Establish a main information Board with a locality map of the Reserve at the access point into the Reserve.	SB	High	2001
8.3b	Smaller information boards should also be established to inform the public of the scenic beauty and any significant flora and fauna species in parts of the Reserve.	SB	Medium	2002
Off-Site Educational Facilities and Public Information				
8.4a	Provide a general pamphlet on the Reserve, which is to be distributed to the nearby residents, the general community and visitors to the Reserve stating its purpose and significance with regard to historical, cultural and conservation values. It should also summarise the possible impacts they may have on Big Rock Reserve through their land uses, firebreaks, pets and recreational activities.	SB FOR	Medium	2003 – ongoing

RECOMMENDATION		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
Progress Reports And Displays				
8.5a	Submit a yearly progress report to the Shire of Busselton on the Reserve that should include requests for future projects that need to be conducted to ensure its management and conservation can continue.	FOR	Medium	2003 – ongoing
8.5b	Distribute information leaflets summarising the progress report to the various government bodies and interest groups who are partly involved in the Reserve's management. It should also be available in the main information board at the Reserve to inform and update visitors on the progress of the Reserve.	FOR	Low	2004 – ongoing
8.5c	Ensure there are regular ranger patrols of the Reserve and encourage a neighbourhood watch program with the local residents.	SB FOR	Medium	2004 – ongoing
GENERAL MANAGEMENT CONSIDERATIONS				
Managing Authority				
9.2a	Establish a Friends Group for the Reserve to assist the Shire of Busselton and Friends of Reserve Groups with the management of Big Rock Reserve.	SB	High	2001
9.2b	The Friends Group should liaise with the relevant government organisations and community groups to aid in the management of the Reserve.	FOR	High	2001 – ongoing
9.2c	The Friends Group should liaise with and encourage participation of the neighbouring residents of Big Rock Reserve to address conservation issues such as weed control, flora rehabilitation and fauna monitoring.	FOR	High	2001 – ongoing
9.2d	The Friends Group should carry out the conservation issues where possible as outlined in the Figure 9.2 and any new issues that arise to ensure the continual management of the Reserve.	FOR	High	2001 – ongoing
9.2e	The Management Plan should be reviewed every 5 years to ensure the conservation of the Reserve is maintained.	SB	High	2006

1. INTRODUCTION

1.1 BACKGROUND

With the majority of native bushland in the south west cleared for agriculture over the past century, conserving and protecting the remaining areas of remnant vegetation has become increasingly important. Big Rock Reserve consists of a jarrah / marri vegetation complex and is regarded to have a very high conservation value with respect to the flora, fauna and the landscape, (Keating and Trudgen, 1985). The Reserve is vested in the Shire of Busselton and is comprised of Reserve C28665 and what was formerly known as Lot 8.

1.2 STUDY AREA

Big Rock Reserve is located on the Leeuwin-Naturaliste Ridge in the south-west of Western Australia, approximately 280 km south of Perth. It is situated approximately 2 km west of the Dunsborough town site on Caves Road (Figure 1.1). The Reserve is approximately 78 hectares in area, figure 1.2 shows the surrounding properties and figure 1.3 is an aerial photograph of the Reserve, indicating the vegetation and topography of the area.

The Reserve is classified as a "C" Class Reserve under the Land Act 1933 and is vested for the purpose of "Preservation of Caves and Conservation of Flora". In the past, small sections of the Reserve has been used for gravel extraction. Lot 5073, located in gravel pit one (see figure 1.2) is separated from the reserve for a Telstra mobile phone tower and access is restricted to the public. Visitors and nearby residents undertake a variety of recreation activities including visiting the rock; bush walking; bird watching; horse riding; motor cycling; and four-wheel driving.

1.3 SIGNIFICANCE OF THE RESERVE

Big Rock Reserve is surrounded by private properties that have been zoned for general farming, special rural, tourism and recreation. It is one of the few large reserves in the area that is not located on the coast and thus containing different vegetation communities in comparison to reserves such as the Meelup Regional Park and the Leeuwin-Naturaliste National Park. The Reserve is in generally good condition despite some small areas being disturbed due to historical gravel extraction activities. The Reserve has been given the recognition as a regionally important Environmental Protection Authority System 1 Conservation System and is listed as a Heritage Place in the Shire of Busselton Municipal Inventory of Heritage Places. The Reserve is also understood to have cultural significance to the local Bibulmen Mia Aboriginal Community. These combined values emphasise importance of protecting and conserving this area.

Big Rock Reserve at present is classed as a "C" Class Reserve under the Land Act 1933 and is in the process of being reclassified as an "A" Class Reserve. The class level of a Reserve is an indication of the level of protection afforded to the Reserve and the level of approval required to change the purpose of vesting of that Reserve. Reclassifying the Reserve from Class C to Class A indicates the Reserve has cultural, regional and ecological significance and will require greater protection. In order to reclassify the Reserve to Class A an approval from both the Legislative Council and the Legislative Assembly is required.

The purpose of the Reserve at present is "Preservation of Caves and Conservation of Flora". There is the intention in the near future to change the purpose of the Reserve to "Landscape and Fauna Protection", while still ensuring the Reserve is vested in the Shire of Busselton.

1.4 AIM AND OBJECTIVES OF MANAGEMENT PLAN

To conserve, protect and enhance the ecological system, natural and cultural characteristics through the management and protection of areas of conservation value, cultural and historical significance, scenic beauty and scientific interest.

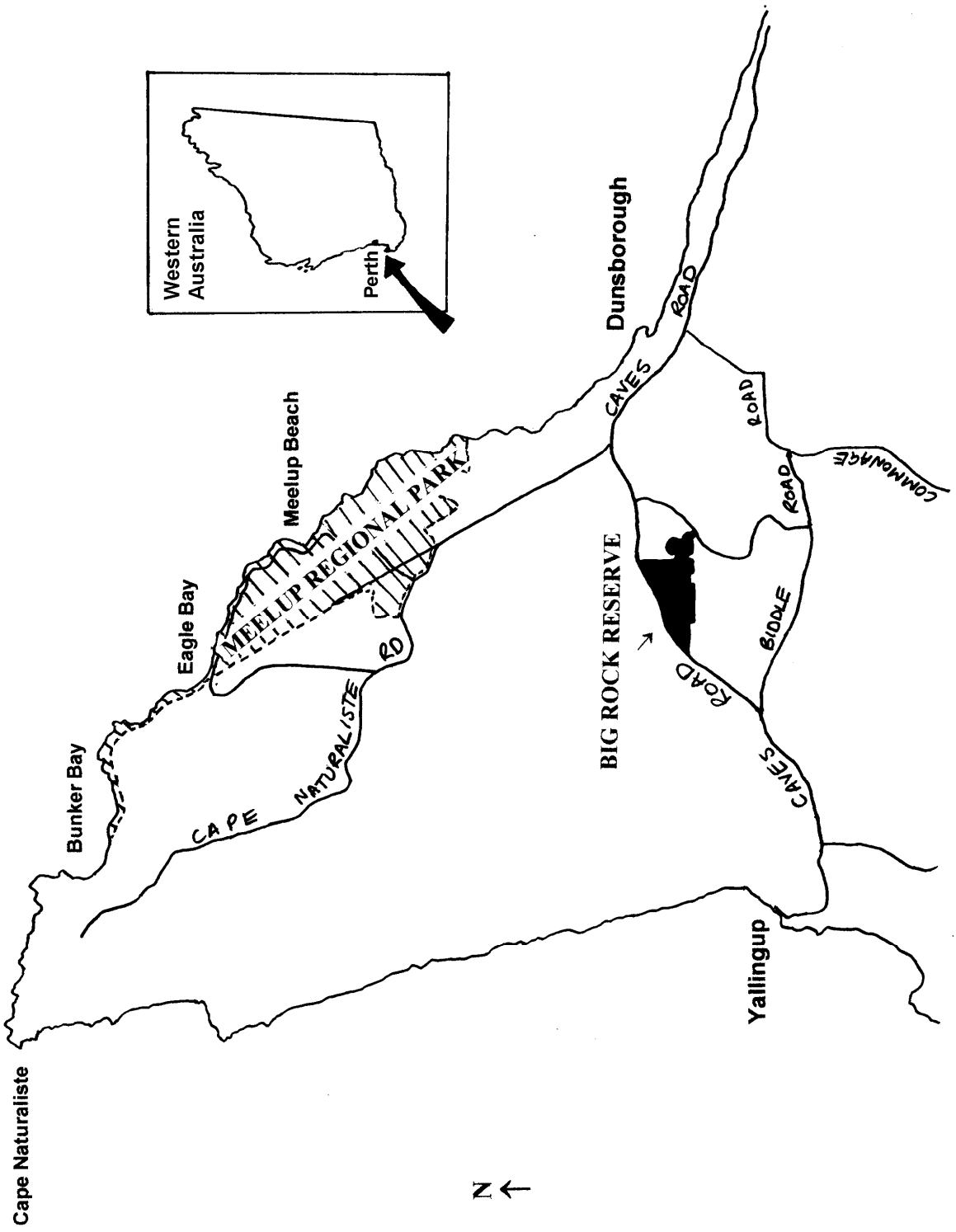

Figure 1.1 Location Big Rock Reserve

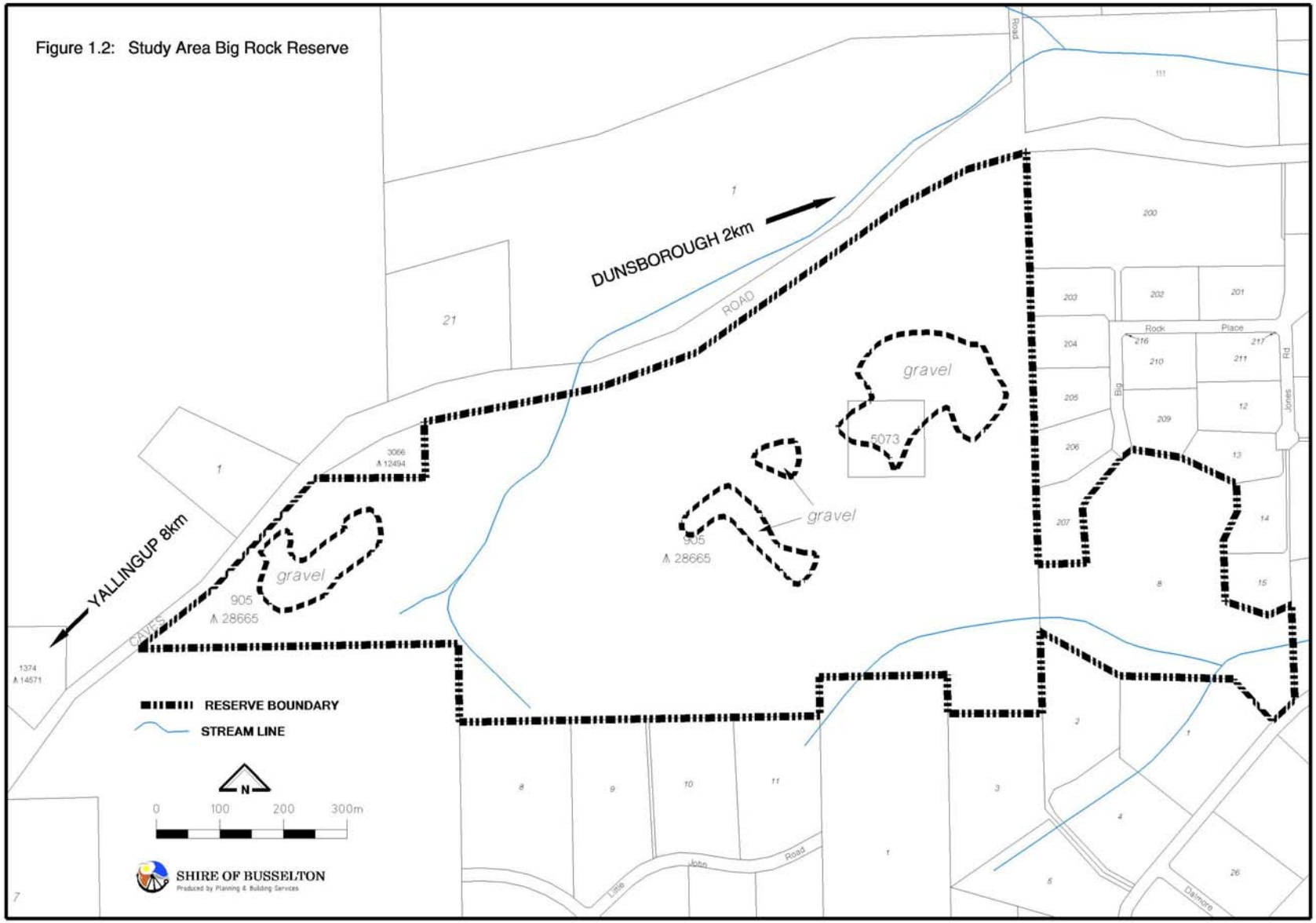

Figure 1.2: Study Area Big Rock Reserve

(insert Figure 1.3)

2. HISTORICAL PERSPECTIVE

2.1 OBJECTIVE

To identify and preserve Aboriginal and non-Aboriginal heritage within the Reserve for the benefit of present and future generations.

2.2 ABORIGINAL HISTORY AND SIGNIFICANCE

Prior to European settlement, the Aborigines of the South West Region formed a distinctive socio-cultural group of tribes, collectively known as Nyungar (Connor *et al*., 1995). Big Rock Reserve lies in an area inhabited by the Wardandi, meaning 'People that live by the sea and follow the forest paths", a tribe associated with much of the coastal land of this region. The Wardandi seasonally migrated, as did most indigenous tribes, between the coastal plain and its hinterland to exploit the various food and water resources. It is likely that the area including the Reserve was utilised by these people because of the abundance of such resources, the strategic position that Big Rock offers, and its proximity to known Wardandi camps and water sources.

2.2.1 SIGNIFICANCE OF BIG ROCK RESERVE

Although there are no registered significant sites within the Reserve, the area is understood to have cultural significance to the local Bibelmen Mia Aboriginal Corporation and it is believed that the Big Rock was used as a lookout and meeting place. The view offered from the summit of the granite outcrop would have given the Wardandi warning of bushfires and moving tribes (Plate 2.1). There is apparently evidence of campfires, perhaps of Wardandi origin, on Big Rock and also grooves in the granite where spear heads have been sharpened (Webb, pers. comm., 1998; Danischewski, pers. comm., 1998). A range of mammals, reptiles, and bird species that were hunted and trapped by these people are known to have existed in abundance in the area of the Reserve. A 'spring camp' used by the Wardandi was located approximately 3km from Big Rock where the Dunsborough Lakes subdivision is now located.

Management of the Reserve should respect and acknowledge indigenous beliefs associated with Big Rock and ensure activities at the site are not in conflict with these beliefs. During consultation, the Webb family spoke of spiritual entities of their culture which have been identified as having attachments to the area.

