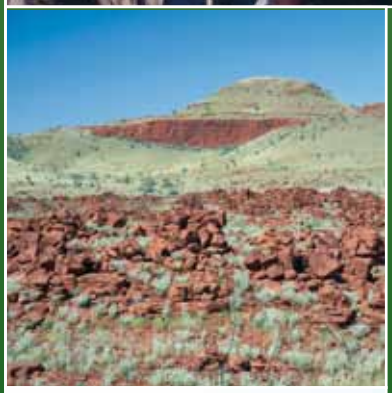
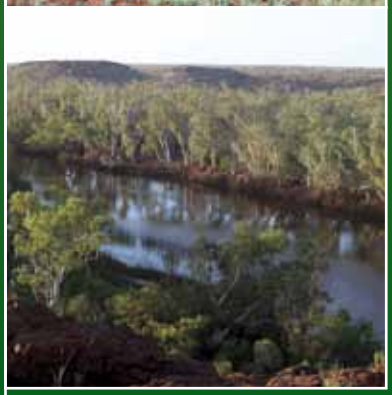
Millstream Chichester National Park and Mungaroona Range Nature Reserve

Management Plan No. 69 2011





Department of Environment and Conservation

Traditional Owners
Millstream Park Council

Conservation Commission
WESTERN AUSTRALIA

20110464-10-200

MILLSTREAM CHICHESTER NATIONAL PARK AND MUNGAROONA RANGE NATURE RESERVE

Management Plan

2011

Traditional Owners – Millstream Park Council

Department of Environment and Conservation

Conservation Commission of Western Australia

VISION

By 2021, the Millstream Chichester National Park and Mungaroona Range Nature Reserve will have greater recognition by the local and broader community, visitors and others of its important cultural and mythological significance for the Yindjibarndi and Ngarluma Traditional Owners. The Indigenous heritage of the planning area will be preserved by the ongoing involvement of the Traditional Owners, who will have a critical and active role in jointly managing the cultural and natural values of the planning area.

The significant wetland ecosystem and other natural values of the planning area will be in better condition than at present and the subterranean aquifer will remain in its current healthy condition. This will have been achieved through efforts focused on effective weed control, restoring the resilience of the natural ecosystems and improved management of water extraction from the aquifer, through monitoring, research and adaptive management. In particular, those values that are not found or are uncommon elsewhere will have been conserved, and their special conservation significance will be recognised by the local and broader community and visitors.

The planning area will continue to support a wide range of nature-based recreational activities with a focus on preserving the natural character of the region and its wilderness qualities including its rangeland landscapes and open pools of the Fortescue River. The local and broader community will identify with the planning area and recognise that its natural, cultural and recreational values are of national significance. An increasing number will support and want to be involved in its ongoing management.

Front cover images:
Ngarluma and Yindjibarndi Traditional Owners. Photo by Ross Kermode.
Mount Herbert. Photo by Cliff Winfield.
Crossing Pool (*Murlunmunjurna*). Photo by Clare Atkins.

THE DREAMING: WHEN THE WORLD WAS SOFT

Ngurra Nyujung Gamu

Balamu Yindjibarndi Ngardangarli wanggarnmarda Ngurra Nyujung Gamu ngurra nhaa nhantharriyarndu barna matha Minkarla nhurnu matha manggunha marawayi bathamanha ngurrayu waramarna warndangarli marndangarli wundungarli gagingarli bajarrimijarnu nhungula nhantharriyarndu Yindjibarndiyarndu ngurrarngga.

Minkarla waramarna Marrga wangganha nyinda barni nhungula ngurrangga barni nyinda nhungula ngurrawarndrala banggarri ngunhu nyinda nhaningarli Minkarla waramarna nyinda barni nyambali ngurra nhurnu nyinda mirda jajamagayi ganyjanma waba
Marrga barna nhungu ngurrangga barra banggarrinha Ngardangarli waramarna wantharna nyambali yala nyinda nhuwayi Ngardangarli nhurnu nyambali.

Burndud jawi Jarlurra wanggamijarnu yala Ngardangarli ganyjagu. Burndud Minkala nyunkurna Yindjibarndi Birdirra wantharna Bilinbilin Ganyiyanha Marrga banggarrinha Minkala wangga wirndarna mani Marrgangarli mankunha birdawumanha yala nhaa Birdirra Yindjibarndi nyambali.

Marrga ngunhula ngurrangga yala Ngardangarli nhuwayi marndangarlingga ngurrawarndrala Ngardangarli banggarri wuthurrumagayi ngurrayiyu mirdawarlu Ngarda ngunha jiniyarri Marrga ngunhagu mankarn mundagayi.

Ngurra ganagarrinha nyinku bulurrmagayi mirda nhantharri nhanimagayi!
Country, we've come to visit, don't harm us!

When the World was Soft

In *Ngarda* Yindjibarndi beliefs, in the Dreaming - When the World was Soft (*Ngurra Nyujung Gamu)*, everything was like wet cement. The Sky God (*Minkala*) and his first creation of man, (the *Marrgangarli)*, together shaped this country. The Yindjibarndi Elders, through their stories, describe the land being created and shaped when it was soft. *Minkala* and the *Marrgangarli* moulded this clay into a masterpiece, a sculpture that symbolises *Ngurra*, the homelands of the *Ngardangarli*, their rich culture, their strong values, and their fundamental ways of life which have enabled their survival over countless millennia. The Indigenous people's *(Ngardangarli*) connection to this land, its inherent elements and images, is demonstrated, reinforced and reproduced through the songs, stories, culture, traditions, language, actions and customs, taught by the Elders. Each element of flora, fauna, traditions, language, cultural heritage and landscape are incorporated and interconnected, with this knowledge network being the key to *Ngarda* survival. This complex web of understanding, tradition, communication and action, describes the contemporary social reality of Yindjibarndi people today, contributing to and supporting their special and unique personal and collective identity.

In Yindjibarndi customs, the *Marrga* are the first beings of this country, and the *Ngardangarli* are descendants of the *Marrga*.

In Yindjibarndi Law it is said that in the beginning the sky was very low. When the creation spirits got up from the ground, they lifted the sky and the world out of the sea. The creation spirits are called *Marrga* and they still live in the rocky mountains and gullies. In the early morning, the mist over the water represents smoke from their breakfast fires.
{Reference: Know the Song Know the Country}

High up in the tableland[1], the Fortescue River (*Yarnda Nyirranha*) runs like a spine through the heart of Yindjibarndi tribal country. The river is a living force in the lives of Indigenous people all over the Pilbara today. Rising in the Western Desert, it travels through the country of five tribes to the Indian Ocean.

Its middle and lower reaches within Yindjibarndi territory are at the centre of the Law and creation. This country is literally a holy land whose myths and law reverberate across tribal boundaries throughout the Pilbara and cross the Central Australian deserts to reach as far as Uluru.

The Dreaming determines all relationships with every creature on the land and influences everyday life. It connects people to the spirit world and is maintained through honour, preservation, celebration and ceremony.

Before *Ngarda,* the *Marrga* occupied these lands, freely moving from location to location designing the environment as we see it today and leaving behind petroglyphs marking early flora and fauna. The *Marrga* images in the petroglyphs are reflections of themselves, and are still apparent even to this day. Yindjibarndi people believed that the *Marrga* men and women stood tall and were shaped like the praying mantis, which is also called *Marrga* in the Yindjibarndi language. If *Marrga* are not approached and spoken to in the proper manner, they become angry. Elders believe they can still hurt people or make them sick if the right *Ngarda* ways are not practised.

The Dreaming - When the World was Soft (*Ngurra Nyujung Gamu)* and the Dreamtime stories provide the fundamental basis for the ways that Yindjibarndi (*Ngardangarli*) conduct themselves. These rules apply to all aspects of relationships between men, women and children, and are the rules of governance that apply to all Yindjibarndi *Ngarda* laws encompassing land, country, environment, plants, animals, culture and tradition. These laws of governance remain intact and alive today. It was the *Marrga* with *Minkala* that named and shaped the country, then all the birds and animals, and finally the Indigenous people (*Ngardangarli*) came from the *Marrga* too. It is also said that before *Ngardangarli,* birds of all spectrums were the country's caretakers of language, Law and culture. Through them our relationship structures are taught to the Yindjibarndi by the events and tales of the Dreaming, where birds played out the first tribulations before Indigenous people's (*Ngardangarliyarndu*) existence.

In our relationship system, it is forbidden to speak, make eye contact or be in the same space with our mother in-laws. Our skin system (*Galharra*) governs *Ngardangarli* men and women in obeying these strict *Ngarda* relationship laws.

[1]The Chichester tablelands are an area of broad tablelands that lie behind the crest of the Chichester escarpment. These tablelands slope gently to the south, until they runs into the Hamersley Range (see Section 15 – *Geology, Landforms and Soils*).

THE STORY OF THE WARLU

Barrimirndi Travelling up the Fortescue River (*Yarnda Nyirranha*)

Balamu ngurranyujungamu Barrimirndi ganagarrinha baya birdawangungu guwayiyarra ngarrgunha Barrimirndiyarndu thalu gurdarnkurdarn Miyanhangunalangu.Barrimirndi barndinha gurdarnkurdarn gambangarlingu banggarrinha baya wundungarli barni wirndarnu. Barrimirndi bula gabranha Wirrawarndinha ngunhala gabranha mujimarna.

Wirrawarndinha nhuna banggarrinha Wuyumarri, Wuyumarrinha Barrimirndi ngunhungga gabranha Ngarrarnkarri buyawarrinha Ngarrarnkarri yindamarna.

Ngarrarnkarrilangu banggarri ngunha gabranha Jindawurrunha mirdawarlu bandayinha Ngardangarli. Garlinyjarrinha waramarna Gumarnu yinda.

Gumangunhanungu banggarrinha Yandiwurrunha mirdawarlu bandayinha Yandiwurrunha yindamarna.

Yandiwurrunha banggarrinha Marlimadurnkanha yindamarna Marlimadurnkanha barnha nhuna wayarringu birdawangu guwayiyarra.

Marlimadurnkanha ngunha banggarinha Marlanggunha bangarrinha ngurra thurnungga gabranha Biigunula waramarna guwayiyarra mujingarli.

Biigun banggarrinha Marduyambulangu, Marduyambulanha ngunha yindamarna Marduyambulanha Barrimirndi gabranha Milingunha.

Milingunha banggarrinha wirndarnu wunduyu yindamagu Barrimirndi Bagumarringunha waramarna banggarrinha Jirndawurrunha bala ngunha wirndanha.

Jirndawurrunha ngunha banggarrinha wayarringu, wayarringu yindamarna ngunhu mardarrga ngurra.

Miyanha Barrimirndi barndayinha guwayiyarra birdawangu gabranha baiya munyjurna thumbungga Barrimirndiyarndu. Ngardangarli barna ngayiingu wirndarnujanku marda biijarringu buduwungga Ngardangarliyarndu. Jujungarli, jardangarli manku marnda warnbirnujarnku buya. Barrimirndi bayiyarrinha ngardimu gabranha munyjunha jurluwarlu Ngardangarli ngunhangga Ngangganhunala nyindawa yala.

Long ago, a sea serpent became angry with two boys. That was at *Miyanha*. Two novices had eaten a *Gurdarnkurdarn* parrot. The serpent smelled it in the sea and came out from the wild. It came from the north and made a deep trench in the land, digging it halfway, and came on along the river from the north. He cut off these two halves by making waterholes beginning at the edge, and cut open *Wirrajanha*, went to *Wuyumarri* and made *Wuyumarri* Pool. After being underground there, he rose toward *Ngarrarnkarri*, making that a pool too. Again going underground, we went to *Yandiwurrunha*. No one there, so he came back. Back again, he made *Guma* Pool. From *Guma*, he went on again to *Yandiwurrunha* and made a pool there. After he made *Marlimadurnkanha* Pool, he went underground close to *Marlimadurnkanha* and went near *Malany*. Again he went underground from *Malany*, and, being further around, he dug out *Niyali* and made the two *Birgun* pools. And he came to *Marduyambalanha* and made *Marduyambalanha* Pool. Going underground from there, he went somewhere near *Mirlingunha*. No one was there at *Mirlingunha*, so he came back. Again he dug at *Bargumarriguna* and cut *Bargumarrigunha* open and went from there near *Jindawurrinanha*, making *Jindawurrinanha* a pool. He went underground at *Jindawurrinanha*, but he returned to where the red ochre edge is, being underground close by from there, and made a pool in the red ochre.
Southward, where the stone is swallowed and the foam forms, he got the boys. He took them up on top of a whirlwind at *Miyanha*. The serpent got them and swallowed them. This land had no water before he got the two boys and swallowed them. Just before he swallowed them the people cried and cried. Using a stick, they tried to get into the serpent to get the boys out, but they couldn't reach. They returned to their camp by the river crying out, a big crowd. That was too much for the serpent, so he buried them in a flood of water. Finished! All drowned! He's in the water now, which fills the whole trench. We call it *yinda*.

Story by Wimiya King

PREFACE

The Millstream Chichester National Park and the Mungaroona Range Nature Reserve are important cultural, natural and recreation values in the Pilbara. The Millstream aquifer supports ecologically significant and unique wetlands in the Millstream Chichester National Park, which provide habitat for a diverse range of flora and fauna, many endemic to the Pilbara. In addition, the Millstream area has very significant Indigenous cultural values and is part of one of the most important Indigenous cultural areas in Western Australia.

In conjunction with the Harding Dam, Millstream is also very important as a source of public water supply for the Pilbara towns of Karratha, Dampier, Roebourne, Wickham and Point Samson, and nearby industrial development. The underground water supply at Millstream is the same source which maintains the permanent springs and associated wetland ecosystems along the Fortescue River (*Yarnda Nyirranha*). The management prescriptions in this plan provide for protection of the planning area's significant natural and cultural values.

The planning area has very significant cultural values for the Yindjibarndi and Ngarluma people and is part of the tribal country for people of these two different language groups. The Millstream Chichester area is one of the most, if not the most significant Indigenous cultural and mythological sites of importance in northern Western Australia (Rijavec *et al.* 2005). Not only does the area contain numerous Indigenous, cultural heritage sites, Millstream is the home of the mythological serpent or Warlu, whose presence is still strongly felt at Deep Reach Pool (*Nhanggangunha*) (See *The Story of the Warlu*). Yindjibarndi and Ngarluma people come to the planning area to spend time on country and to carry out customary activities. The importance of the planning area for Yindjibarndi and Ngarluma people is recognised in this management plan and is a central component to many of the objectives and strategies outlined within it. There is a particular focus on providing for the involvement of Indigenous peoples in the management of the planning area and this is achieved through the Millstream Park Council (see Section 8 – *Management Arrangements with Indigenous People*). The plan is consistent with Government endeavours to give practical recognition to the need for Indigenous peoples to practice their culture (including caring for country) and protect heritage sites. Strategies to ensure that this can happen consistent with Government policy have been incorporated into this management plan.

This management plan is for the Millstream Chichester National Park and Mungaroona Range Nature Reserve and has been prepared by the Department of Environment and Conservation ('the Department') on behalf of the Conservation Commission, a community-based body established under the *Conservation and Land Management Act 1984* (CALM Act). In this case, the management plan was also prepared collaboratively with the Traditional Owners of the Millstream area. The Conservation Commission issues draft plans (for terrestrial conservation reserves vested in it) for public comment and provides final plans for approval by the Minister for Environment.

The CALM Act specifies that a management plan must contain:

- a statement of the policies or guidelines proposed to be followed; and
- a summary of operations proposed to be undertaken.

In accordance with section 55 of the CALM Act, the term of the final management plan will be 10 years, or until the plan is superseded by a new management plan.

The Millstream Chichester National Park, the additions to the park proposed in this management plan and the Mungaroona Range collectively are known as "the planning area". However, there are many instances in this management plan where management differs between the Millstream Chichester National Park and the Mungaroona Range Nature Reserve. In these cases, either the park or the reserve is referred to specifically. The Department and the Conservation Commission understand that effective management of the Millstream Chichester National Park and Mungaroona Range Nature Reserve depends on the support, cooperation and participation of the community, and therefore seek to ensure that there is ample opportunity for the community to be involved – both in the preparation of the management plan as well as the ongoing management of the planning area. By working together we can provide for the continued wise use of the planning area whilst ensuring that future generations also have opportunities to appreciate the values of this special area.

Proposals in this management plan have also been developed by taking into consideration comments received from the community and key stakeholders during preparation of the draft plan. This included submissions received during the development of the draft management plan, meetings with stakeholders and feedback from community meetings and displays.

The management planning process provides the Department and Conservation Commission with a valuable opportunity to become better informed about the range of public and stakeholder views and to make decisions that are more sensitive and responsive to public concerns. This process will however, invariably reveal a wide variety of competing interests and opinions. In these circumstances, the Conservation Commission and Department are guided by the need to ensure that the key conservation, cultural and recreation values of the planning area are protected so that they may be appreciated and enjoyed by both present and future generations – other interests can only be accommodated if this can be done without compromising the primary purpose for which the area has been reserved.

The Conservation Commission and Department will seek to achieve the plan's objectives by taking the actions specified. Improvements in management are planned through adaptive management strategies built into the document. The Department and Commission are committed to the implementation of the plan, although priorities for the implementation of all actions will depend, to some extent, on the provision of necessary funds. Reports by the Conservation Commission on the implementation of the plan will make it clear if any actions have not been progressed and for what reasons.

Whilst the Department is responsible for the day-to-day management of the planning area under the CALM Act, it recognises that partnerships with the community are integral to doing this effectively. Ongoing community involvement, in particular with the Traditional Owners in the management of the planning area, will be vital. To this end, the plan provides for education and public participation programs to raise community awareness, understanding and cooperation with management.