Webbs - All were concerned when informed that children have been seen playing on the rock. They spoke of the presence of a 'Wudaiche', a spiritual figure in the shape of a small man who protects or guards his place. These 'Wudaiche' are protectors of the Bulyar men, the Doctor men, the old people. These spirits are spoken of as protectors but the Webbs believe they can react in a hostile manner. They mentioned occurrences such as 'Wudaiche' following people home and inhabiting and wrecking their houses, and believe that children playing on the rock are in danger.

Mr Mike Hill of the Gnuraren Aboriginal Corporation, who also represent the Aboriginal people of the area, felt that it was unlikely that previous inhabitants of the land would object to people walking on the rock and the surrounding land (Hill, pers. comm., 1998). He stated that the Corporation would have no objections to passive

recreational use of Big Rock providing that visitors were encouraged to respect the heritage values attached to it.

Plate 2.1 Field of view offered from summit of Big Rock

RECOMMENDATION	RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
2.2a Approach the Bibulmen Mia Corporation and the Gnuranen Aboriginal Corporation to be actively involved in the management of Big Rock Reserve.	SB FOR	Medium	2002

2.3 NON-ABORIGINAL HISTORY AND SIGNIFICANCE

The first European colonists to inhabit this region of the south west of Australia were a group of settlers lead by the Bussell family. They established the first settlement in the early 1830s in the Vasse area (Shann, 1926). It is unlikely that the Big Rock Reserve area became involved in colonisation until the establishment of Caves Road and the Group Settlement Scheme launched by the Western Australian Government in 1921 (Blond, 1987). This involved the movement of settlers through the area and the establishment of further settlements from which several towns of the region have developed.

Big Rock has been used by local fishermen as a 'lookout' point, but otherwise does not appear to have significance as part of the region's European history and culture. Rather its importance lies in its role as an intact representation of native forest which is endemic to the area. It is for this reason that Big Rock Reserve is listed as a Heritage Place in the Shire of Busselton Draft Municipal Inventory of Heritage Places.

RECOMMENDATIONS	RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
2.3a Approach the Busselton Historical Society to conduct a search of their records for possible involvement of the Big Rock Reserve area in the development of the region since colonisation.	FOR	Low	2003
2.3b Approach the Busselton Historical Society to	FOR	Low	2003

conduct a search of their records for possible involvement of the Big Rock Reserve area in the development of the region since colonisation.	

2.4 PAST MANAGEMENT AND USE

There are no previous Management Plans existing for Big Rock Reserve and past management has been limited to basic maintenance of firebreaks and fences by the Shire of Busselton. Lot 8, recently acquired as part of the Reserve, was previously private land and has not been substantially disturbed.

2.4.1 QUARRY PITS

Reserve 28665 was previously used as a site for gravel extraction by the Shire of Busselton and four separate 'pits' can still be identified. Gravel extraction has ceased and the pits have been left to revegetate naturally.

2.4.2 TELSTRA TELECOMMUNICATIONS FACILITY

In September 1995, Telstra notified the Shire of Busselton of its intention to construct a radio base station in Reserve 28665 In accordance with their National Code of Practice, Section 116 of the Telecommunications Act 1991, and the Telecommunications (Exempt Activities) Regulations. After subsequent consultation with the Shire of Busselton and assessment of alternative sites outside and within the Reserve, an 80 m guyed mast and station housing was constructed in the first gravel pit (Figure 1.2). The site is now on a separate title identified as Location 5073.

3. PHYSICAL ENVIRONMENT

3.1 OBJECTIVE

To preserve the physical features of Big Rock Reserve and manage potential and existing physical impacts on the reserve.

3.2 SOILS AND GEOLOGY

The soils that characterise the Reserve are illustrated in Figure 3.1. Approximately 40% of the Reserve is Cowaramup Ironstone flats and is surrounded by Metricup Rocky Valleys. The different soil types follow the changes in topography and have consequently resulted in different vegetation communities. The Cowaramup Ironstone Flats represent the gravel pits and the Cowaramup Rocky Gentile slopes represent the Big Rock itself. Consequently the flora study has been designed to represent these different soil types, as illustrated in Figure 4.1. The soil types in Figure 3.1 are classified as follows:

C: Cowaramup Flats: Flats (0 -2 % gradient) with gravely duplex (forest grove) and pale grey mottled (mungite) soils.
Cd2: Cowaramup Deep Sandy Rises: Flats and gently sloping rises (gradients 0 - 5 %) with deep bleached sands. Some areas of low and moderate slopes (gradients 5 - 15%).
Ci: Cowaramup Ironstone Flats: Flats and gentile slopes (0 - 5 % gradients) with some laterite outcrops and shallower gravely sands over laterite.
Cr2: Cowaramup Rocky Gentile slopes: flats and gentile slopes (0 - 5% gradients) with shallow rocky soils and some granite outcrops.
Mvr: Metricup Rocky Valleys: Deeply incised valleys with steep sideslopes and valley floors with relatively steep gradients. Shallow gravely soils and occasional lateritic and granitic outcrops.
(Tille and Lantzke, 1990).

The Reserve is located on the Leeuwin Naturaliste Ridge as illustrated in Figure 3.2, and at the junction of the Cowaramup Uplands and Metricup Scarp. The Cowaramup Uplands extend from Cape Naturaliste southwards to Augusta. It has formed on the lateritized granitic basement of the Leeuwin Block (Tille and Lantzke, 1990).
Figure 3.3 shows the Cowaramup Upland Land System with the Reserve being located on the Cr2, Cd2 and C land units. The remaining part of the Reserve is the Metricup Scarp Land System represented in Figure 3.4 where the Reserve is part of the Mvr land unit (Tille and Lantzke, 1990).

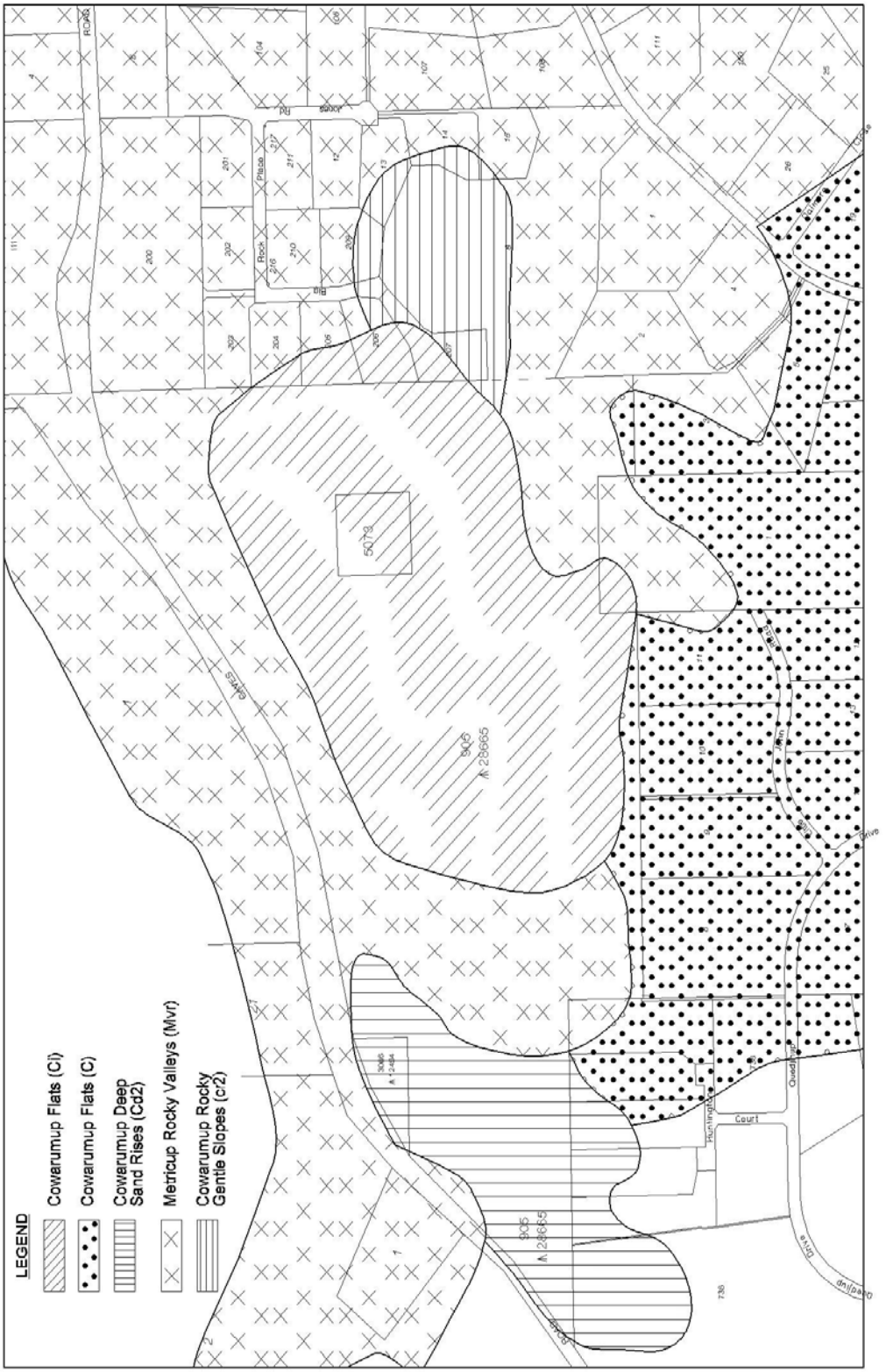

Figure 3.1 Soils of Big Rock Reserve (Source Tille and Lantzke, 1988)

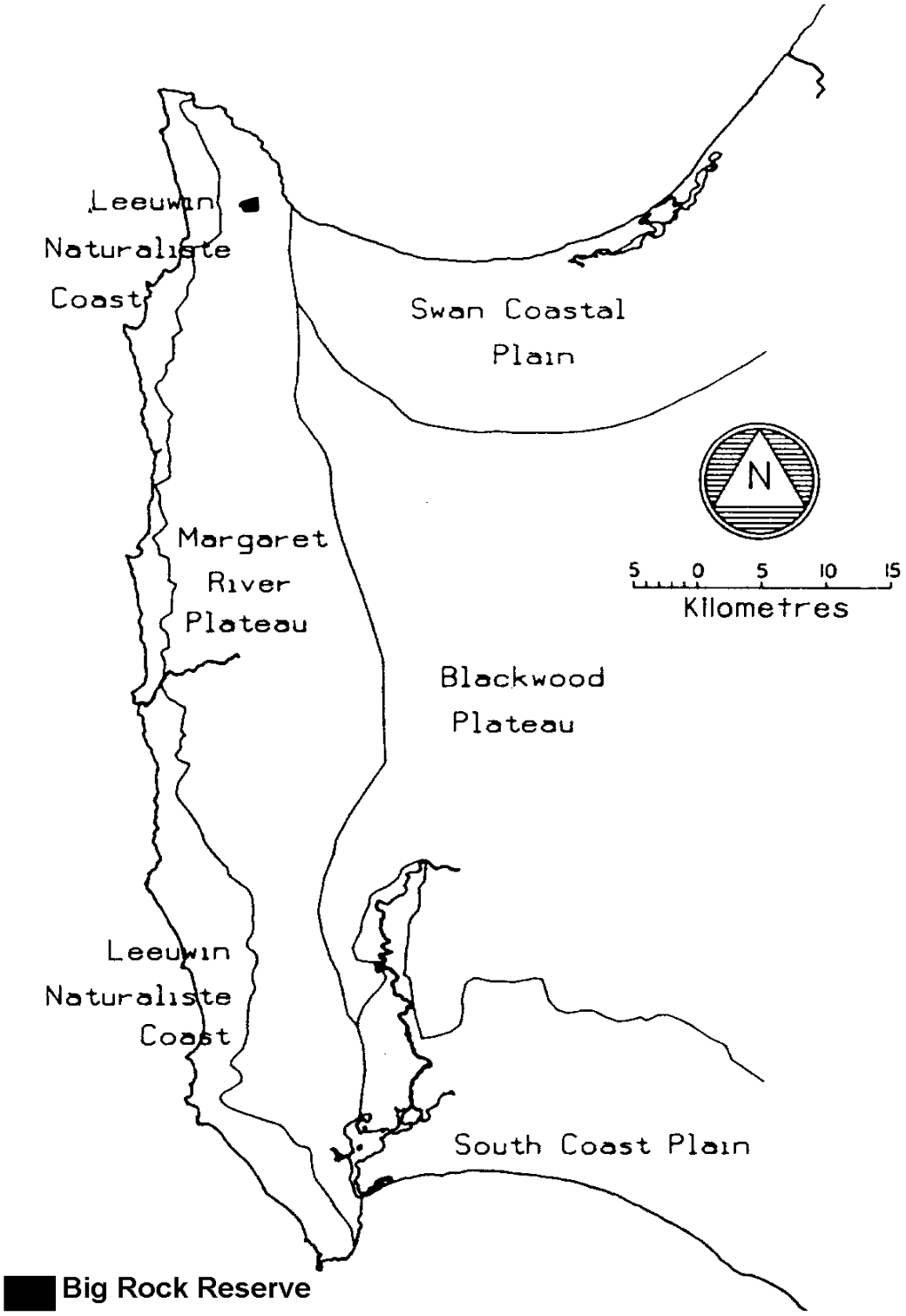

Figure 3.2 Physio-graphic Regions of the Leeuwin Naturaliste Area (Tille & Lontzke, 1990)

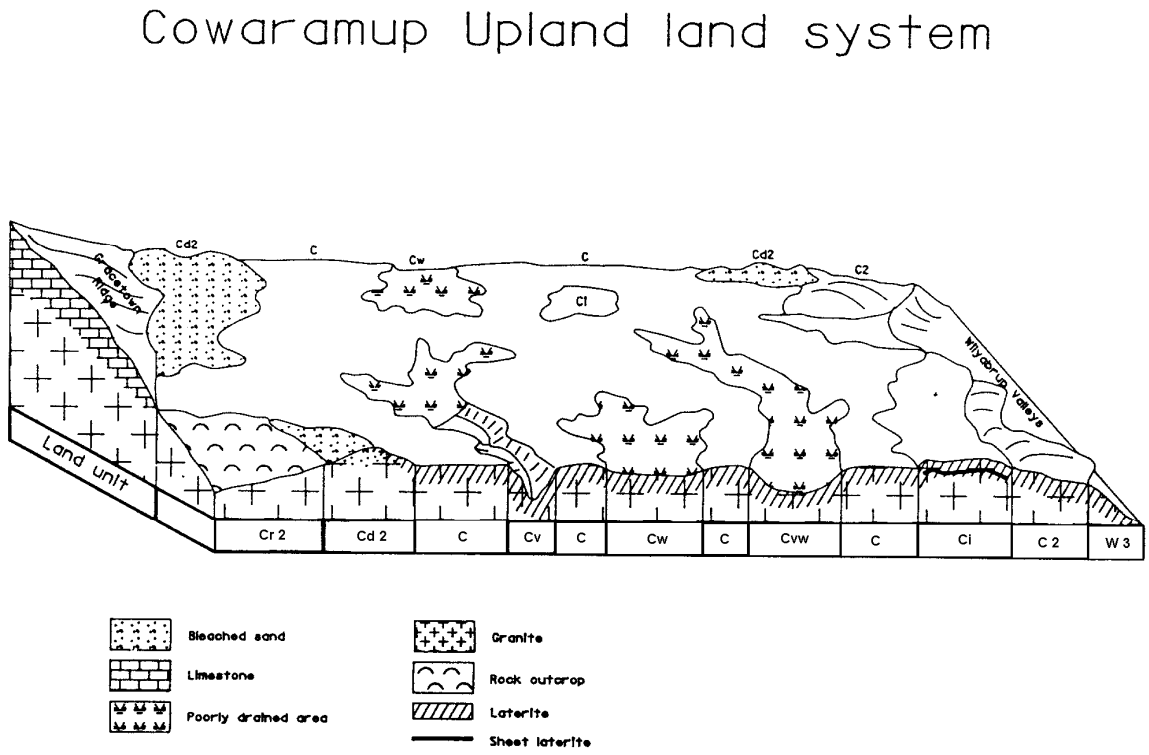

Figure 3.3 Block Diagram of the cowaramup system (Tille & Lantzke, 1990)

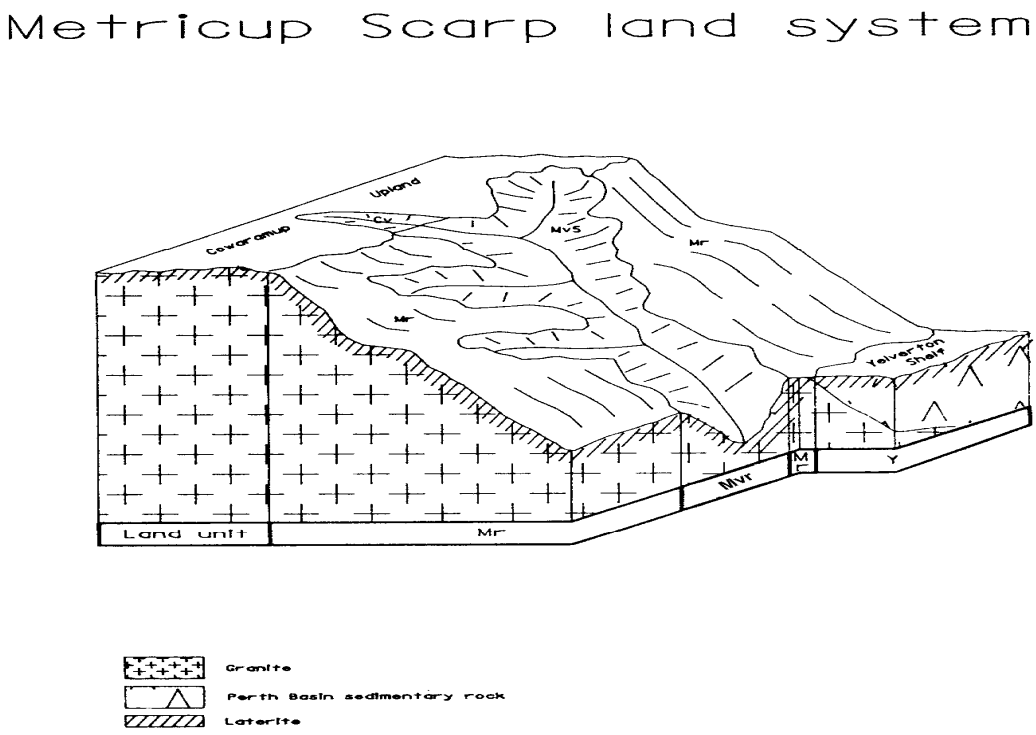

Figure 3.4 Block diagram of the Metricup scarp land system (Tille & Lantke, 1990)

3.3 TOPOGRAPHY AND EROSION

Being located on the Leeuwin Naturaliste Ridge, the Reserve represents a rich diversity of remnant vegetation associated with ironstone flats, rocky valleys and sandy rises. The topography of the landscape is illustrated in Figure 3.5. Steep slopes are located in several areas within the Reserve especially along Caves Road and in the south east of the Reserve. Flat areas are mainly concentrated in the centre of the Reserve associated with the previous uses for gravel pits.

The steep relief in conjunction with the high rainfall has been responsible for the degradation of some walk trails and firebreaks within the Reserve. Areas of extreme erosion risk have been identified within the Reserve. These areas are located along firebreaks which were previously constructed down steep slopes and where water runoff from Caves Road has contributed to water erosion.

There are several areas within the Reserve which have been degraded by water erosion and consequently represent a safety hazard to the public. Heavy rainfall periods and the topography are responsible for the erosion hazards illustrated in Figure 3.6. The construction of boundary firebreaks and walk trails down steep slopes have accelerated erosion processes to the extent where it is recommended they be fenced off and rehabilitated. The new walk trails for the Reserve will be located in areas where water erosion is at a minimum and in a zigzag format down slopes. This will minimise water runoff and erosion processes down the slopes.

Specifically the areas to be rehabilitated include the four gravel pits, the Telstra easement which connects the three gravel pits, the old boundary line of Lot 207 where the fencing is to be removed, and the degraded firebreak around the pool within the Reserve.

The restriction of certain recreational activities including four wheel driving will aid in accelerating the success of these rehabilitation programs. Extensive planting programmes with the riparian vegetation will also increase the success and at the same time, promote the diversity of the flora for rehabilitation programs and for all bushland reserves in the area.

Spoon drains have also been proposed as they redirect the flowing water off the firebreaks and walk trails. These will be located in parts of the Reserve which are subject to seasonal flooding, near the two streams, or affected by water erosion. However the exact positioning of the drains requires further field assessment of the landscape after the new walk trails have been constructed within the Reserve.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
3.3a	Any future construction of walk trails and firebreaks should avoid areas of steep slopes to minimise erosion within the Reserve.	SB	High	2001 – ongoing
3.3b	Establish rehabilitation programs for the areas illustrated in Figure 9.2 that have been degraded by erosion processes.	SB FOR	High	2001 – ongoing
3.3c	As apart of formalising the walk trails, investigate the need for drainage management along these trails.	SB	Medium	2002

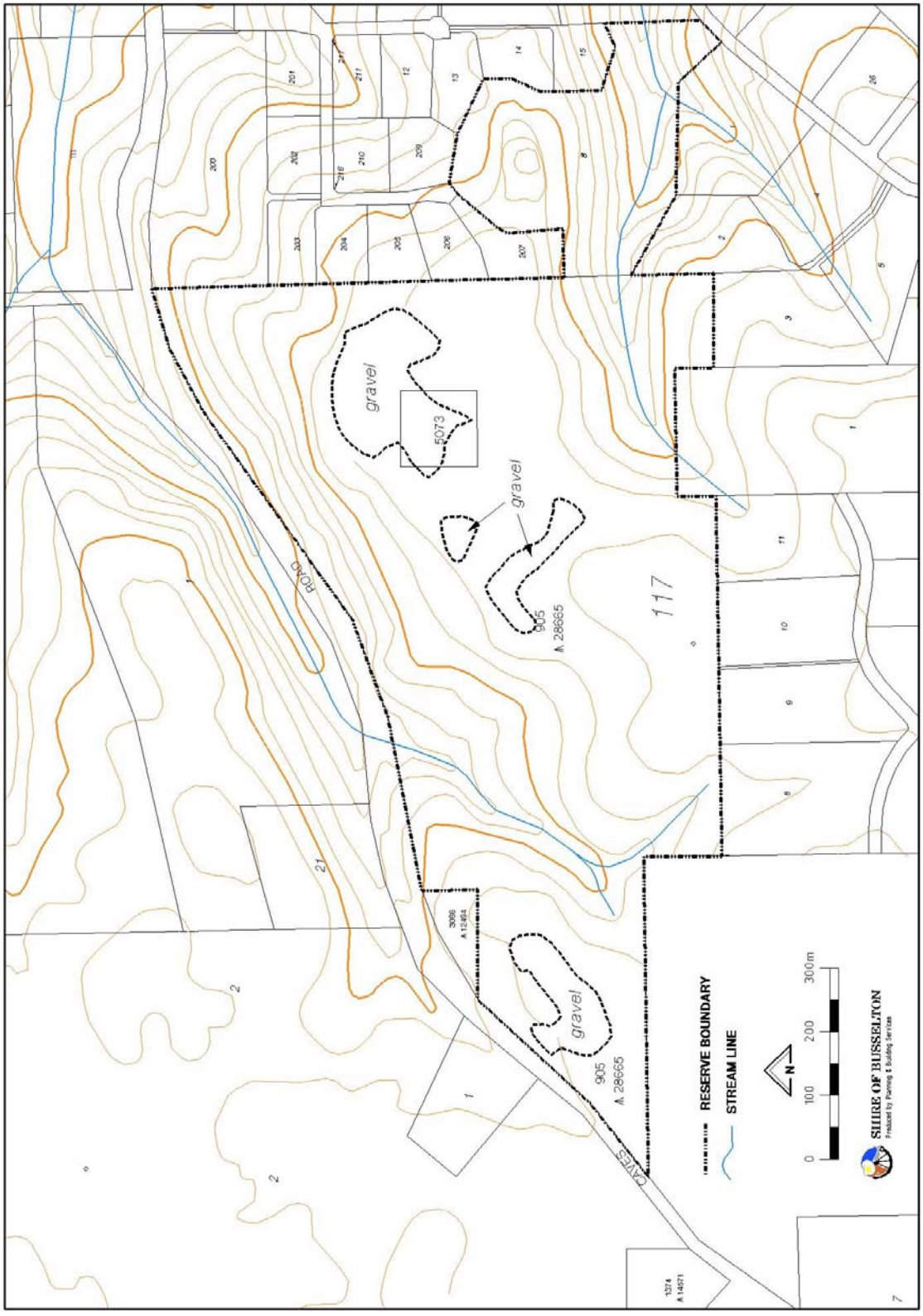

Figure 3.5 Topography and Hydrology of Big Rock Reserve

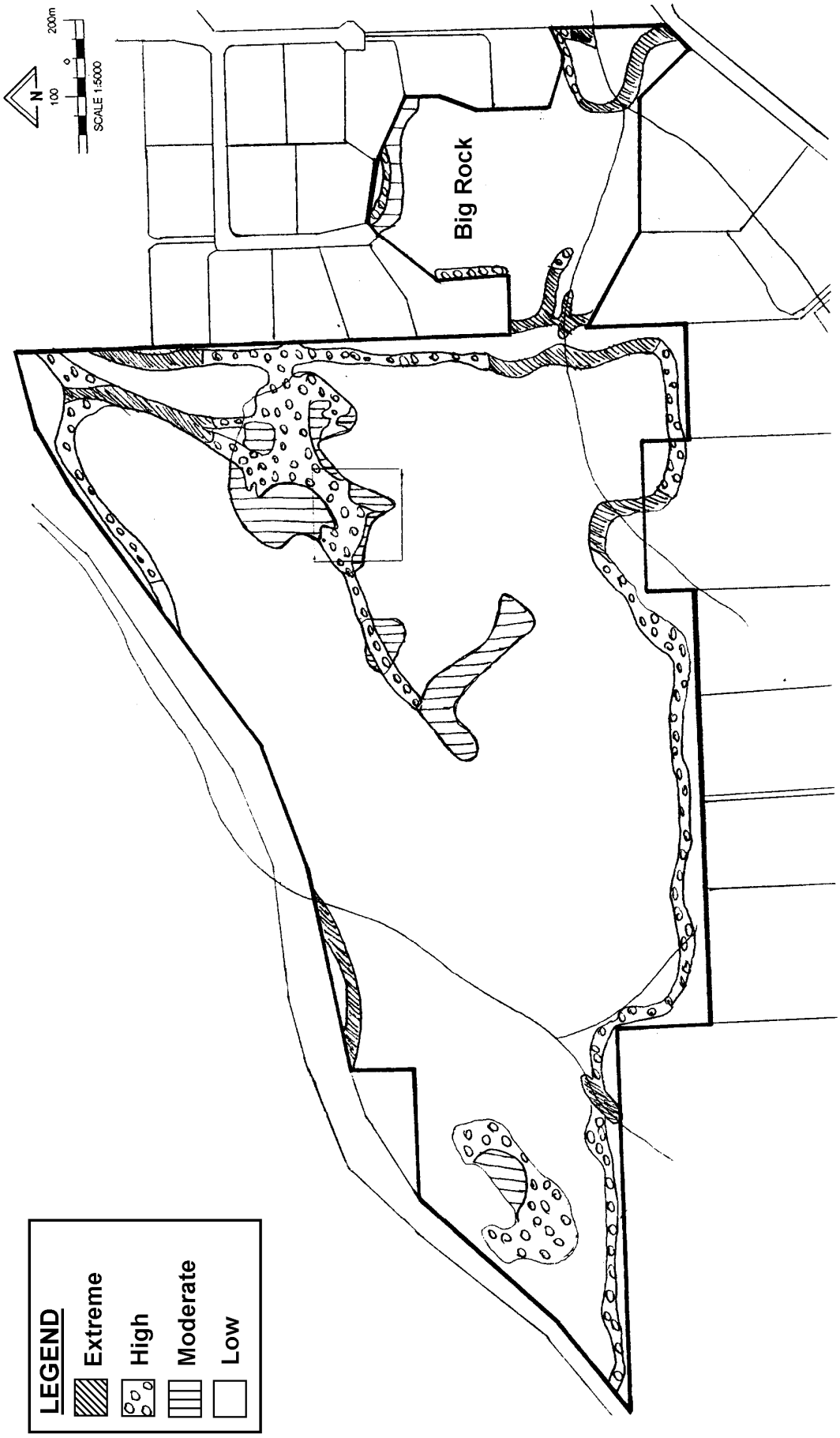

Figure 3.6 Erosion Risks of Big Rock Reserve

3.4 HYDROLOGY

There are two main streams, which flow through the Reserve. These are associated with the steep slopes on the northern and southern parts of the Reserve. Figure 3.5 shows their location and their extent. There is also a pool located along the stream in the southern part of the Reserve. There is no fringing vegetation associated with this pool and it is thought the stream was once dammed to retain the water for aquaculture purposes.

Water quality data from sampling of the pool are presented in Appendix 3.2. Data were within criteria for phosphorous and nitrogen, however, more comprehensive data may be required as these sites were only sampled once during October.

4. THE BIOLOGICAL ENVIRONMENT

4.1 NATIVE FLORA

4.1.1 OBJECTIVE

To conserve and protect the native flora and vegetation communities in the Reserve.