NOMENCLATURE

Inclusion of a name in this publication does not imply its approval by the relevant nomenclature authority. The meanings of abbreviations and general terms used throughout this plan are given below. A glossary of technical terms and phrases is provided on page 163.

The term **'Director General'** refers to the Director General of the Department of Environment and Conservation. References in this plan to the "Director General" are references to the "CEO" as defined in section 3 of the CALM Act.

The **'Minister'** refers to the Minister for Environment administering the CALM Act.

The **'Department'** or 'DEC' refers to the Department of Environment and Conservation, the agency responsible for managing areas declared under the CALM Act and species under the *Wildlife Conservation Act 1950*.

The **'Conservation Commission'** refers to the Conservation Commission of Western Australia, which is the controlling body for the terrestrial conservation reserve system in Western Australia.

The **'planning area'** refers to the existing and proposed Crown lands that will be covered by this management plan.

The **'park'** refers to the Millstream Chichester National Park. Some parts of the plan only relate to the Millstream Chichester National Park. In these cases, the park is referred to specifically.

The **'reserve'** refers to the Mungaroona Range Nature Reserve. Some parts of the plan only relate to the Mungaroona Range Nature Reserve. In these cases, the reserve is referred to specifically.

The **'region'** refers to the Department of Environment and Conservation's Pilbara Region.

The **'Park Council'** refers to the Millstream Park Council. Joint management between the Department and the Yindjibarndi and Ngarluma community of the Millstream Chichester National Park is facilitated through the Park Council. This group is comprised of 10 Yindjibarndi members and 2 Ngarluma members (see Section 8 – *Management Arrangements with Indigenous People*).

Throughout this plan and where they are known, the Yindjibarndi and Ngarluma place names and names of flora and fauna are used. The English name, place or species name is given first, with the Yindjibarndi or Ngarluma name given second in brackets and in italics. Where a common name and species name is known, the English common name is given first, followed by the Yindjibarndi or Ngarluma name in brackets, then the species name, with both being in italics. Yindjibarndi and Ngarluma place names can be spelt in numerous ways. These spellings should be seen to encompass all other spellings. A glossary of Yindjibarndi and Ngarluma terms used in this management plan is provided on page 161, together with a pronunciation guide.

ACKNOWLEDGMENTS

This management plan was prepared by the planning team for the Millstream Chichester National Park and Mungaroona Range Nature Reserve; its vision, direction and strategies to care for country would not have been possible without the input of past and present Millstream Park Council members; Maudie Jerrold, Jill Tucker, Jimmy Horace, Bruce Monadee, Bruce Woodley, Dora Solomon, Joyce Hubert, Lyn Cheedy, Rosie Cheedy, Sylvia Allen, Ricky Smith, Trevor Solomon, Berry Malcom, Aileen Sandy, Joyce Hubert and Geraldine Jenkins. Numerous other Indigenous community representatives and representatives from the Department also took part in Park Council meetings in some capacity either as proxies, observers or guests and their input is appreciated.

The planning team comprised; Clare Atkins (Planning Officer and management plan coordinator); Cliff Winfield (Regional Leader; Parks and Visitor Services, Pilbara Region); Geoff Passmore (Operations Officer; Pilbara Region); Peter Kendrick (Regional Leader, Nature Conservation; Pilbara Region) and Scott Godley (Acting Senior Ranger, Millstream Chichester National Park).

Comment and advice during the preparation of this management plan was provided by:

- other Pilbara Regional staff – in particular Judymae Napier, Vicki Winfield and Ken Sandy;
- past Departmental staff associated with the planning area and the planning process – Chris Muller, Ian Walker, Dave Whitelaw, Stephen White, Stephen Van Leeuwen, Simon Watkin, Ross Kermode, Shawn Councillor, Chris Portlock, Craig Faulkner Geoff Kregor, Russell Asplund, Jamie Birnie, Jack Green and Simon Kilbane;
- other Departmental staff – in particular Daryl Moncrieff, Paul McCluskey and Aaron Rivers;
- specialist branches within the Department;
- the Department's Corporate Executive;
- the former Department of Environment (DoE) **–** in particular Ross Doherty and Jeff Kite;
- the Department of Water (DoW) – in particular Darryl Abbott;
- the Water Corporation; and
- members of the Conservation Commission of Western Australia

Many individuals and organisations - Government and non-Government - have contributed to the plan, and their assistance is also acknowledged.

Particular thanks to all members of the Pilbara Native Title Service and the Roebourne community who attended Park Council meetings in Roebourne, Karratha and at Millstream, providing valuable input to the plan as well as considering various drafts of the plan. Special thanks must also be given to the Juluwarlu Aboriginal Corporation for providing Yindjibarndi translations of "When the World as Soft" and "The Story of the Warlu".

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PART A. INTRODUCTION

1. BRIEF OVERVIEW

The Millstream Chichester National Park is located in Western Australia's North West in the Pilbara, some 150 kilometres by road south of Karratha. Mungaroona Range Nature Reserve lies about 100 kilometres east of Millstream (see Map 1). The initial gazettal of the Millstream area as a wildlife sanctuary occurred in 1956, acknowledging its values and need for protection. The park's unusual and outstanding scenic and natural values are also recognised by its listing on the Register of the National Estate.

The Millstream Chichester National Park and Mungaroona Range Nature Reserve are important regionally for their natural and cultural values. The Millstream Chichester National Park contains unique wetlands of important natural value and, with the associated aquifer, supports a high diversity of flora and fauna. These wetlands are nationally significant and the Department supports the nomination for listing under the Convention on Wetlands (Ramsar Convention). In addition, the Millstream wetlands hold very significant Indigenous cultural values and, for Yindjibarndi and Ngarluma people, are part of one of the most important Indigenous cultural areas in Western Australia. Sensitive planning is essential to maintain the long-term integrity of the area's natural and cultural heritage.

Along with the Harding Dam, the Millstream aquifer is important as a public drinking water supply for the Pilbara towns of Karratha, Dampier, Roebourne, Wickham and Point Samson, and nearby industrial development. There are existing legal rights associated with the extraction of water from the Millstream aquifer and the planning area needs to be managed within the constraints of these rights. The underground water supply at Millstream is the same source that maintains the permanent springs and associated wetland ecosystems along the Fortescue River (*Yarnda Nyirranha*). Effective management is therefore essential.

The planning area is managed by the Department through the Pilbara Region's Karratha office. The Department has resident staff located at Millstream.

2. REGIONAL CONTEXT

The Millstream Chichester National Park and Mungaroona Range Nature Reserve are located in the Pilbara region of the Department of Environment and Conservation. It is also part of the Western Australian Planning Commission's (WAPC) Pilbara Region.

The Pilbara comprises a variety of natural features from escarpments and plateaus, alluvial, granite and basalt plains. Hummock grasslands, acacia forests and woodlands dominate the vegetation of the region and there are smaller areas of acacia shrublands, tussock grasslands, salt marshes, mangroves and eucalypt woodlands along watercourses. The planning area falls within the Fortescue, Chichester and Roebourne subregions of the Pilbara Craton Bioregion (Environment Australia 2001b).

The Pilbara contains rich Indigenous culture. Indigenous people have been living in the Pilbara for up to 25 000 years and by 4000 years ago; much of the region was either inhabited or traversed. Tindale (1974) recognised nearly 30 language groups in the Pilbara and more recent examination of Indigenous communities suggests this is around 33. The planning area lies in both Yindjibarndi and Ngarluma country and is of considerable cultural significance to Indigenous people, being seen as one of the most significant Indigenous cultural and mythological sites of importance in Western Australia, possibly Australia (Rijavec *et al.* 2005). This stems from thousands of years of occupation, and Millstream being the home of the mythological serpent or Warlu, whose presence is still strongly felt at Deep Reach Pool (*Nhanggangunha*). Other significant language groups in the region include Banjima, Gurrama, Panyjima, Kurrana and Yinhawangka. Other parts of the Pilbara are also of cultural importance to Indigenous people, with the Burrup Peninsula being one of the most abundant, oldest and diverse sites in the world for petroglyphs and the Abydos Plain to the north of the Chichester Ranges containing an abundance of rock engravings on granite outcrops. There are also numerous habitation sites and stone structures scattered throughout the region.

Land use around the planning area is diverse and includes mining and petroleum industries, pastoralism, tourism and Indigenous occupation. Mining and petroleum are the most significant industries for the region, with oil and petroleum production, iron ore, LPG, LNG and natural gas production being the largest contributors to the

Pilbara economy (Pilbara Development Commission 2006). Gold and other minerals are also products of the Pilbara. The region contains Australia's largest ports, longest private railway and largest iron-ore and petroleum production areas. The growth of the mining, petroleum and gas industries in the area, especially on the Burrup Peninsula, is likely to be associated with increased demands for water for industrial use, which could place greater pressure on water sources in the Pilbara. This may, in turn, place greater pressure on water extraction from the Millstream aquifer. In addition, the presence of rail, road and pipeline corridors through the Millstream Chichester National Park, some of these associated with the mining industry may lead to continued impact from weeds, introduced animals and fire on the park. Management of these threats along infrastructure corridors will be imperative to protect the natural and cultural values of the Millstream Chichester National Park.