4.1.2 VEGETATION COMMUNITIES

Big Rock Reserve (and the adjacent reserve 12494) supports a large undisturbed stand of Jarrah and Marri in the area (Keating and Trudgen, 1985). The variability of the soil types, rock outcrops and slope of the land within the Reserve allows many different expressions of the vegetation.

A variety of vegetation communities are associated with the stream; granite outcrop; regenerating gravel pits; Jarrah, Marri and *Banksia* woodlands; and sandy soil vegetation associations. Flora species identified via surveys undertaken in July and September 1998 are found in Appendix 4.1. Plate 4.1 shows a collection of the orchids that were found during October 1998 within the Reserve.

The flora survey undertaken by Keating and Trudgen in 1985 identified two species of particular interest on the Reserve. These species were *Calothamnus graniticus var graniticus* (Plate 4.2) and *Dasypogon hookeri* (Plate 4.3). *Calothamnus graniticus var graniticus* is the dominant heath shrub species. *Dasypogan hookeri* (pineapple bush) is a geographically restricted species (Keating and Trudgen, 1985). The presence of these two species and the particular under-storey composition set the Reserve apart from the Jarrah and Marri woodlands of the Meelup Reserve System.

To further understand the diversity of the ecosystems in Big Rock Reserve, opportunities for scientific research should be encouraged. This could be achieved through the promotion of surveys and research projects within institutions such as universities or government research agencies.

Some disturbance of the vegetation communities has occurred on the Reserve, the most notable being the disused gravel extraction sites. Rehabilitation of these areas is recommended to improve the resilience of the vegetation communities and to provide continuity to the bushland theme of the Reserve. Revegetation of disturbed areas will also assist in minimising the impacts and spread of exotic species and erosion. Revegetation of very disturbed areas is likely to require planting, where as, direct seeding may be appropriate in marginally disturbed areas to encourage natural regeneration.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
4.1a	Promote opportunities for scientific research within the Reserve.	SB FOR	Medium	2003 – ongoing
4.1b	Undertake active revegetation of highly disturbed areas of the Reserve including the four disused gravel extraction sites.	SB FOR	High	2001 – 2002

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
4.1c	Encourage nature regeneration in marginally disturbed areas of the Reserve by utilising direct seeding techniques.	MC	Medium	2003 – ongoing

Caladenia flava (Cowslip orchid)

Elythranthera brunomus
(Purple Enamel orchid)

Caladenia spp

Diuris longifolia
(Common Donkey orchid)

Caladenia chapmanii
(Chapman's Spider orchid)

Caladenia attingens
(Forest Mantis orchid)

Plate 4.1: A collection of orchids which were found during October 1998 within Big Rock Reserve.

Plate 4.2: *Calothamnus graniticus* occurring throughout the Reseve (Photo: Mary Huges)

Plate 4.3: *Dasypogon hookeri* dominated Jarrah and Marri Woodland on sandy soil of the Reserve

4.2 EXOTIC PLANTS

4.2.1 OBJECTIVE

To develop long-term control and eradication programmes for the exotic species in and around the Reserve.

4.2.2 CURRENT WEED PROBLEMS

Weeds can cause major problems within native bush areas by out-competing local species. They can also represent a significant fire hazard and increase the habitat available for feral animals.

Big Rock Reserve is a relatively small piece of land that is surrounded by roads and private property. This kind of fragmentation increases the risk of infestation of the bushland with weeds. As would be expected the worst weed affected areas are those around the edge of the Reserve and along water courses. The diversity of invasive weed species is low and the extent of the current problem is manageable. Figure 4.1 illustrates the distribution of the weed species in and around the Reserve.

Weed species found within or adjacent to Big Rock Reserve are:

❑ *Zantedeschia aethiopica* (Arum lily)	Found on private property along Big Rock Place (Lots 203 -207) and spreading into the Reserve from there (Plate 4.5); also found on the southern and western side of the Reserve, in gravel pit 4, and along the streams (Plate 4.4).
❑ *Myrsiphyllum asparagoides* (Bridal Creeper)	A few individual plants found on adjacent Lot 206 (Plate 4.5).
❑ *Solanum hermannii* (Apple of Sodom)	Individual plants found directly north of Big Rock itself on adjacent Lots 206 and 14 (Plate 4.6).
❑ *Eragrostis curvula* (Weeping love grass, African love grass)	Found on the far western corner of the Reserve
❑ *Hypochaeris glabra* (Flatweed)	Found throughout the Reserve to different densities where the soil has been disturbed in the past, especially along the firebreaks.
❑ *Watsonia bulbillifera* (Watsonia)	Found in extensive stands in man made winter wet depressions of gravel pit four towards the west of the Reserve.

Other weed species that could occur in the Reserve are:

Arctotheca calendula (Cape Weed)
Echium plantagineum (Paterson's Curse)
Euphorbia terracina (Geraldton Carnation Weed)
Homeria miniata (Two leaf Cape Tulip)

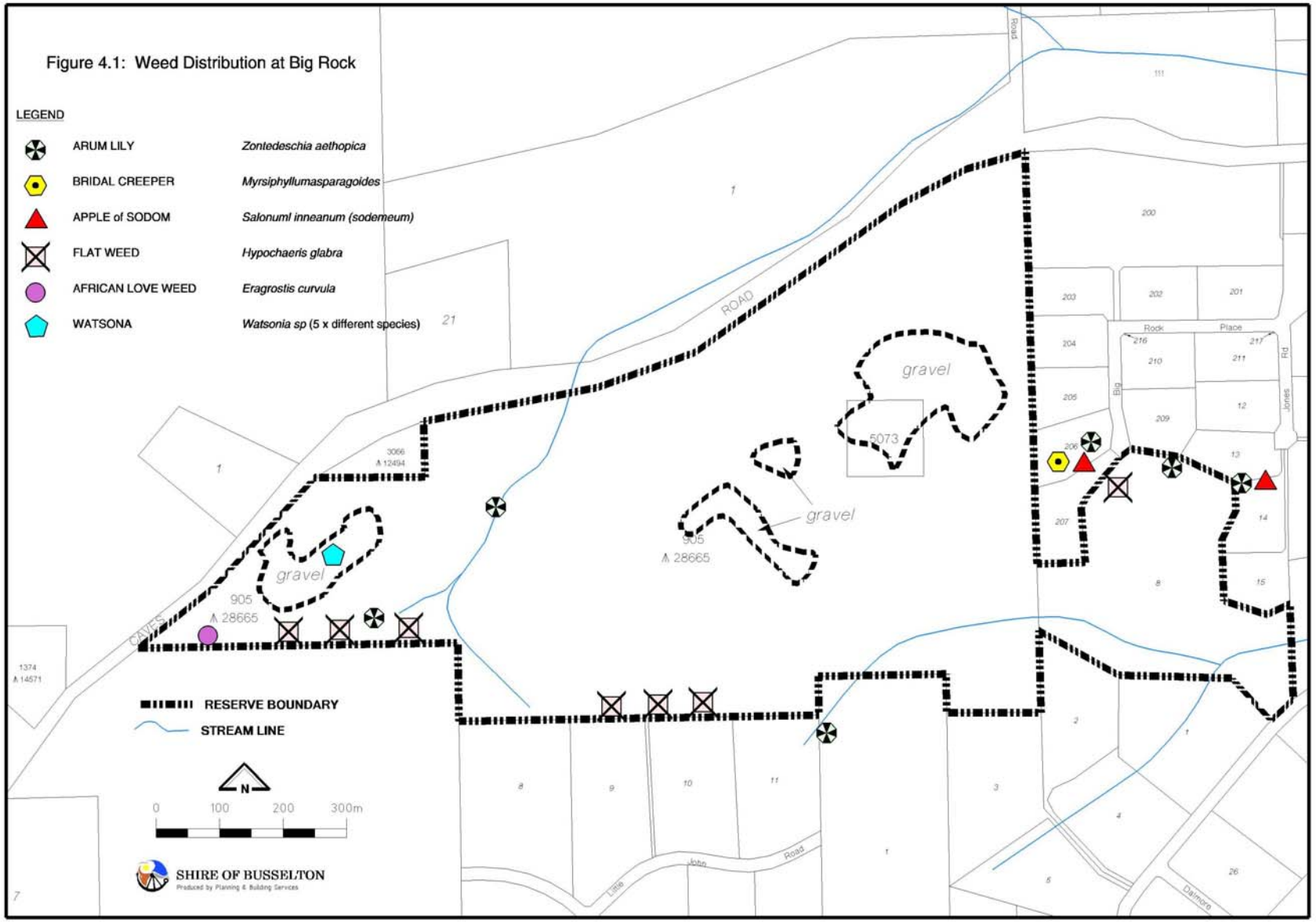
Figure 4.1: Weed Distribution at Big Rock
LEGEND
ARUM LILY
Zontedeschia aethopica
BRIDAL CREEPER
Myrsiphyllumasparagoides
APPLE of SODOM
Salonuml inneanum (sodemeum)
FLAT WEED
Hypochaeris glabra
AFRICAN LOVE WEED
Eragrostis curvula
WATSONA
Watsonia sp (5 x different species)
ROAD
gravel
5073
gravel
905
28665
gravel
905
28665
RESERVE BOUNDARY
STREAM LINE
N
0
100
200
300m
SHIRE OF BUSSELTON
Produced by Planning & Building Services
Rock
Place
Big
Jones
Rd
Little
John
Road
Dalmore

Gomphocarpus fruiticosus (Narrow leaf cotton bush)
Ehrharta longiflora (Annual Veldt Grass)
Ehrharta calycina (Perenial Veldt Grass)
Poa annua (Annual Winter Grass)
Briza maxima (Blowfly Grass)
Stenotaphrum securdatum (Buffalo Grass)
Cynodon dactylon (Couch Grass)
Pennisetum clandestinum (Kikuyu)
Oxalis-pes-caprae (Soursob)
Avena fatua (Wild Oats)

The most problematic weed species on the Reserve is Arum lily. Control measures for this species include herbicide wipe and spot spraying. Continuously cutting and removing vegetative matter from the plants will also eventually kill Arum lily, yet considerable follow up treatment is required. Neither of the two chemical options are recommended for use near stream systems as herbicides can be transported in aquatic environments and impact on non-target species. Many herbicides spread rapidly in running water and through stream and river systems (Scheltema and Harris 1995). The existing infestation is not too large to be successfully addressed by hand-weeding, however spot spraying is recommended for the large stands on private property which are going to cause progressively worse problems if left unaddressed. Spot spraying from June to October is recommended prior to set of seed.

The distribution of Watsonia species in the Reserve is limited to gravel pit 4, however a large infestation has formed. Watsonia is highly invasive especially in disturbed areas.

Weeding programmes should be undertaken several times per year during winter and spring to reduce vegetative growth and the spread of seeds from their flowers. This will allow the undergrowth to regenerate with reduced competition from the exotics. Planting programmes should be established when the weed populations have decreased. This will allow the diversity of the local flora to increase where exotics have dominated and will also decrease soil erosion after the removal of a number of plants.

With private property so close to Big Rock Reserve, the likelihood of weed species escaping from private gardens is very high. The once disturbed land on lot 207 is a prime example of weeds gaining a foothold and advancing on healthy vegetation. To reduce the risk of further weed problems, local residents should be encouraged to plant local native species in their gardens, and control declared flora that may pose a threat to the nearby bushland.

Along with the weed control programme, a weed monitoring programme should be established for the Reserve, especially along areas of access for the public, i.e. walk trails. Monitoring where the weeds are located will help to concentrate the weed control programmes in the areas which most need attention; allow assessment of the success of the control program; and address new problem areas.

Limiting recreation activities especially the riding of horses and the use of motor bikes will ensure a decrease in the distribution and germination of seeds along the firebreaks. Seeds from exotic species are often carried on the tyres of bikes or germinate in the manure from horses.

Control of Watsonia species will be difficult by hand weeding with a large infestation in the Reserve. Gravel pit 4 has a number of small streams and pools of water, so

chemical control may also be problematic. Spot spraying may be safer and more effective although further investigation is still recommended to establish the location and presence of water bodies in the Reserve.

Apple of Sodom is a woody perennial that grows in dense thickets and provides a habitat for rabbits. New plants rapidly establish on cleared and disturbed land, and therefore should be addressed as soon as possible to reduce the risk of further infestation (Agriculture Protection Board of WA). It is recommended that these plants are removed by hand as soon as possible.

Bridal Creeper is a major weed species that smothers other plants and can take over an area very quickly. The seed is also dispersed by birds (Scheltema and Harris, 1995). It is recommended that all of these plants be removed by hand as soon as possible.

African Love Grass is currently a relatively small risk, however, this annual species presents a serious fire hazard when the plants die and leave dry matter during the summer months. Control measures should therefore be carried out before the dry weather begins. Possible control measures include hand weeding, herbicide wipe, or spot spraying. Considering the limited range of the species it is recommended that it be controlled through hand weeding.

Flatweed is a very common weed that competes with native herbs. It does particularly well on disturbed sites. Considering the wide distribution and low density of the species throughout the Reserve, a herbicide wipe could be used for its control.

Control of all weed species should occur before the plants set seed. Weeding and herbicide application should occur as soon as possible with follow up weeding and spraying within two months to reduce regrowth, and increase the effectiveness of the efforts. By starting weed control in relatively undisturbed areas first and progressively working towards areas of high weed infestation, efficient control may be effected.

	RECOMMENDATIONS	RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
4.2a	In areas where weeds have dominated the under-storey, a rehabilitation program is recommended to allow the local flora to regenerate.	FOR	Medium	2002 – ongoing
4.2b	Encourage private landowners to undertake weed control and plant local native species in their gardens.	SB FOR Landowner	Medium	2003 – ongoing
4.2c	Monitor the invasion of weeds around the walk trails and the firebreaks to reduce their spread and introduction into the Reserve.	FOR	Low	2003 – ongoing

RECOMMENDATIONS	RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
4.2d Implement the following weed control measures to reduce the population of weed species in the Reserve: ❑ Work from areas of low weed infestation to areas of high weed infestation. ❑ Spot spraying of Arum lilies in large stands, hand removal of individuals and stands along water courses. ❑ Spot spraying of Watsonia or hand removal near water courses. ❑ Hand removal of Apple of Sodom, Bridal Creeper, and African Love Grass. ❑ Herbicide wipe to control Flatweed.	SB FOR	Medium	2002 – ongoing

Plate 4.4: Arum Lily growing on the edge of gravel pit 4 within a small water body

Plate 4.5: Bridle Creeper on Lot 206

Plate 4.6: Apple of Sodom on Lots 206 and 14

4.3 DIEBACK

4.3.1 OBJECTIVE

To control and contain the spread of dieback form small infected areas to the rest of the Reserve.

4.3.2 DIEBACK EXTENT AND MANAGEMENT

Dieback (*Phytophthora cinnamomi*) is a fungal disease that was introduced in Western Australia in the late nineteenth century. The disease has since spread to many areas of the state, and poses a serious threat to many flora species in the South West. The fungus is carried by water above or below the ground or via soil transportation. The fungus moves along water gradients (down slopes and along stream lines) as well as on vehicles, people, and animals (Bailey, 1995). Dieback can also travel from plant to plant if the roots are touching. It kills plants by blocking their roots so they cannot take up water and nutrients, often giving the appearance of plants dying of drought (Bailey, 1995).

Dieback has already been identified in Big Rock Reserve along Caves Road (Broadbent, pers. comm., 1998). Other areas, such as near quadrat 2 (stream site) and in gravel pit 4, indicate signs of possible dieback infection. Taking into consideration the topography and hydrology of the land itself, dieback would be expected to move further south towards the stream line in the west of the Reserve. The spread of dieback is therefore an important issue for the management of the Reserve.

It is recommended that a dieback survey be undertaken to identify the full extent of dieback infection in Big Rock Reserve. Once identified, these areas should be restricted to all recreational activities and vehicle access.

The extent of dieback in the Reserve requires assessment of the vegetation with respect to:

- **presence of indicator species;** such as *Banksia, Adenanthos, Persoonia, Xylomenum* and *Macrozamia* (Webb, A. pers. comm. 1998). Where all examples are healthy this would indicate that dieback is not present;
- **pattern of death;** if a majority of plants from indicator species are dead it is more likely dieback than natural senescence or other disease;
- **pattern of development;** over time may show evidence of susceptible species but limited regeneration;
- **vector of disease introduction;** this will indicate the area that the infection began and the area which is next at risk. This will be of great importance in deciding the management of the area;
- **elimination of false symptoms;** like other diseases, insect damage, salt and fire are important in correctly assessing the area.

(Bailey, 1995).

The management of dieback is difficult in Big Rock Reserve due to the complexity of the ecosystems and the topography of the landscape. The spread of the disease can be minimised by implementing preventative procedures in areas that show little or no evidence of the disease, and rehabilitation procedures in areas that are visibly affected by the disease.

It is possible to kill the fungus with standard fungicides such as phosphite but there is no known method of eradicating the disease once established in native vegetation. The best strategy to control dieback is to prevent the spread of the fungus by people, in contaminated soil, water and or plant material (Bailey, 1995). This may involve quarantining areas and or implementing hygiene procedures. This may be difficult to monitor within the management area, however it should be considered as a possible option in certain areas.

RECOMMENDATIONS	RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
4.3a Conduct a dieback survey through the entire Reserve to identify where dieback exists	SB	High	2001
4.3b Monitor the spread of dieback where it exists.	SB	High	2001 – ongoing
4.3c Identify dieback – free areas in the Reserve and minimise activity in these areas.	SB	High	2001 – ongoing
4.3d Determine the effectiveness and the cost of managing quarantine areas and implementing a hygiene program for the area.	SB	High	2001 – ongoing
4.3e Source information on the use of fungicides for application in the management area.	SB	High	2001

4.4 NATIVE FAUNA

4.4.1 OBJECTIVE

To protect and conserve the native fauna populations that occur within the Reserve.

4.4.2 BIRDS

The dense shrub vegetation surrounding the rock attracts many birds, as do the sclerophyll forest areas. Bird species observed on the Reserve include:

Common Name	Species Name
New Holland Honey Eater	*Phylidonyris novaehollandiae*
Splendid Fairy Wren	*Malurus splendens*
White-Tailed Black Cockatoo	*Calyptorhynchus baudinii*
Willie Wagtail	*Rhipidura leucophyrus*
Magpie	*Gymnorhina tibicen*
Laughing Kookaburra	*Dacelo novaeguineae*
Australian Raven	*Corvus coronoides*
Rufus Tree Creeper	*Climacteris rufa*
Wattlebird	*Anthochaera sp*.

The full number of species that use Big Rock Reserve could be expected to reflect the surrounding region. The survey published in Clay and Clay 1996 is a sufficient representation of the birds in the area and would be expected to be similar to the bird population at Big Rock Reserve.

The Reserve provides a perfect location for bird watching and this should be reflected in the provision of walk trails, educational information, and rest sites along the trails. It would also be beneficial to establish a database to record bird sightings within the Reserve. This database could be lodged with the Management Committee.

4.4.3 AMPHIBIANS

A survey to establish the species richness of frogs within Big Rock Reserve could be undertaken to collect frog calls for identification. This program could be co-ordinated through a Friends Group and carried out on a long term basis to monitor their diversity within the Reserve.

Frog populations can be impacted on by fire, predators, pollution, or loss of habitat. Collecting data with respect to all these issues will allow a further understanding of the ecology of the Reserve, and provide further baseline data for comparison in the future, especially after changes in management practices or after fire events.

4.4.4 MAMMALS

Observations and fauna evidence around the Reserve indicate populations of western grey kangaroos, and ringtail possums.

The local residents around Big Rock Reserve have also sighted bandicoots, wallabies, honey possums, echidnas, dunnarts, ring tail possums, kangaroos (Plate 4.8) and brush tail possums within the Reserve.

The fauna species that may be found within the Reserve are:

Common Name	**Species Name**
Ringtail possum	*Pseudocheirus peregrinus*
Pygmy possum	*Cercartetus concinnus*
Phascogales	*Phascogale tapoatafa*
Mardo (Yellow footed Antechinus)	*Antechinus flavipes*
Black glove wallaby(Western Brush Wallaby)	*Marcropus irma*
Quokkas	*Setonix brachyurus*
Brushtail possum	*Trichonosurus vulpecula*
Honey possum	*Tarsipes rostratus*
Native rat	*Rattus fuscipes*
Dunnarts	*Sminthopsis murina*
Southern Brown Bandicoot	*Isodon obesulus*
Western grey kangaroo	*Macropus fuliginosus*
Echidna	*Tachyglosus aculealus*

(Voight, G. pers. comm., 1998)

4.4.5 REPTILES

Big Rock Reserve provides ideal habitats for reptiles, in particular the number of granite outcrops found throughout the Reserve.

4.4.6 FIRE AND FAUNA

The occurrence of fire in the Reserve has the potential to impact on native fauna of the Reserve via the destruction of important habitats and food sources. Possible and recommended fire control measures are addressed in Chapter 7. With the Reserve being relatively isolated from other bush areas the chances of finding new shelter nearby are slim. Considering the perceived risk of a fire occurring within the Reserve it is important to establish ecological management mechanisms that give the animals a greater chance of survival. Creating corridors from Big Rock to the surrounding

bushlands is the main mechanism that needs to be addressed with respect to this issue. The populations within and around the Reserve will also benefit from this by the increased opportunity for genetic exchange these corridors provide.

4.4.7 IMPACTS OF ROADS AND VEHICLES

Vehicles have the potential to cause road kills and destroy habitats within the Reserve. To meet other objectives with respect to conservation, erosion and dieback control, the roads through the Reserve should be kept to a minimum and vehicles will be excluded from the Reserve except for emergency access.

RECOMMENDATIONS	RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
4.4a Establish a local database to record bird sightings within the Reserve.	FOR	Low	2003 – ongoing
4.4b Locate walk trails and rest sites for bird watching.	FOR	Low	2003
4.4c Establish a local database to identify frog populations in the Reserve through a monitoring program.	FOR GeoCatch	Low	20032 – ongoing
4.4d Conduct a fauna trapping program during summer to establish a database of the fauna within the Reserve.	FOR	Low	2003 – ongoing
4.4e Establish vegetation corridors to allow safe fauna movement away from and into the Reserve.	FOR	Low	2003 – ongoing
4.4f Vehicle access in the Reserve be restricted to Shire employees or contracted workers, fire control and emergency vehicles.	SB	High	2001

Plate 4.8 One on the many kangaroos sighted within Big Rock Reserve

4.5 INTRODUCED FAUNA

4.5.1 OBJECTIVE

To minimise the impact of feral animals on the native flora and fauna of Big Rock Reserve.

4.5.2 FERAL ANIMALS – EXTENT AND MANAGEMENT

Non native animals such as feral cats, foxes, rabbits and domestic pets can have a detrimental effect on the local fauna and flora (Scheltema et al., 1995). They can compete with the endemic fauna for food and habitat; cause the destruction of habitats; introduce weeds into the Reserve; and prey on the endemic fauna.

The introduced species that were expected to be found in Big Rock Reserve are listed below. Evidence of some of these species was found during the September/October fauna trapping program:

Introduced species expected to be found in Big Rock Reserve:

Common Name	**Species Name**
House mouse	*Mus musculus*
Fox	*Vulpes vulpes*
European Rat	*Rattus rattus*
Rabbit	*Oryctolagus cuniculus*
Feral Cat	*Felis catus*

(Voight, G. pers. comm. 1998)

Introduced animals impact on native flora by increasing the grazing pressure on the plants and can cause damage to them by grazing, trampling and digging (Scheltema, et. al., 1995). The impact of rabbits on natural regeneration is of particular concern, they tend to gaze heavily on seedlings thus suppressing regeneration of disturbed areas.

Rabbits do need to be kept at low densities as they can ringbark shrubs and damage small trees decreasing the regeneration of native species within the Reserve (Williams et. al., 1995). Control measures include destroying the rabbit warrens and fox dens and implementing a baiting program for both pests.

Limiting the effect of domestic pets, especially cats and dogs on nearby bushland requires informing and educating local householders of the effects their pets are having on the bushland flora and fauna (Scheltema et al., 1995). Domestic dogs in the past have been allowed in the Reserve and are recommended to be prohibited due to their ability to threaten the native animals within the Reserve.

Cats are a greater threat to the fauna of the Reserve, however their control is more complex. Their population can be controlled by sterilisation, but their entry into the Reserve is unrestrained. A ‘Cat Welfare Strategy’ has been initiated by the Shire of Busselton to improve domestic cat management in the Busselton region. The purpose of the strategy is to encourage private landowners to sterilise and licence their cats and to limit cat movement to private property. The strategy is being implemented by the Shire with sterilisation and licensing coming into effect in June

2000. Education of local cat owners is currently the best way to reduce their impact on the Reserve fauna. Education campaigns for cat owners are further discussed in Chapter 8.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
4.5a	Implement a rabbit and fox baiting program to reduce the number of feral animals in the Reserve.	SB AgWA	Medium	2002 – ongoing
4.5b	Encourage the neighbouring properties to sterilise their domestic cats.	SB FOR	Medium	2002 – ongoing

5 LAND USE AND RESERVE

5.1 OBJECTIVE

To ensure that existing and proposed land use within and surrounding the Reserve does not significantly impact on its conservation value.

5.2 LAND TENURE

Big Rock Reserve is vested with the Shire of Busselton as Reserve 28665, comprised of Lot 905 Caves Road and the recently acquired Lot 8.

5.3 PLANNING

5.3.1 LEEUWIN-NATURALISTE REGION

The management area is identified as a Conservation Reserve by the Leeuwin-Naturaliste Ridge Planning Policy (Western Australian Planning Commission, 1998). There are several policy statements which place conditions for land use within and around existing and proposed conservation reserves:

- Land Use Strategy 2.5: Maintaining or enhancing the conservation and landscape values within existing and proposed Conservation Reserves will be the primary determinant in decision-making on proposals for land use, subdivision or development within these areas.

- Land Use Strategy 2.6: Proposals for development surrounding Existing and Proposed Conservation Reserves will demonstrate that the development meets fire hazard and risk standards associated with this category of Conservation Reserves.

5.3.2 SHIRE PLANNING

The Reserve is zoned for recreation with the Shire of Busselton and as discussed, is currently a Class C Reserve for the purpose of "Preservation of Caves and Flora". The Reserve is currently awaiting a change of status to ‘A’ Class Reserve for the purpose of ‘Landscape and Fauna Protection’.

5.4 EXISTING LAND USE

The majority of the land in the Reserve is public open space with the only exception being Location 5073, the Telstra Telecommunications Station, and its access easement. Four gravel pits exist in the Reserve and all are no longer active and have been left to revegetate on their own accord.

The Telstra site measures 1.44 ha in area and has been excised from the Reserve as Location 5073 and is directly leased by DOLA to Telstra. Therefore it is not part of Big Rock Reserve land but because it lies within the Reserve area activities on this land have the potential to impact heavily on the Reserve. The site is utilised for co-location of similar facilities from Optus and Vodaphone and the Council's own two - way radio installation, on the one mast. Access to the site is provided by an easement route utilising an old extraction track for the gravel pit and the old firebreak running parallel to Caves Road.

5.5 SURROUNDING LAND USE AND MANAGEMENT IMPLICATIONS (FIGURE 5.1)

The Reserve is surrounded by several roadways including Caves Road, a major roadway connecting Dunsborough to Yallingup and identified as a Tourism Corridor for the Leeuwin-Naturaliste Region (WAPC, 1997). The close proximity of a major roadway, to a conservation Reserve which provides shelter for native fauna, is of concern to the safety of motorists and the preservation of endangered species.

It is approximately 2 km from the urban residential area of Dunsborough, after which private property is in the form of larger special rural lots. The land east and south of the Reserve is principally zoned for rural residential use and hence is either already or destined for subdivision into special rural lots. Most of this land that adjoins the Reserve is relatively uncleared except for Lots 738, and Lots 8 to 11 (see Figure 1.2 and 5.1) which was previously cleared for agriculture. Inherent problems with small rural lots include potential overgrazing, poor control of weeds and vermin, and a lack of bushfire prevention (Tille and Lantzke, 1990). These properties are often used as holiday destinations and their temporary occupancy can contribute to these problems. Land holders should be encouraged to maintain their firebreaks, control weed and pest infestation on their properties both for their own safety and the preservation of Big Rock Reserve. They should also be asked to ensure that pets are not given opportunity to stray from properties into the Reserve.

The land north of the Reserve is predominantly zoned for agriculture, including the land immediately north, across Cave Road, in which the native vegetation appears relatively intact (see Figure 1.3). Several lots to the north west of the Reserve along Caves Road are zoned for tourism and include the Banamah Wildlife Park. Established tourist facilities, such as the park, could play a role in raising awareness of the Reserve.