The vast resource sector coexists with iconic cultural and natural values such as Western Australia's largest and second largest national parks, Karlamilyi (Rudall River) and Karijini National Parks, the Montebello and Barrow Islands and the Dampier Archipelago to name a few. As well as Millstream Chichester National Park, Karijini National Park is the other major nature-based attraction in the region. This park contains dramatic gorges and Western Australia's two highest peaks, Mount Bruce and Mount Meharry. The Dampier Archipelago consists of 42 islands, some of which are used by visitors for fishing, diving and camping. Recreational activities in the region have a strong nature-based and remote focus (Western Australian Tourism Commission 2003). Tourism contributed $225.9 million towards the economy of the region in 2004/05 and attracted an estimated 339,000 visitors (Pilbara Development Commission 2006). The region offers a variety of recreational opportunities. The mining industry in the region has created a tourist attraction in itself, with many visiting the port in Dampier, the gas project on the Burrup Peninsula and the iron ore mines at Newman and Tom Price. The towns of Cossack, Roebourne and Marble Bar have an interesting non-Indigenous cultural heritage.

The Pilbara Region comprises four local government areas including the Shires of Ashburton, East Pilbara, Roebourne and the Town of Port Hedland. All of the Millstream Chichester National Park lies within the Shire of Ashburton. This Shire covers over 10 million hectares and includes the major towns of Tom Price, Parraburdoo, Onslow and Pannawonica. Indigenous communities include Bellary Springs, Ngurrawaana, Wakaathuni, Yathalla and Youngaleena Banjima. All of the Mungaroona Range Nature Reserve lies within the Town of Port Hedland (see Map 1).

Overall, the Pilbara contains a sparse population. In 2005, this was 39,282, making up 2.0 percent of the State's population. Population growth in the Region was considerable in the 1980s due to the expansion of mining and construction infrastructure, but declines in the 1990s were due to reduced employment associated with the mining industry and the introduction of fly-in, fly-out schedules. Population growth is likely in the future with the commencement of new resource projects. Improved access through the region is likely with the construction of a sealed highway between Karratha and Tom Price and passing through the Millstream Chichester National Park.

3. PLANNING AREA

The management plan area consists of existing conservation reserves and proposed conservation reserve additions including:

- Millstream Chichester National Park, which is made up of three 'class A' reserves, totalling 238,497 hectares;
- Mungaroona Range Nature Reserve which is a 'class A' reserve of 105,842 hectares (see Map 2).

Both these reserves total 344,339 ha and the total planning area (including proposed reserve additions) is 438,007 hectares.

4. KEY VALUES

Maintaining the key values of the lands vested in the Conservation Commission will be the major focus of this management plan. Some of the key values of the planning area include:

Natural Values

- A significant wetland ecosystem, which provides habitat for a wide range of flora and fauna species.
- A subterranean aquifer, providing habitat for significant aquatic stygofauna.
- Ancient geological landforms including stromatolite fossils near Mount Herbert.

- Remote qualities of the area and the opportunity to create wilderness areas under the CALM Act.
- The location of dynamic river capture on the Fortescue River.

Cultural Values

- One of the most significant Indigenous cultural and mythological sites of importance in WA and possibly Australia.
- An important place for use by Traditional Owners for cultural activities and ceremonies.
- An important place for non-Indigenous cultural heritage, with old buildings, stockyards, wells and stock routes.

Recreational Values

- Intact and varied landscape of high scenic quality ranging from arid rangelands to large open pools on the Fortescue River (*Yarnda Nyirranha*).
- An environment that provides a wide range of landscapes and caters for a diversity of experiences such as swimming, camping, canoeing, sightseeing, bushwalking, wildflower viewing, bird-watching and photography.

Commercial Values

- Natural and cultural values which attract nature-based tourism and contribute to regional expenditure (approximately $225.9 million a year in revenue is generated by visitors to the Pilbara Region who would have visited natural areas and participated in nature-based activities [Pilbara Development Commission 2006]).
- The Millstream aquifer is an important source of drinking and industrial water in the Pilbara.

Educational and Research Values

- Research opportunities to increase knowledge associated with ground and surface water hydrological process, vegetation health and distribution, species of flora and fauna, their ecosystems, threatened ecological communities, archaeological, ethnographic and other cultural research.
- An extensive range of educational and interpretation opportunities in the Millstream Chichester National Park that describe elements of the geology, flora and fauna, Indigenous cultural heritage, wetlands and their significance and the Department's management of the area.

Community Values

- An opportunity to engage with Indigenous people and consider their aspirations in the management of the planning area and to implement meaningful joint management with Indigenous people.
- Opportunities to interpret the values of the planning area and to educate the community about their significance.
- Opportunities to work with the community and stakeholders to encourage greater involvement in the management of the planning area.

5. PUBLIC PARTICIPATION

The Millstream Chichester National Park attracts around 20,000 visitors each year, and holds special interest for Indigenous people, conservation and recreation groups, the tourism industry and water supply interest groups. All attempts have been made to address the full scope of public interests in the Millstream Chichester National Park and Mungaroona Range Nature Reserve in preparing this management plan.

A draft plan was developed in consultation with the local community, visitors to the planning area and other interested parties in the following ways:

- a planning team comprising representatives from the Yindjibarndi and Ngarluma community, the then Water and Rivers Commission, the Water Corporation and the Department was formed and regular meetings were held;
- public submissions were invited through State and local newspapers and the Department's website during the preparation of the draft management plan and submissions from a number of groups and individuals were received;
- discussions were held with interested individuals, groups and stakeholders;

- talks were given to interested groups and subsequent comments received;
- local, State and Commonwealth Government officers were consulted;
- facilitating community group and individual contributions; and
- public meetings held in Karratha and in Roebourne. Key issues raised by stakeholders during this process included:
  - joint management with Indigenous people;
  - camping and living areas for Indigenous people;
  - Indigenous cultural tourism;
  - protection of special Indigenous sites;
  - allowing traditional hunting;
  - the need for biological survey of the Millstream Chichester National Park;
  - the need for increased funding for management;
  - the need for a comprehensive monitoring plan;
  - weed management; and
  - water source protection.

The Millstream Park Council was established in early 2003. Since then, regular meetings of the Park Council have been held to discuss the joint management and the strong involvement of the Yindjibarndi and Ngarluma community in all aspects of management of the planning area.

In addition to regular meetings of the Millstream Park Council, consultation with the local community, visitors to the planning area and other interested stakeholders has occurred in the following ways:

- visitor surveys were conducted in the Millstream Chichester National Park;
- discussions were held with interested individuals, groups and stakeholders;
- shopping centre displays were held in Karratha;
- the Millstream Park Council produced a DVD highlighting the cultural connection to country and show casing the amazing landscape of the Millstream Chichester National Park. This was distributed to Ministers, Government agencies, organisations and the local community across the region and State; and
- *An Ancient Land, a Living Culture* presentation communicated the vision and key directions for the Millstream Chichester National Park across the Pilbara region to a range of audiences.

The draft management plan was released in October 2007 and public submissions were invited through State and local newspapers and the Department's website for a two-month public comment period. The submissions received during the public comment period were analysed and considered in the preparation of the final management plan.

PART B. MANAGEMENT DIRECTIONS AND PURPOSE

6. VISION

The vision for the planning area is that;

By 2021, the Millstream Chichester National Park and Mungaroona Range Nature Reserve will have greater recognition by the local and broader community, visitors and others of its important cultural and mythological significance for the Yindjibarndi and Ngarluma Traditional Owners. The Indigenous heritage of the planning area will be preserved by the ongoing involvement of the Traditional Owners, who will have a critical and active role in jointly managing the cultural and natural values of the planning area.

The significant wetland ecosystem and other natural values of the planning area will be in better condition than at present and the subterranean aquifer will remain in its current healthy condition. This will have been achieved through efforts focused on effective weed control, restoring the resilience of the natural ecosystems and improved management of water extraction from the aquifer, through monitoring, research and adaptive management. In particular, those values that are not found or are uncommon elsewhere will have been conserved, and their special conservation significance will be recognised by the local and broader community and visitors.

The planning area will continue to support a wide range of nature-based recreational activities with a focus on preserving the natural character of the region and its wilderness qualities including its rangeland landscapes and open pools of the Fortescue River. The local and broader community will identify with the planning area and recognise that its natural, cultural and recreational values are of national significance. An increasing number will support and want to be involved in its ongoing management.

The vision of this plan is derived from State legislation and policy and community input. The vision also reflects the key values of the planning area and the importance of sustainably managing those values (see Section 4 - Key Values).