Several nearby properties are zoned for recreation, similar to Big Rock Reserve, including Reserve 12 494 (see Figure 1.2 and Figure 5.1) which is vested in the Shire of Busselton for the purpose of gravel extraction. Currently, no gravel pit exists in this Reserve and no gravel has been previously extracted. Reserve 12 494 measures only 0.84 hectares and is relatively undisturbed with intact native vegetation similar to Big Rock Reserve. Its close proximity has implications in that gravel extraction from this site has the potential to increase the spread of dieback and weeds to adjoining land to Big Rock Reserve. Reserve 12 494 is also referred to as having a high conservation value by Keating and Trudgen (1985) because, like Big Rock Reserve, it contains unique vegetation types. It is therefore recommended that this Reserve be 'adopted' by Big Rock, and be subsequently managed as a single conservation Reserve.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
5.5a	Provide information to surrounding properties requesting landholders to respect and value Big Rock Reserve by maintaining their required firebreaks and fence lines, controlling weed and pest infestations, and preventing their household pets from straying into the Reserve.	SB	High	2001 – ongoing
5.5b	Change the boundaries of Reserve 12 665, to include the area previously known as Reserve 12 494, and this land be subsequently included in the management of Big Rock Reserve.	SB DOLA	Medium	2002

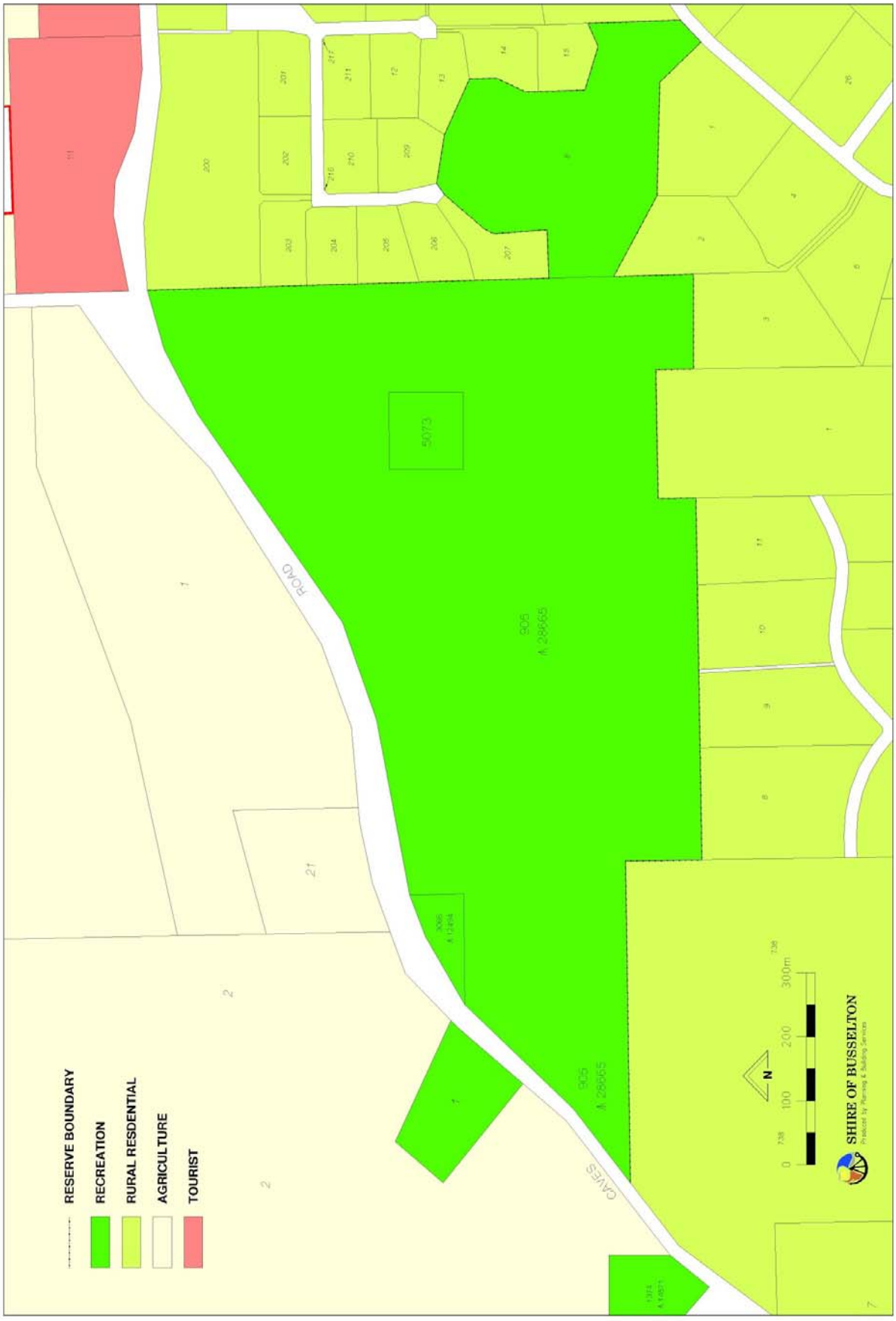

Figure 5.1 Surrounding Land Use (Shire of Busselton TPS No 20)

5.6 ACCESS

Currently vehicle access into Big Rock Reserve is possible from Big Rock Place, Caves Road and Yungurra Drive all via existing firebreaks. Vehicle use within the Reserves should be minimised to prevent the spread of dieback, and to decrease the risk of soil erosion. Public access to the Reserve should be limited to walk trails and via a single entry point at Big Rock Place. The Caves Road and Yungurra Drive entry points have no space for vehicle parking and offer poor vision of oncoming traffic. Additionally, Big Rock Place already has sufficient space for a small carpark to be established adjacent to the Reserve. Gates may need to be erected at the Caves Road and Yungurra Drive entrances to discourage the public from entering with vehicles while allowing access for emergency vehicle. Access at Yungurra Drive should be removed altogether if the entrance is not required for fire control measures as the land is severely eroded and requires rehabilitation. Adjacent land to the Reserve at the Yungurra Drive entrance has established and maintained firebreaks which would provide adequate fire access to this part of the valley. Signs should also be established at these points to discourage the public parking at these entrances.

The Telstra easement has a gate at its entrance preventing vehicles entering the Reserve at this point. In the event of a bushfire, entry to the Reserve from this part of Caves Road and will provide strategic access to the centre of the Reserve.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
5.6a	A gate fitted with a lock and a sign stating 'NO UNAUTHORISED VEHICLES" be placed at the western firebreak entrance along Caves Road.	SB	High	2001
5.6b	South eastern firebreak entrance along Yungurra Drive be fenced off and a sign stating 'NO ENTRY' be placed at this site.	SB	High	2001
5.6c	Provide the Shire of Busselton, the Dunsborough Bushfires Board, the Busselton Volunteer Bushfires Brigade and the SES with a set of keys for the Telstra easement gate on Caves Road.	Telstra	High	2001

5.7 FENCING

The establishment of fencing around the majority of Big Rock Reserve has helped to protect the important biological ecosystems that exist. It has also provided a boundary between the Reserve and the private rural lots along the southern side. Figure 5.2 illustrates the extent of the fencing around Big Rock Reserve.

A fence line exists along the southern boundary bordering Lots; 3, 1,11,10, 9, 8 and 738. This fence line is in good condition, has been well maintained and is shown in Plate 5.1. It should remain as the boundary fence however, sections of the fence line along the southern boundary are electrified and the public visiting the Reserve should be informed.

The fence line along the boundary of Lot 1 and the Reserve will need to be reviewed as the fence does not follow the surveyed boundaries as illustrated in Figure 7.1. This discrepancy needs to be resolved as the Reserve boundaries become unclear and part of the existing walk trail passes through the private property of Lot 1. Resolution of this issue will affect the final placement of the firebreaks and fences along this area of the Reserve.

Possible causes of action for resolution of this issue include:

If the owners of Lot 1 eventually subdivide their lot, the Shire could cede part of the land from Lot 1 so the southern boundary of the Reserve is in a straight line and significant vegetation is conserved.

Redirect the walk trails inside of the Reserve boundary. However steep slopes exist inland from this lot so the walk trail may need to be located elsewhere in the Reserve.

A fence line also exists along the private Lots 207, 206, 205, 204 and 203. Some parts of this fence line and the previously mentioned southern boundary are damaged and in need of repair. This deterioration is often caused by falling vegetation as illustrated in Plate 5.1, or severe erosion. It is therefore proposed that the existing fence line be repaired in these areas when funds are available, to establish a clear boundary line and a safe environment between the Reserve and private property.

Lot 1042 recently sold part of their land to the Shire of Busselton to increase the area of the Reserve. This included Big Rock and the surrounding land bordering Lots 2 and 207. Consequently there is still an old fence line extending from Lot 207 down to Lot 2. It is proposed that this portion of the fence line be removed. The location of this fence is illustrated in Figure 5.2.

No fencing exists within the Reserve along Caves Road. The need for this boundary to be defined seems irrelevant as the boundary is well defined by Caves Road and public entry along here is unlikely due to access difficulties. Therefore this part of the Reserve should remain free of fencing which will ensure the aesthetic beauty of the Reserve is maintained.

The newly acquired Lot 8 which contains Big Rock, also has no fence line. Unfortunately, this has allowed uncontrolled recreational use of the area as illustrated in Plate 5.2. There is also no fence line north of Lot 203 along the eastern boundary of the Reserve to Caves Road. Due to the costs of erecting fencing for the Shire and the private landowners, fencing the remaining areas of the Reserve should only be considered as a long term goal as many of the advantages that fencing provides, have been incorporated into other recommendations. Exclusion of dogs from the Reserve is recommended to protect local fauna from disturbance. Only certain recreation activities have been recommended. Trail bike riding for example is prohibited decreasing the degradation of the landscape, and the future patrols within the Reserve will ensure minimal uncontrolled recreation.

Limited fencing also allows the local fauna to move freely however ferals and domestic cats have been allowed to enter the Reserve. Baiting is recommended for foxes and rabbits and the Shire is currently implementing the ‘Cat Welfare Strategy’, aiming to encourage owners of cats to sterilise and licence them.

In areas where a definite boundary needs to be defined such as at the entrance near the small carpark, other infrastructure can be used instead of fencing such as boulders or pine logs. These would prevent unauthorised vehicles entering the Reserve.

Erecting a fence along the eastern part of the Reserve will restrict the entrance to emergency vehicles such as those from the fire brigade. In the event of a fire within the Reserve driving in and out would be difficult with a fence surrounding the Reserve.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
5.7a	Construct signs informing the public of electric fencing along the southern boundary.	SB	Medium	2002
5.7b	Inform the neighbouring landowners of their responsibility to remediate their fence line if damage has occurred on their lot as indicated in Figure 5.2.	SB Landowner	Medium	2002
5.7c	Remediate the existing fence line where it is deteriorating within the Reserve boundary as illustrated in Figure 5.2	SB	Low	2002
5.7d	Removal of the fence line historically separating the 'Big Rock' from the existing Reserve.	SB	Medium	2002

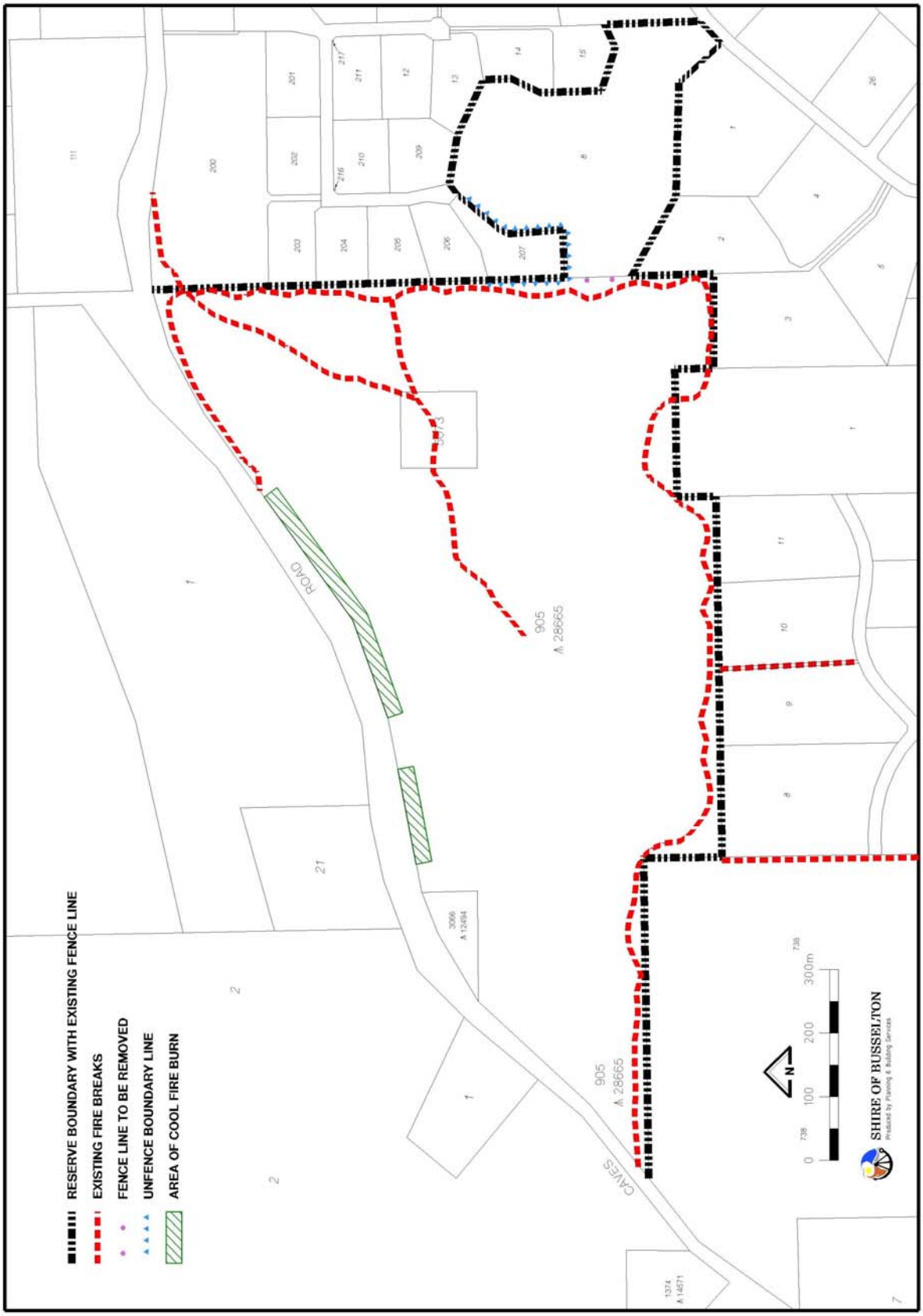

Figure 5.2: Fencing and Firebreak plan for the Reserve.

5.8 FUTURE MANAGEMENT IMPLICATIONS

It is anticipated that Big Rock Reserve will soon be an 'A' Class conservation area and subsequent land use in the Reserve should reflect this higher level of protection. Further development, similar to the existing Telstra facility should be vigorously discouraged, to ensure its preservation. There has previously been discussion of the development of a second mast at this site increasing the amount of area required. The Shire of Busselton should continue to discourage expansion of such facilities at this site and ensure that the remainder of the Reserve is retained for its conservation purpose.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
5.8a	Discourage further Telecommunication development on the Reserve unless it can be incorporated within the existing site.	SB	High	2001

6. RECREATION AND PUBLIC USE

6.1 OBJECTIVE

To provide a diverse range of low impact recreation opportunities that are compatible with the conservation of the flora and fauna of Big Rock Reserve.

6.2 INTRODUCTION

Recreational activities that are known to occur in the Reserve include bird watching, bush walking, horse riding, trail bike riding, mountain bike riding, and four wheel driving. It is possible that the area is also used as a campsite by visitors to the region, particularly in the summer (Howes, pers. comm., 1998). The view of the surrounding land offered by the summit of Big Rock is another attraction of the Reserve. The recent acquisition of Lot 8, which includes Big Rock itself, means that this feature can be promoted as an attraction of the Reserve. The emphasis should be placed on conservation, with low impact recreation use and minimal amenities in the Reserve given the close proximity to the Dunsborough townsite.

6.3 EXISTING RECREATION USE AND THEIR IMPACTS

Bird watching and bush walking are only of concern if the public are straying from established paths or traversing through dieback infected areas into uninfected areas. This can be prevented by the establishment of formal walk trails. Bushwalking is also an issue with the inclusion of dogs which can threaten native fauna if allowed to roam freely through the Reserve. This is a difficult issue as bushwalking with dogs is a popular pastime, allowing the public to exercise their pets in a scenic environment, and the prohibition of dogs would most likely result in an initial decrease in visitors to the Reserve. Restricting dogs to be on leads at all times in the Reserve can decrease the potential for impact on the biota but depends on the publics adherence to the rules. Additionally, allowing domestic animals in the Reserve is in conflict with the pending upgrade of conservation status to 'A' Class. In CALM managed Reserves, domestic animals are not permitted. Consequently, the high conservation value of Big Rock Reserve and the difficulty with ensuring dogs are kept under control demands that the activity be discouraged.

Four wheel driving and trail bike riding are unacceptable recreational pursuits in the Reserve as they have the potential to have a detrimental impact on the landscape and biota (see Plate 6.1). As discussed in Section 5, access should be limited to prevent the public entering with vehicles and signs provided to discourage their use within the Reserve. Horse riding, although less aggressive, is usually discouraged in conservation reserves as horse faeces can carry seeds, having the potential to introduce and spread weeds through the landscape and the physical impact from horse riding off designated tracks can cause erosion. Owing to significant local interest in the continuance of horse riding as a permitted use in Big Rock Reserve, the Busselton Shire Council has resolved to allow horse riding to continue as a trial only for a two year period (2001 – 2003) with impacts to be monitored during this time. Camping is not permitted in Shire Reserves and is of particular concern from a fire management perspective (Howes, pers. comm., 1998).

RECOMMENDATIONS	RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
6.3a Prohibit the walking of dogs within the Reserve.	SB	High	2001
6.3b Monitor the impacts of horse riding in the Reserve over a two year trial period with this use to be reviewed after this period. Horse riders should be encouraged to stay on existing fire tracks in the interim period.	SB	High	2001
6.3c A sign at the entrance of the Reserve be provided, informing the public that the following activities are not permitted in Big Rock Reserve: ❑ Walking of Dogs; ❑ Vehicle Use; and ❑ Camping.	SB	High	2001

6.4 PROPOSED FUTURE USE AND AMENITIES

Although the low frequency of visitors has been a large factor in maintaining the healthy state of Big Rock Reserve, managing for future recreational pursuits can benefit the environment and the community. The encouragement of passive recreation at properly designated sites may not only help to prevent or limit further degradation but also add to the community's appreciation of the conservation value of the area. The increase in population around the Reserve as a result of further subdivision and the heavy tourism focus on the region, will most likely result in an increase in the number of people using the area for recreational pursuits. Therefore measures should be taken to ensure that this increase in use does not have a negative impact on the conservation value of the Reserve.

6.4.1 CARPARK

Future car parking facilities should be located in the most degraded area of the park and the perimeter clearly defined to prevent vehicles leaving the designated area (CALM, 1996). Access, location, capacity, and topography are also important factors when determining the appropriate position for a car park. Using these criteria the most appropriate site is the access point to Big Rock Place (see Figure 9.2). This site is relatively clear of vegetation, in close proximity to Big Rock, with existing walk trails leading to the Rock and into the Reserve. The site is large enough to accommodate three to four cars, with the verges of property in the cul-de-sac offering sufficient space for a small excess of this number of cars. The removal of two juvenile trees may be necessary to increase the capacity of the area.

6.4.2 RUBBISH BINS

The provision of bins is complicated by the fact the reserve is surrounded by special rural and rural land use, for which a kerbside rubbish collection service is not provided. Discouraging litter dumping can be undertaken by appropriate signage requesting that visitors of the park take their litter home with them to dispose thoughtfully.

6.4.3 WALK TRAILS

As discussed, Big Rock Reserve does not appear to have a large amount of constructed paths through its bushland. Trails which are being used include existing firebreaks along fence lines, the Telstra access road, and other small walk trails which have been gradually established from frequent use. The largest problem

facing the establishment of formal walk trails at the Reserve is that many of the paths that are currently being used by bush walkers pass through private property. Clearing new paths through the bush should be minimised so as not to compromise the reserve's conservation value. Ideally, the walking paths should begin from the car park and enter areas that are in a more natural state (CALM, 1996), and subsequently return to the carpark. It is recommended that any tracks which are not going to be used for firebreaks or for walk trails should be fenced off and regenerated.

The preferred locations of walk trails through the Reserve is shown in Figure 6.1 and in most part utilise existing firebreaks or paths through the bush. New trails have only been recommended where current access will be prevented by the inclusion of private fence lines and where necessary to complete a circular route. When establishing the new walk trails, it is important that precautions are taken to ensure valuable flora are not removed and dieback is not spread. An additional consideration is the erosion potential of the walk trail locations. Further consultation and investigation into the location of these walk trails is necessary to ensure their establishment does not effect the surrounding landscape.

6.4.4 PARK BENCHES

Park benches included at intervals along the walk trails would provide opportunities for visitors to rest and to enjoy the aesthetic appeal of the area. Interpretative information could also be included at these rest points. The locations of six proposed park benches for the Reserve are shown in Figure 6.1.

6.4.5 BOARDWALKS

Several boardwalks would assist visitors to cross waterways and damp areas in comfort and safety. Boardwalks would also define access paths, therefore minimising trampling and associated erosion of stream banks. Treated pine boardwalks could be constructed at waterway crossing points along the walk trails and traversing over the damp areas at the Big Rock as indicated by Figure 6.1. On occasions where the walk trail is actually following a firebreak, the boardwalks may need to be situated to the side of the paths as to ensure that they remain intact when vehicle access is necessary. Adequate space will need to be left to allow vehicles to pass over the waterways without destroying the boardwalks.

6.4.6 OTHER AMENITIES

There is no apparent need to provide picnic and barbecue facilities at Big Rock Reserve as many nearby recreation reserves, including Meelup Regional Park, provide these facilities. Toilets and ablution blocks have associated problems with effluent and are deemed unnecessary at this stage because of the relatively low use of the Reserve.

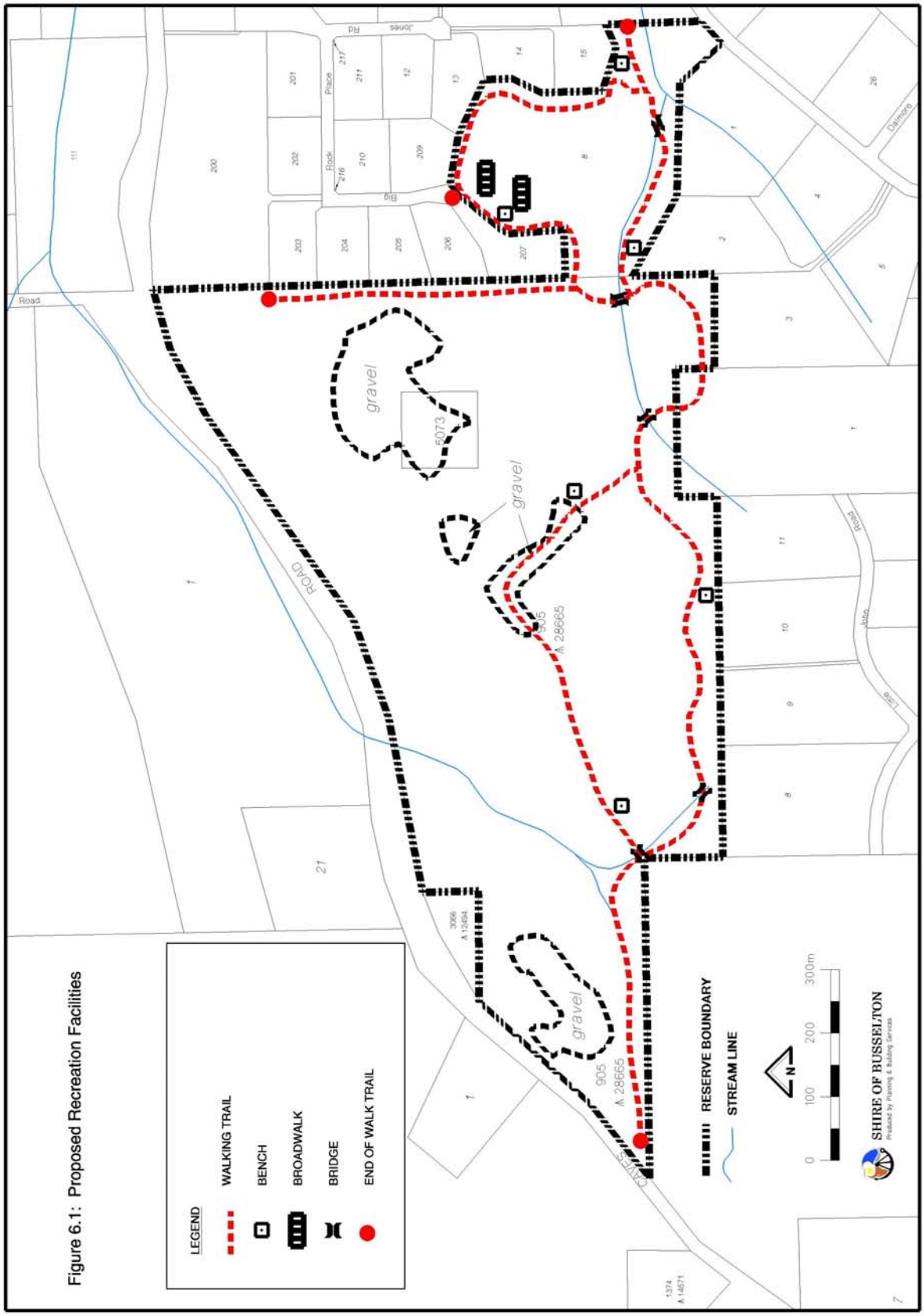

Figure 6.1: Proposed recreation amenities at Big Rock Reserve.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
6.4a	Assess the suitability of Big Rock Place in between Lot 207 and Lot 1042, for the establishment of a small, unsealed, carpark facility with a capacity of four vehicles.	SB	Medium	2002
6.4b	Appropriate signage to be erected requesting visitors to take litter home with them for responsible disposal.	SB	Low	2004
6.4c	Construct designated walk trails for public pedestrian access within the Reserve after further investigation into the locations as indicated in Figure 6.1.	SB	Medium	2003
6.4d	Park benches to be provided at locations indicated in Figure 6.1.	SB	Medium	2003
6.4e	Boardwalks to be constructed of treated pine at locations indicated in Figure 6.1.	SB	Low	2004

7. FIRE MANAGEMENT

7.1 OBJECTIVE

To maintain the conservation values of the Reserve while providing adequate fire protection for the Reserve and surrounding properties.

7.2 CLIMATE AND FIRE

Western Australia experiences several different climatic regimes. The south west region is characterised by a Mediterranean climate of cool wet winters, where the mid latitude depressions move in a easterly direction. The warm to hot dry summers consequently result in very little rain for a five to six month period (Corrick and Fuher, 1996).

Climate has contributed to the intensity of many fires in the south west of WA. Limited rain during the summer months leaves the ground dry increasing the potential of leaf litter to act as fuel for a bushfire. Even though a large majority are claimed to be deliberately lit, the extremely hot temperatures during the summer months and the afternoon sea breezes are believed to have resulted in large proportions of bushland being burnt in some locations.

Bush fires caused by lightning still occur today as the summer storms move across the south west land division. November to April is the time when reserves such as Big Rock are most at risk (Broadbent pers. comm., 1998). There is no record of Big Rock Reserve experiencing a fire (Howes, pers. comm., 1998), and this accounts for high fuel loads observed in some areas of the Reserve. There is a strong possibility the Reserve will eventually experience a fire during the summer and it is therefore essential a fire management programme be established for the Reserve.

7.3 FIRE AND VEGETATION

A wide range of Australian flora has evolved to survive fire, as has been common occurrence and a strong ecological selection factor. There are many different mechanisms which plants use to overcome the impacts of fire, such as resprouting, or having hardy seeds that germinate after fire. However, the frequency and temperature of fire events may affect the ability of the species to recover after fire and alterations to the natural fire regime can have adverse impacts on many vegetation communities.

Managing fire at Big Rock Reserve requires a balance between reducing fuel loads to decrease the probability of a very hot burn; protecting the adjacent properties; and excluding fire for conservation reasons. Fire management should be ecologically sustainable so the activities do not cause a detrimental change in the ecosystems. This requires study of the species and assessment of their susceptibility.

Fire can cause an increased infestation of weeds within the Reserve, as most weeds are opportunistic species that grow and set seed quickly. This can in turn lead to a greater fire hazard as grasses and other annuals that create large amounts of dry biomass during summer can take over the area. Fire management therefore needs to be conducted in conjunction with weed management programs and any control burning should be carried out only in areas that will not be adversely affected in this respect.

Big Rock Reserve has not been burned by fire for many years and currently contain a high fuel load. The Dunsborough region has not yet seen a summer fire and consequently a number of reserves around the town exhibit high leaf litter fuel loads (Howes, pers comm.

1998). It is therefore essential that an adequate fire management programme be established for Big Rock Reserve.

The firebreaks within and around the Reserve are illustrated in Figure 5.2. The fire breaks are already being used as walk trails and access for emergency and Shire vehicles. The existing firebreaks are wide enough (2 to 3.5 meters) for the fire vehicles to drive through in the event of a fire, and extend around most of the Reserve. The condition of the firebreak varies depending on the level of water erosion with some breaks being heavily eroded and needing remediation, but the majority are in fairly good condition.

The private properties directly abutting Big Rock have well established fire breaks. However these firebreaks are not within the Reserve boundary as illustrated in Figure 5.2. If a fire does occur within the Reserve near these private lots, the fire vehicles will have to use these fire breaks in order to gain access to the fire.

The Telstra easement (the gravel road from Caves Road to the Telstra tower) should continue to act as a strategic firebreak for this area. It will be the only vehicle access to the centre of the Reserve as the existing road linking the other gravel pits will be revegetated.