7. LEGISLATIVE FRAMEWORK

Planning for conservation reserves occurs at a number of levels. Management plans are a part of a broad suite of planning undertaken by the relevant managing agencies. Management plans are guided by legislation and policy and in turn provide guidance for subsidiary management documents such as fire response plans, weed and feral animal control plans and recreation site development plans.

Legislation and Policy

National parks and nature reserves are vested in the Conservation Commission and managed by the Department according to the CALM Act and associated regulations. Sections 54-56 of the Act specify that:

- the Commission is responsible for the preparation of management plans, through the Department, for all land vested in it;
- a management plan must contain a statement of policies or guidelines to be followed in the management of the area, and a summary of the operations proposed to be taken over the life of the plan;
- a management plan for a national park shall be designed to "…*fulfil so much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest"*.

Each plan is periodically subject to assessment by the Conservation Commission (section 19 of the CALM Act) and remains in force until such time as a new plan is prepared. The procedure to make an amendment to a gazetted management plan is governed by section 61 of the CALM Act and involves a public consultation process.

The CALM Act also covers such matters as defining categories of lands and waters managed by the Department, establishing and defining the functions of the Department and the controlling bodies, management planning and auditing, permits, licences, contracts, leases, offences and enforcement.

The Department is responsible for administration of the *Wildlife Conservation Act 1950* (Wildlife Conservation Act) and associated regulations for the conservation and protection of indigenous flora and fauna on all lands and waters within the State.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) contains provisions relating to the protection of nationally-listed threatened species and ecological communities, listing of key threatening processes, heritage protection and also applies to areas that become listed under the Ramsar Convention on Wetlands.

The *Environmental Protection Act 1986* (Environmental Protection Act) provides for protection of the environment across the State. The Act provides for the development of Environmental Protection Policies and the assessment of development proposals and planning schemes for potential environmental impacts. Significant development proposals within the planning area (e.g. mining, significant water extraction and utilities/services development proposals) may be referred to the EPA.

This management plan is required to conform to the *Bush Fires Act 1954* and satisfy the Fire and Emergency Services Authority (FESA) that adequate fire protection will be provided for in the conservation reserves (see Section 22 – *Fire*). Under section 34(1a)(a) of that Act, the management plan requires approval from FESA.

Activities within the planning area that occur within the Public Drinking Water Source Areas (see Section 37 – *Water Extraction*) need to be consistent with the *Country Areas Water Supply Act 1947* (CAWS Act) and associated by-laws and regulations.

Under the *Aboriginal Heritage Act 1972*, the Department is required to report Indigenous heritage sites to the Trustees and ensure that sites are protected. The Commonwealth *Native Title Act 1993*, amongst other things, requires that native title claimants and representative bodies are advised when a management plan is being prepared or major public works undertaken. The Pilbara Native Title Service (PNTS), which is part of the Yamatji Marlpa Barna Baba Maaja Aboriginal Corporation (Yamatji Land and Sea Council) is the native title representative body for the planning area and have a number of functions prescribed under the Native Title Act.

The CALM Act does not derogate any of the powers of the *Mining Act* 1978, the *Petroleum and Geothermal Energy Resources Act 1967* or any other Act relating to minerals or petroleum, or any Government agreement within the meaning of the *Government Agreements Act 1979* (see Section 34 – *Mineral and Petroleum Exploration and Development*).

The Department's management is guided by a number of policy statements, administrative instructions and circulars. The relevant policies are highlighted throughout the plan as appropriate.

The Millstream Park Council (see Section 8 – *Management Arrangements with Aboriginal People*) is established to ensure that the Traditional Owners have input into the management of the planning area, and can provide advice directly to the Minister. The Conservation Commission and the Park Council may advise the Minister on matters relating to the management of the planning area.

Land Classification

A strategy for the conservation of natural and cultural values and the facilitation of sustainable resource use is the implementation of a land classification scheme to designate appropriate levels and types of use and access. Areas of land managed by the Department can be classified under section 62(1) of the CALM Act to establish the following land classifications to which specific management prescriptions or regulations apply:

- wilderness area;
- prohibited area;
- limited access area;
- temporary control area;
- forest conservation area;
- recreation area for purpose specified in the notice; or

- such other class of area as the Minister, on recommendation of the Conservation Commission, thinks necessary to give effect to the object of this area.

Areas within the planning area that meet wilderness criteria (as defined in the Department's *Policy Statement 62 – Identification and Management of Wilderness and Surrounding Areas* [CALM 2004]) have been identified in Map 5. It is proposed that all of the Mungaroona Range Nature Reserve will be gazetted as wilderness under the CALM Act (see Section 13 – *Wilderness*).

Obligations and Agreements

Australia is a participant or signatory to a number of important international conservation agreements and some of these affect management of the planning area. These include the following:

Convention on Biological Diversity (the Rio Convention)

The Rio Convention dates from 1992 when the United Nations Conference on Environment and Development (also known as the "Rio Earth Summit") was held in Brazil. The *National Strategy for the Conservation of Australia's Biological Diversity* was adopted in 1996 as the principal means for co-ordinated implementation of the convention in Australia. Its main goal is to protect biological diversity and maintain ecological processes and systems. To address this goal, there have been a number of significant changes to policy and legislation for biodiversity conservation in Australia to strengthen regulatory and institutional mechanisms. This includes the Commonwealth's EPBC Act and the 'Caring for our Country' programs.

Convention on Wetlands of International Importance (Ramsar Convention)

The 'Convention on Wetlands' (more commonly known as the Ramsar Convention) is an intergovernmental treaty dedicated to the conservation and wise use of wetlands. It encourages contracting parties to designate sites containing representative, rare or unique wetland types, or that are important for conserving biological diversity (Ramsar sites). These sites need to be managed to ensure their special natural values are maintained or improved. Australia became a Contracting Party in 1974.

Currently there are no Ramsar listed wetlands within the planning area. However during the life of this plan, the Department will propose nomination of the Millstream pools in the Millstream Chichester National Park to be considered for listing under the Ramsar Convention. The Millstream Pools are likely to meet six of the possible nine criteria.

National Wetlands Program

The National Wetlands Program was established in 1989 in response to growing concern for wetland conservation in Australia. Its establishment recognised the need to act more strategically and co-operatively with State and Territory governments in implementing Australia's obligations under the Ramsar Convention, JAMBA and CAMBA. The National Wetlands Program now incorporates the Migratory Waterbird Program.

The third edition of the *Directory of Important Wetlands in Australia* (Environment Australia 2001a) lists 851 sites as being nationally important. Within the planning area, the Millstream Pools are listed as an Important Wetland, being an excellent example of a system of permanent river pools and springs in the semi-arid tropics. The Millstream Pools represent a significant isolated area of habitat for wetland flora and fauna, some of which does not occur or is rare elsewhere in north-western Australia (Environment Australia 2001a).

National Wild Rivers Project

The Wild Rivers[2] Project commenced in 1993 in response to concern about the rapid change in Australia's rivers caused by human impacts. Environment Australia initially identified all of Australia's 'wild' rivers with the Department now implementing, in conjunction with a broad range of agencies, steps to encourage protection and proper management of these rivers.

[2] 'Wild' rivers are defined "those rivers which are undisturbed by the impacts of modern technological society. They remain undammed and exist in catchments where biological and hydrological processes continue without significant disturbance. They occur in a variety of landscapes, and may be permanent, seasonal or dry watercourses which flow only occasionally."

Approximately 26 wild rivers have been identified in Western Australia (V Klemm, pers. comm. 2004). These are recognised as near pristine waterways and catchments ('Wild River' systems) and were assessed by the Australian Heritage Commission/Environment Australia and the then Water and Rivers Commission in 2002.

Tanberry Creek is the only wild river located in the Millstream Chichester National Park. This also flows through an area of pastoral lease, unallocated Crown land and other reserves (see Section 16 – *Hydrology and Catchment Protection*).

Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) and Republic of Korea-Australia Bird Agreement (ROKAMBA)

Australia's treaties with Japan and China came into force in the 1980s and Korea in 2007 to protect migratory birds in these countries. The treaties provide for bilateral cooperation between the governments involved in order to protect shared species in the East Asian-Australasian Flyway and their habitats. The agreements also give a strong foundation for the conservation efforts of the recently launched East Asian-Australasian Flyway Partnership (Asia-Pacific Shorebird Network 2007). Nearly 80 bird species are listed in these agreements.

Migratory birds listed under these agreements are further protected under the Commonwealth's EPBC Act, which stipulates that all actions that are likely to impact on such species are subject to environmental assessment and approval. This places Australia in a stronger position to meet its international obligations for the protection and management of migratory birds listed under the JAMBA, CAMBA and ROKAMBA agreements.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)

Australia is also a contracting party to the Convention on the Conservation of Migratory Species of Wild Animals (called the Bonn Convention), which came into force in 1992. Under this Convention, countries are expected to agree to protect species that regularly migrate across international boundaries (see Section 18 – *Native Animals and Habitats*).

There are 25 migratory bird species protected under the EPBC Act and listed on the JAMBA, CAMBA, ROKAMBA and/or Bonn agreements that have been recorded in the planning area (see Section 18 – *Native Animals and Habitats*).

The Australian International Council on Monuments and Sites Charter for the Conservation of Places of Cultural Significance (the Burra Charter)

In 1979 the Australia International Council on Monuments and Sites (ICOMOS) adopted a charter for the conservation of places of cultural significance, now known as the *Australia ICOMOS Burra Charter, 1999* (Burra Charter). The charter has been widely adopted as the standard for heritage conservation practice in Australia and applies to all types of places of cultural significance including natural, Indigenous and historic places with cultural values.

Memoranda of Understandings

It is possible for the Department to enter into a memorandum of understanding or partnership with government agencies, local government authorities, industry groups or resource users to manage lands. This expands the Department's possible sphere of responsibilities onto private property or land otherwise not under its control.

Responsibility for pre-suppression of fire, fire risk planning, feral animal and weed control on non-metropolitan, non-townsite Crown land was transferred from the Department of Land Administration (now the Lands Division of the Department of Regional Development and Lands) to the Department on 1 July 2003. The Department may take on other on-ground management activities (e.g. management of camping and four-wheel drive access) in the future if (i) they are consistent with the Department's core business as a manager of natural lands, and (ii) provided appropriate levels of resources are made available to ensure base levels of management of these lands are achieved. A memorandum of understanding has been developed between the Department and the former Department for Planning and Infrastructure in relation to the management of unallocated Crown land (UCL) and unmanaged reserves. There are two portions of UCL which adjoin the Millstream Chichester National Park: a portion adjoining the eastern boundary of the park; and a portion adjoining the northern boundary of the park (see Map 2). The latter is proposed to become part of the park within the life of the plan (see Section 9 – *Existing and Proposed Tenure*). Both of these portions of UCL will be managed according to this memorandum of understanding.

A MOU also has been developed between the Department and the former DPI in relation to the acquisition and management of former pastoral leases that have acquired as additions to the conservation reserve system.

7 - Legislative Framework

Key Points:

- Australia is a signatory to the Ramsar Convention, which obliges the Department to manage listed wetlands to meet certain international obligations. Wetlands in the Millstream Chichester National Park are proposed to be nominated for listing under the Ramsar Convention over the life of the plan.
- The Millstream Wetlands are listed in the *Directory of Important Wetlands in Australia.*
- Tanberry Creek is a "wild river" found in the planning area.
- Australian is signatory to JAMBA, CAMBA, ROKAMBA and the Bonn Convention. There are 25 migratory bird species protected under these agreements that are recorded in the planning area.

The objective is to ensure obligations to international treaties and conventions are met.

This will be achieved by:

1. ensuring the implementation of this plan is consistent with international, national and state obligations, where relevant;
2. implementing Australia's obligations, in the planning area, under the JAMBA, CAMBA and ROKAMBA agreements and the Bonn Convention;
3. proposing nomination of the Millstream wetlands as a wetland of international importance under the Ramsar Convention; and
4. ensuring that the implementation of this plan is consistent with a memorandum of understanding between the Department and the Department of Regional Development and Lands regarding the management of unallocated Crown land adjoining the planning area.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

8. MANAGEMENT ARRANGEMENTS WITH ABORIGINAL PEOPLE

Traditional Owners have a strong desire to 'care for country' according to their traditional laws, to be involved in the management of conservation estate in Western Australia and to strengthen cultural ties to the land. Working together with Indigenous people to care for the land will be beneficial to the preservation of natural and cultural heritage, as well as enriching cross-cultural awareness. The involvement of Traditional Owners in the joint management of conservation estate also provides a suite of cultural, spiritual and economic benefits to Indigenous people.

The planning area is part of the tribal country for people of two different language groups. The Yindjibarndi people's homeland is from the foot of the Hamersley Ranges, across the Fortescue River (*Yarnda Nyirranha*) through to the Chichester escarpment. The Ngarluma people's lands run from the Chichester escarpment northward to the sea (see Section 23 – *Indigenous and Non-Indigenous Heritage*).

The Pilbara Native Title Service, as part of the Yamatji Land and Sea Council is the native title representative body for lands that include the planning area. The role of native title representative bodies is to assist Indigenous groups or individuals to make applications for native title, help resolve disagreements between groups making applications, and assist groups and individuals by representing them in native title negotiations and proceedings. During the preparation of this management plan, the Native Title representative body, as well as the Native Title claimants, were notified of the management planning process.

The Conservation Commission and the Department acknowledge the aspirations of Indigenous people to obtain native title over their traditional lands and waters under the provisions of the Native Title Act. Both agencies acknowledge that native title rights and interests may be found to exist, except where they have been legally extinguished under Australian law. This management plan will not however have any bearing in relation to Native Title Tribunal processes.

The High Court Decision of 8 August 2002 in the case of *Western Australia v Ward* held that reserves vested under section 33 of the *Land Act 1933* (as in the case of the reserves within the planning area) completely extinguished native title. However, the Department will continue to recognise the interests of Indigenous people on reserves where native title has been extinguished and their desire to continue cultural activities and customs in these areas.

There are two active native title claims over the planning area: Yindjibarndi #1 (WC03/3) and Ngarluma/Injibandi (WC99/14) (see Map 3). This latter claim combines separate claim areas for Ngarluma and Yindjibarndi people and encompasses all of the Millstream Chichester National Park. Most of the Mungaroona Range Nature Reserve also lies within this claim area, although the southern portion of the reserve is within the Yindjibarndi #1 claim. On the 4th July 2003, determination of the combined Ngarluma/Yindjibarndi claim found no exclusive native title rights and interests to be held in these determination areas. However, this determination did find rights and interests held by the Ngarluma and Yindjibarndi people in the claim areas associated with access, ritual and ceremony, camping, hunting and foraging, fishing, bush medicine and tucker, taking fauna, taking flora, taking ochre, taking and using water, cooking and lighting fires, protecting and caring for sites and objects.

A Demonstration Park Council (DPC) has been established for the Millstream Chichester National Park — the Millstream Park Council was formed in March 2003. DPCs are partnerships between Indigenous people and the Department for the joint management of specified areas of the conservation estate. There are 12 members on the Park Council, who represent the Yindjibarndi and Ngarluma people (see Section 23 – *Indigenous and Non-Indigenous Heritage*). These members have been approved by the then Minister for Environment. The Millstream Park Council has the role of:

- developing projects that are of benefit to the Indigenous community;
- protecting Indigenous sites of significance;
- supporting Indigenous trainee ranger programs;
- promoting Indigenous involvement in the day to day management of the planning area;
- promoting the Indigenous use of fire, cultural uses of the planning area and Indigenous customs;
- supporting Indigenous employment and enterprises;
- promoting cross-cultural knowledge to other staff and visitors;
- involvement in capital works projects;
- involvement in assessing leases and licences such as mining tenements;
- liaising with the Department to develop a management plan for the planning area; and
- involvement in any other matter in relation to the planning area.

The Millstream Park Council make decisions by consensus of its members and any matters on which agreement cannot be reached are referred to the Minister for Environment for direction.

Another option for facilitating joint management in the area may be through the establishment of Indigenous land use agreements (ILUAs). These are agreements between a native title group and others about the use and management of lands and waters and allow parties to negotiate flexible, practical arrangements to suit their particular circumstances. ILUAs can be negotiated over areas where native title has or has not been determined and they can be advantageous as they can be a faster way of resolving native title issues, compared with going through the courts. ILUAs can be formed surrounding issues such as future developments, how native title rights coexist with the rights of other people, access to an area, extinguishment of native title and compensation. ILUAs are registered with the National Native Title Tribunal and, once this occurs, all parties and native title holders are bound by the agreement. Currently, 11 ILUAs in Western Australia are registered with the National Native Title Tribunal; although none of these occur within the planning area. However, the development of an ILUA with the Ngarluma and Yindjibarndi people may be an option for progressing joint management in the planning area.

The Millstream Park Council, in liaison with the Department, has also been involved in increasing the employment of Indigenous staff within the planning area. To date, several Yindjibarndi trainees have been employed at the Millstream Chichester National Park and the Millstream Park Council has been actively involved in the recruitment process. The employment of Indigenous people across the region and including the planning area will continue over the life of the plan. Across the State, the Department has developed the Mentored Aboriginal Training and Employment Scheme (MATES). Other employment opportunities such as through contracts for the supply of services will also be developed over the life of the plan.

One of the ways in which the connection of Indigenous people to country can be more widely recognised is through the naming of the planning area. Naming of the Millstream Chichester National Park has been discussed by the Millstream Park Council. The Yindjibarndi people speak for the Millstream area, although, to date, no name has been agreed to for this area. Similarly, no equivalent name has been recommended by the Ngarluma people for the part of the park lying within Ngarluma country, which is predominantly the Chichester Ranges. Once a recommendation for a Yindjibarndi and Ngarluma name for the park is made, further public consultation will occur prior to the new Indigenous name being recommended to the State Geographic Names Committee.