A technical problem exists with the position of the boundary fence for Lot 1 as mentioned previously. The property has a fence line approximately 50 to 75 meters south of their boundary line, but no adequate firebreak has been provided. According to the Commonage precinct for Strategic Firebreaks (1998), Lot 1 and 8 should have strategic firebreaks where indicated. Lot 8 complies, but the firebreak for Lot 1 exists mainly in the Reserve boundaries, this is illustrated in Figure 5.2. The existing firebreak is satisfactory and if approved by the Shire should remain as the break for this property to reduce the area of bush cleared. However this will be determined by the outcome of negotiations between the Shire and the owner of Lot 1.

There are no firebreaks within the Reserve abutting Caves Road. This is of major concern if a fire does occur here for there is no boundary with which the fire vehicles can stop the spread of the fire. This area also has a high fuel load that will increase the intensity of a fire. It is therefore proposed that a cool burn be administered during autumn in the area indicated in Figure 5.2. The fire should only occur 10 to 20 meters South from Caves Road and away from the stream. The location of the cool fire burn is approximate and further field studies are required to establish the exact boundary of where to start and finish. After the fire, weeds may germinate in this area due to the reduced competition from native vegetation and proximity to the grasses along Caves Road. Weeding programs are proposed until the native vegetation has returned.

The area around the stream should not be included in the cool burn due to the risk of erosion occurring on the slopes. There is also the possibility of weeds germinating along the bank as the water from upstream private property can carry their seeds. Apart from this area, there are adequate firebreaks in place and no other burns are proposed in the Reserve

This proposed burn is not the beginning of a current fire management programme for the Reserve, it is simply to reduce the fuel load as there are no nearby firebreaks and the Reserve borders a major road. As Caves Road carries all the traffic travelling along the coast, the possibility of the public causing a fire event from cigarette butts is high, especially with the increase in the population during the summer period (Howes, pers comm., 1998). The Reserve should be monitored yearly to identify fuel loads and which areas would encourage the intensity of a fire.

For further fire management practises, it is recommended the Shire liaise with the Bushfires Board and the Department of Conservation and Land Management to develop a detailed fire management plan for the Reserve.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
7.3a	Liaise with the owner of Lot 1 regarding the remediation of the existing firebreak so it can remain as the firebreak along the boundary for this Lot.	SB	Medium	2001
7.3b	Develop a detailed Fire Management Plan taking into considerable conservation values of the Reserve	SB FOR	High	2001
7.3c	Undertake a cool burn in the restricted area identified in Figure 7.1.	SB	High	2001
7.3d	Establish weeding programs after any cool fire burns to stop weed invasion in control burn areas.	FOR	Medium	2001 – ongoing

8. EDUCATION AND INFORMATION

8.1 OBJECTIVE

To promote visitor safety, awareness and appreciation of the natural processes and the scientific, cultural and heritage attributes of Big Rock Reserve.

8.2 INTRODUCTION

Education should be seen as an essential management tool, which recognises the fact that people can play a role in the efforts of nature conservation, (Meffe *et. al*., 1997). Big Rock Reserve has the potential to be a valuable source of information and education for the general public with its diverse community of flora and fauna which is endemic to the region, as well as the cultural significance of Big Rock itself.

While there is a focus on the use of education and information to help minimise human impacts on the Reserve, it is important to recognise that dispersing information on the Reserve and the issues at hand will have other benefits. Not only does it provide a better understanding of the Reserve for those using it, it also taps into any local knowledge regarding the Reserve that may be unknown to the Management Committee. Leading to the accumulation of information and human resources, which aids in the further management of the Reserve.

Effective strategies that involve conservation should incorporate programs that involve communication and education aiming at peoples awareness, attitudes and behaviours towards natural resources and land management, (Meffe *et. al.,* 1997) and how these concepts can come to play in the role of conserving the Reserve.

8.3 ON-SITE EDUCATIONAL FACILITIES AND PUBLIC INFORMATION

The use of educational facilities on-site is a very effective way of informing the public on the Reserve with regard to its historical, cultural and conservation significance. The use of such facilities also helps to relate the environment back to those using the Reserve and allows them to see the direct and indirect relationship that humans have with the surrounding environment. This will hopefully encourage those using the Reserve to adopt more of a conservation perspective when visiting the Reserve.

The use of on-site educational facilities needs to be low in maintenance and accessible to the public. These facilities may comprise of display panels and trail signs that will be placed strategically within the Reserve where they apply (see Figure 9.2), providing information on various areas, such as:

- Conservation and rehabilitation strategies of the area;
- Significant animal and plant species found in the area, include fragile moss species around the rock;
- Aboriginal and Non-Aboriginal history of the area;
- Information regarding Big Rock and its conservation value, as well as historical and cultural significance;
- Signs deterring any chiselling or defacing of Big Rock and graffiti on the Rock;

- Discouraging the public from dumping refuse in the Reserve.

Signs which use a more positive phrase and provide information as to why a particular activity should be discouraged tend to be received better than those that merely state a certain activity is illegal and may have a fine attached. For example, people who may dump their garden waste in the Reserve may not realise the full implications of their actions. Using education as a tool and explaining that though garden waste does biodegrade, it can cause extensive weed invasion through the Reserve, people may respond positively and stop this one particular activity.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
8.3a	Establish a main information Board with a locality map of the Reserve at the access point into the Reserve.	SB	High	2001
8.3b	Smaller information boards should also be established to inform the public of the scenic beauty and any significant flora and fauna species in parts of the Reserve.	SB	Medium	2002

8.4 OFF-SITE EDUCATIONAL FACILITIES AND PUBLIC INFORMATION

The use of off-site educational facilities is another important form of informing and educating the local community, nearby residents and tourists over the importance of the Reserve with regard to its historical, cultural and conservation value.

The use of such facilities with regard to nearby residents would attempt to involve residents in the management and conservation of the Reserve on a more personal level. This would ideally have the effect of encouraging a sense of pride and responsibility that nearby residents would adopt towards the Reserve. Possible ways in which to achieve this would be to:

- Provide informative pamphlets to nearby residents regarding the possible impacts that they may be having on the Reserve and why they are having an impact. This is with regard to firebreaks, pets (e.g. cats and dogs on native fauna), using motor vehicles in the Reserve (e.g. four-wheel driving, motor cycling, etc.), horse-riding, picking native flora from the Reserve, planting declared plants on their land etc.; and

- Conduct meetings between the local residents and the Management Committee every few months over the Reserve to discuss the relevant management and conservation issues at hand. This is to ensure that there is continual networking between the two, so that the impacts on the Reserve are minimised and the Management Plan objectives are achieved.

With regard to the local community and tourists, information pamphlets and brochures on Big Rock Reserve could be provided through the Tourist Bureau, the Environment Centre, the Department of CALM, the Local library and the Shire of Busselton. It should be stressed that the Reserve is an area vested in the Shire mainly for the purpose of conservation.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
8.4a	Provide a general pamphlet on the Reserve, which is to be distributed to the nearby residents, the general community and visitors to the Reserve stating its purpose and significance with regard to historical, cultural and conservation values. It should also summarise the possible impacts they may have on Big Rock Reserve through their land uses, firebreaks, pets and recreational activities.	SB FOR	Medium	2003 – ongoing

8.5 PROGRESS REPORTS AND DISPLAYS

Providing an update on the management of the Reserve through a progress report, is another important tool that can be used to help the Management Committee identify and focus on the relevant issues at hand that need to be dealt with as well as help prioritise these issues. This progress report should be submitted to the Shire of Busselton to update the Shire on the Committees management of the Reserve and help to gain funding and extra resources that may be required to carry out future projects and programs to further manage the Reserve. The progress report should also be distributed to the various government bodies and interest groups who are involved in managing the Reserve to update them and clarify issues and areas of concern with regard to the Reserve. The use of progress reports will also aid in keeping the local community and nearby residents updated on the Management Committees progress with the Reserve.

Information leaflets should also be used in conjunction with the progress reports, these will summarise the progress of the Committee over the management of the Reserve, as well as provide general information on upcoming events concerning the Reserve. For example:

- Busy bee days; and
- Important issues concerning the Reserve at that time (e.g. flora and fauna surveys being conducted, pest control, fire-breaks, recreational concerns etc.)

These information leaflets should be distributed to the relevant groups involved in the management of the Reserve. As well as being placed in the main Information Board in the Reserve.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
8.5a	Submit a yearly progress report to the Shire of Busselton on the Reserve that should include requests for future projects that need to be conducted to ensure its management and conservation can continue.	FOR	Medium	2003 – ongoing
8.5b	Distribute information leaflets summarising the progress report to the various government bodies and interest groups who are partly involved in the Reserve's management. It should also be available in the main information board at the Reserve to inform and update visitors on the progress of the Reserve.	FOR	Low	2004 – ongoing
8.5c	Ensure there are regular ranger patrols of the Reserve and encourage a neighbourhood watch program with the local residents.	SB FOR	Medium	2004 – ongoing

9. GENERAL MANAGEMENT CONSIDERATIONS

9.1 OBJECTIVE

Ensure that Big Rock Reserve is managed appropriately through the establishment of a Managing Authority.

9.2 FRIENDS OF THE RESERVE

Though the Reserve is vested in the Shire of Busselton the establishment of a community based 'Friends' group is recommended to ensure that the purpose for the Reserve and the objective of this Management Plan is carried out through the appropriate management of the Reserve.

This is to ensure that management of the Reserve is carried out adequately and is an ongoing process which improves with the passage of time and that there is an increase in information gathered and understanding of the ecological processes taking place in the Reserve.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
9.2a	Establish an Friends Group for the Reserve to assist the Shire of Busselton with the management of Big Rock Reserve.	SB	High	2001
9.2b	The Friends of Reserve group should liaise with the relevant government organisations and community groups to aid in the management of the Reserve.	FOR	High	2001 – ongoing
9.2c	The Friends of Reserve group should liaise with and encourage participation of the neighbouring residents of Big Rock Reserve to address conservation issues such as weed control, flora rehabilitation and fauna monitoring.	FOR	High	2001 – ongoing
9.2d	The Friends of Reserve group should carry out the conservation issues where possible as outlined in the Figure 9.2 and any new issues that arise to ensure the continual management of the Reserve.	FOR	High	2001 – ongoing

9.3 CONCEPT PLAN

A Concept Plan has been designed for Big Rock Reserve and is illustrated in Figure 9.1. It is based on the recommendations that have been made throughout this Management Plan. The use of a concept plan helps to focus the aims of the Management Committee. The plan will show the areas for recreation and conservation and the proposed changes to be made in improving the management of the Reserve, which will help focus the aims of the Management Committee.

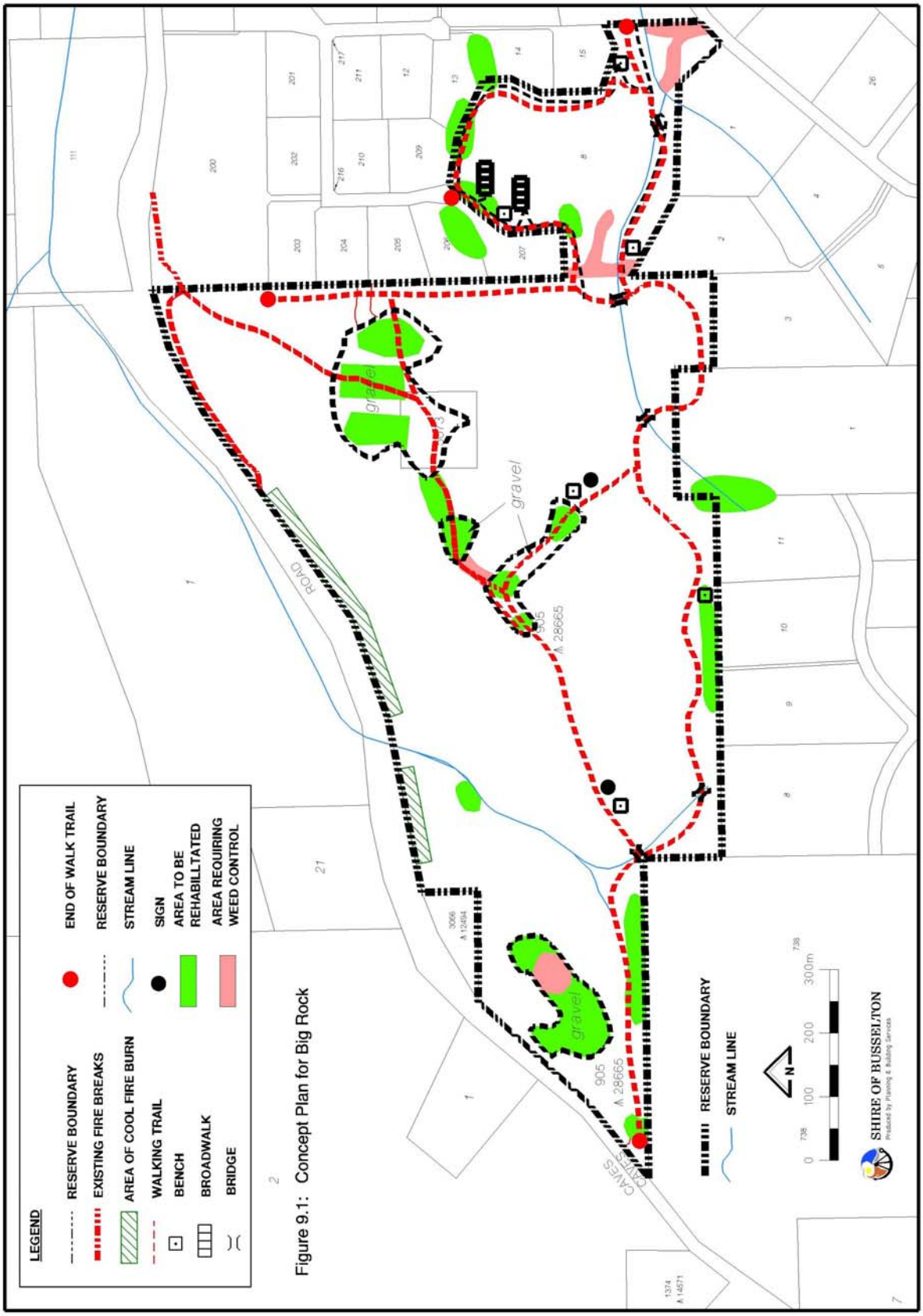

Figure 9.1: Concept Plan for Big Rock

FIGURE .9.1

9.4 TENURE OF THE PLAN

This plan should be reviewed within five years of Ministerial approval of the plan with provision for the plan to be amended as required.

RECOMMENDATIONS		RESPONSIBLE AUTHORITIES	PRIORITY	TARGET DATE
9.5a	The Management Plan should be reviewed every 5 years to ensure the conservation of the Reserve is maintained.	SB	High	2006

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Conservation and Land Management Act 1984
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