8 – Management Arrangements with Indigenous People

Key Points:

- The knowledge and association that Indigenous people have with 'country' can make a valuable contribution to the management of lands and waters by the Department. Involvement in land management of the conservation estate also provides a suite of cultural, spiritual and economic benefits to Indigenous people.
- The planning area is part of tribal country for two language groups; the Yindjibarndi and the Ngarluma people.
- There are two active native title claims over the planning area; Yindjibarndi #1 (WC03/3) and Ngarluma/Injibandi (WC99/14).
- The State Government, the Conservation Commission and the Department are committed to exploring options for joint management with Indigenous people.
- Joint management within the planning area is by way of the Millstream Park Council.

The objective is to provide a mechanism for joint management between the Department and the Indigenous people.

This will be achieved by:

1. maintaining and building upon the commitment to pursue cooperative management arrangements with Indigenous people consistent with Government policy, by way of the Millstream Park Council;
2. contributing to the negotiations of Indigenous land use agreements under the provisions of the Native Title Act;
3. integrating management of the planning area through cooperative advisory bodies such as the Millstream Park Council and other groups such as the Millstream-Harding Consultative Committee and the Technical Working Group (see Section 37 – *Water Extraction*);
4. ensuring that the values of the Traditional Owners inform and guide all management actions carried out in the planning area;
5. ensuring that developments are approved by the Millstream Park Council;
6. the Millstream Park Council advising the Conservation Commission on matters and determinations arising from Park Council meetings;
7. providing training programs for Indigenous people associated with all aspects of management of the planning area. Training programs will be designed by the Department in conjunction with the Indigenous community in accordance with guidelines developed by the Park Council;
8. supporting and encouraging opportunities for Indigenous employment including through contract management associated with all aspects of management of the planning area; and
9. seeking a decision from the Millstream Park Council on the use of a Yindjibarndi and Ngarluma name for the Millstream Chichester National Park and making a recommendation to the State Nomenclature Committee.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
8.1 The continuation of the Millstream Park Council.	8.1 The successful continued operation of the Millstream Park Council.	Annually
8.2 Satisfaction levels of Park Council members.	8.2 Park Council members continue to be satisfied with the operation of the Millstream Park Council.	Every three years.

9. EXISTING AND PROPOSED TENURE

The planning area comprises the Millstream Chichester National Park and the Mungaroona Range Nature Reserve (see Section 3 – *Planning Area*). These lands are reserved under the *Land Administration Act 1997* and vested with the Conservation Commission for management by the Department. Table 1 provides a description of their reserve category and purpose:

Table 1: Reserve Category and Purpose

Reserve Category	Reserve Purpose
National Park	National parks have national or international significance for biological, scenic or cultural values, and can accommodate recreation without detracting from these values. They are managed to conserve wildlife and the landscape for scientific study and to preserve features of archaeological, historical or scientific interest. They are also managed to allow forms of recreation that do not adversely affect their ecosystems or landscapes.
Nature Reserve	Nature reserves are areas with high conservation value, either because they represent natural ecosystems or because they contain or provide habitat for particular species of plant or animal. They are set aside for the conservation of flora and fauna, and are managed so as to maintain and restore the natural environment, and to protect, care for and promote the study of indigenous flora and fauna. The focus of visitor activities is nature appreciation. Forms of recreation that damage natural ecosystems are not permitted.

The Millstream Chichester National Park is comprised of three separate 'class A' reserves (numbers 38333, 30071 and 24392), Reserve 38333 was gazetted in 1984 and reserve 30071 in 1969, both for the purpose of national park. Reserve 24392 was gazetted in 1961 for the purpose of national park and the conservation of indigenous flora and fauna. The Millstream Chichester National Park is located approximately 150 kilometres south from Karratha and 183 kilometres northwest from Tom Price. Most of the park is surrounded by areas of pastoral lease, unallocated Crown land (UCL) and water reserves (Map 2).

All of the State's pastoral leases will expire in 2015. Some of these have been identified in the State Government's 2015 pastoral lease exclusion process, which identified pastoral lands that would contribute towards the establishment of a comprehensive, adequate and representative (CAR) reserve system and provide for future sustainable tourism and recreation use (Department for Planning and Infrastructure 2005). One area has been identified as part of the 2015 exclusion process to be added to the Millstream Chichester National Park; this being an area known as Firestick Block, which is part of Pyramid Station (see Table 2 and Map 4).

Mungaroona Range Nature Reserve, (reserve number 31429, 'class A') was gazetted in 1972 for the purpose of 'conservation of flora and fauna'. It is located approximately 100 kilometres east of Millstream and is surrounded by Mallina Station to the west, an Aboriginal reserve[3] to the north and east, and Hooley Station to the south (Map 2).

As part of the planning process, the Department has also identified lands that will contribute towards the establishment of a CAR reserve system. These proposed tenure changes are provided in Table 2 and also Map 4. Any reserve additions, or changes in classification, will be subject to usual government conservation and determination, including liaison with agencies and pastoralists.

Criteria that may be considered by the Department in the assessment process for incorporating new lands into the conservation estate under this plan may include:

- location – proximity and connectivity to other conservation reserves;
- size and shape;
- presence of threatened or priority species and ecological communities;
- biological and biophysical diversity, and contribution to the CAR system of protected areas;
- assistance in the management of threatening processes impacting on reserve values, such as weeds and feral animals;
- assistance in the resolution of boundary management issues; and

[3] Aboriginal reserves are created under the Land Administration Act for the use and benefit of Indigenous people.

- compatible land use benefits – protection of soils and catchments, cultural heritage values, recreation values, and sustainable resource values.

Each of the proposed tenure changes listed in Table 2 and Map 4 satisfy one or a number of these criteria.

Table 2: Proposed Additions and Tenure Changes in the Planning Area

Land/Reserve	Area (Ha)	Current Vesting	Current Purpose	Proposed Action	Comments
Proposed Boundary Changes – Existing Reserves					
1. Reserve No. 38333 Millstream Chichester National Park	48,617	National Park	National Park	Incorporate into reserve 30071.	
2. Reserve No. 30071 Millstream Chichester National Park	189,444	National Park	National Park	Incorporate into one reserve.	
3. Reserve No. 24392 Millstream Chichester National Park	435	National Park	National Park	Incorporate into reserve 30071.	
Proposed Reserve Additions					
4. Fire Stick Block	3,262	Pastoral Lease – Part of Pyramid Station		To be incorporated into reserve 30071 as a result of the 2015 pastoral excision process.	Boundary rationalisation
5. Langwell Block	33,949	Unallocated Crown Land (UCL)		Incorporate into reserve 30071.	Includes minor (water) reserves 12253 and 12254.
6. Camp Curlews (Barowanna Hill)	66	Crown Land		Incorporate into reserve 30071.	Currently this area is a small island within the Millstream Chichester National Park. Addition to the park would consolidate the park boundary and improve management efficiency.
Areas Requiring Further Consultation					
7. Black Hills Area	4,896	Water Reserve	Water Supply	Consider incorporation into reserve 30071.	'Unclassified' reserve jointly vested with the Water Corporation and the Minister (Water Resources). Provides a more effective management boundary by removing an intrusion into

Land/Reserve	Area (Ha)	Current Vesting	Current Purpose	Proposed Action	Comments
					the park. Proposal requires further consultation with DoW and Water Corporation
8. Fish Pool Block	38,384	Water Reserve	Water Supply	Consider incorporation into reserve 30071 with allowance for traditional Indigenous hunting and other land use to continue.	'Unclassified' reserve jointly vested with the Water Corporation and the Minister (Water Resources). Addition of this area to the park will provide an effective management boundary along the existing Hamersley Iron rail and road alignment. Is part of the Fortescue IBRA subregion, which is poorly represented in the Pilbara Region (currently only 0.89 per cent). Proposal requires further consultation with DoW and Water Corporation
9. Minor unvested reserves (5510 & 5511)	256 hectares each	Unvested		Together with Fish Pool Block, consider incorporation into reserve 30071.	'Unclassified' reserve jointly vested with the Water Corporation and the Minister (Water Resources). Is part of the Fortescue IBRA subregion, which is poorly represented in the Pilbara Region (currently only 0.89 per cent).
10. Airstrip Block	624	Water Reserve	Water Supply	Consider management through a formal section 16 CALM Act management agreement with DoW and Water Corporation.	'Unclassified' reserve jointly vested with the Water Corporation and the Minister (Water Resources). The Department will undertake responsibility for maintenance of the airstrip in return for administrative control over its future use. Proposal requires further consultation with DoW and Water Corporation.
11. Palm Springs Block	12,231	Water Reserve	Water Supply	Manage through a formal section 16 CALM Act management agreement with DoW and Water Corporation.	'Unclassified' reserve jointly vested with the Water Corporation and the Minister (Water Resources). This area has high natural values, which require effective management of fire, water extraction, feral animals and public access. Proposal requires further consultation with DoW and Water Corporation.

Land/Reserve	Area (Ha)	Current Vesting	Current Purpose	Proposed Action	Comments
12. Homestead Block (Part of reserve 38991 and all of unvested reserve 24954)		Water Reserve and Unvested Reserve	Water Supply	Consider incorporation into reserve 30071.	'Unclassified' reserve jointly vested with the Water Corporation and the Minister (Water Resources). Incorporating this area into the Park would allow for expansion and better management of the facilities associated with the Millstream Homestead precinct. Proposal requires further consultation with DoW and Water Corporation.

As part of their submission to the draft management plan, the Water Corporation did not provide support for the proposed addition of Fish Pool Block and the Black Hills areas and the proposed management of Palm Springs Block and Airstrip Block under a Section 16 Agreement. DoW provided only provisional support for these land tenure changes, dependent on the priority of these in relation to other tenure issues across the State. Consequently, further consultation with both DoW and Water Corporation (and any other relevant stakeholders) to progress the addition of these parcels of land to the national park or their management under a Section 16 Agreement is required during the implementation of the management plan. Consequently, these are shown in Table 2 as areas requiring further consultation.

No land tenure changes or additions are proposed for the Mungaroona Range Nature Reserve within this management plan. However, the boundary of the reserve is quite convoluted, particularly the eastern boundary, which adjoins two Aboriginal reserves, 31427 and 31428. Rationalisation of this reserve boundary would provide greater reserve management and operational efficiency. Liaison with the Traditional Owners for these reserves will assist in the development of compatible management with the reserve and may provide opportunities for the addition of land to the reserve.

It is intended that the proposed reserve additions listed will come under the management plan once the change in land tenure and purpose occurs and the reserves are vested with the Conservation Commission, as well as any future possible lands not identified. Other additions not listed will be managed to be consistent with this management plan, or if necessary the plan will be amended to apply to them.

9 – Existing and Proposed Tenure

Key Points:

- Recommendations for tenure changes and acquisitions are addressing the requirements for establishing a comprehensive, adequate and representative National Reserve System (see Section 12 – *Biogeography*).

The objective is to incorporate identified lands into the conservation estate to assist in the protection of the natural and cultural values of the planning area, to provide maximum security of tenure and purpose, and contribute to the establishment of a CAR reserve system.

This will be achieved by:

1. the Department and the Conservation Commission initiating all tenure actions for which they are responsible for as specified in Table 2;
2. negotiating with relevant State agencies and local authorities to manage land according to the proposals listed in Table 2;
3. using the criteria listed above to assess other proposals for the addition of lands to the planning area that may arise over the life of the plan;

4. liaising with relevant stakeholders (e.g. Traditional Owners, DoW and pastoral lessees) to ensure that the management of proposed tenure occurs in sympathy with that of the Millstream Chichester National Park prior to their addition to the National Park; and
5. acquiring by purchase, exchange or other means when opportunities arise and funds are available, any other areas that adjoin or are surrounded by lands of the planning area that have significant conservation or recreation values, management benefits or that could contribute to protecting areas with these values within the planning area and contribute to the CAR reserve system (see Section 12 – *Biogeography*).

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
9.1 Changes in land tenure and purpose as outlined in Table 2.	9.1 To implement the tenure actions as outlined in Table 2 within the life of the plan.	Every five years.

10. MANAGEMENT PLANNING PROCESS

The process of producing a management plan is outlined in Figure 1.

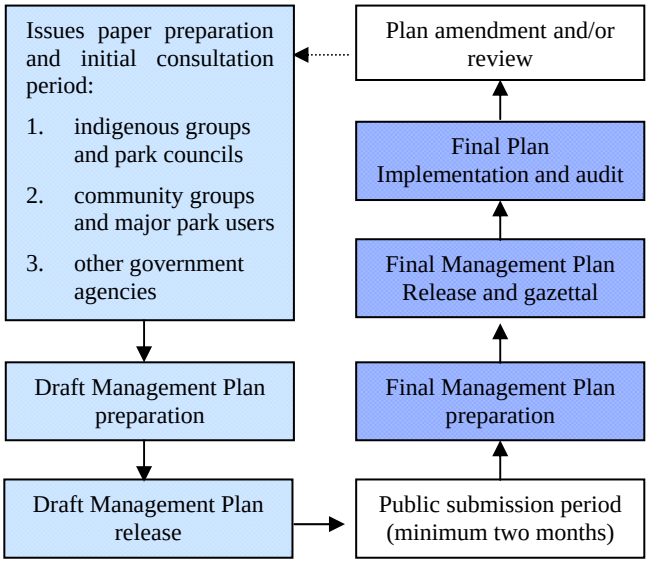

Figure 1: Standard Management Planning Process for Terrestrial Conservation Reserves

Management plans are prepared by the Department in consultation with and on the behalf of the Conservation Commission. The Conservation Commission issues draft plans for public comment and provides final plans for approval by the Minister for Environment.

11. PERFORMANCE ASSESSMENT

The Conservation Commission will measure the success of this plan by using key performance indicators (KPIs) and other mechanisms as appropriate. It is not efficient to measure all aspects of management given resource and technical impediments—consequently indicators will target key components or values of the plan. Each key performance indicator comprises evaluation of a measure and target, reporting requirements and a management response to any shortfall.

KPIs are an integral component of adaptive management. Adaptive management is a process whereby monitoring and other research is utilised to evaluate whether the management being implemented is adequately meeting the management objectives, and, whereby management can be adapted as necessary in the light of new

knowledge or conditions. This is a reiterative process in which there are ongoing adjustments in management as needed to take account of and respond to changing conditions.

The Department is responsible for providing information to the Conservation Commission to allow it to evaluate the success of the Department's management in meeting targets specified in the KPIs. The frequency of these reports will depend upon the requirements of each KPI. Where a report identifies a target shortfall, a response to the Conservation Commission is required. The response will identify factors that have led to the target shortfall, and propose alternative management actions where appropriate. The Conservation Commission will consider the Department's response on the target shortfall and evaluate the need for action in the context of its assessment and audit function under section 19(1)(g)(iii) of the CALM Act. The Conservation Commission will make the results of audits available to the public.

The application of a KPI is identified for relevant sections throughout the plan.

PART C. CARING FOR COUNTRY: MANAGING THE NATURAL ENVIRONMENT

The CALM Act and the Wildlife Conservation Act give the Department responsibility for the conservation and protection of indigenous flora and fauna on all lands and waters throughout the State. The fundamental aim of nature conservation is to maintain genetic resources (i.e. indigenous species and genetic variation within species), biological communities, and ecological processes such as nutrient and hydrological cycles and energy exchange through trophic levels. Conservation through an integrated system of reserves is a strategic approach to help achieve this aim.

While the focus on management of the values of the natural environment and the threats to these values is constrained to the period of this management plan, many of the issues are large-scale and long-term and the strategies outlined will be a part of this longer-term view. The major foci for nature conservation management for the period of this plan are to:

- further contribute to the establishment and management of a comprehensive, adequate and representative (CAR) reserve system through progression of proposed additions described in this plan;
- protect wetland and subterranean ecosystems associated with the Millstream aquifer;
- ensure the protection of threatened flora, fauna and significant ecological communities;
- eradicate new weed infestations and species within the planning area before they become established;
- control weeds that have had a significant impact in the planning area, in particular, buffel grass, ruby dock, kapock bush, morning glory, Parkinsonia, stinking passion flower, Gallon's curse, cotton palm, date palm, water fern, water lilies and khaki weed;
- control introduced animals, in particular feral stock;
- incorporate the knowledge of Traditional Owners in managing fire to protect and promote the biodiversity of ecosystems and to protect life and community assets; and
- improve knowledge regarding the biodiversity attributes of the planning area and proposed additions to the conservation estate to better inform management.

In managing the natural values of the planning area, there is an acknowledgment that, although there is a good understanding of many of these values, there is still a considerable amount of knowledge to be gained (see Section 42 – *Research and Monitoring*). Currently, a survey of the biodiversity of the Pilbara Region is being conducted to improve knowledge of the region. This is a 5 year widespread survey, being carried out across a range of land tenures within the region including the planning area, together with pastoral leases, Indigenous lands, other conservation reserves and mining leases. The survey aims to develop a framework for guiding sustainable resource development, other land uses and conservation planning in the region, assess the existing reserve system, improve systems of environmental impact assessment for development proposals and gather information about threatened species and ecological communities, plants, reptiles, frogs, mammals, bats, birds, terrestrial and aquatic invertebrates (stygofauna). This management plan takes an adaptive management approach, where management policies and practices are continually improved by learning from the outcomes of operational programs, research and monitoring.

The Pilbara Region is an area of high biodiversity and was identified as a National Biodiversity Hotspot in 2003 (Department of Environment and Heritage 2004b). Biodiversity Hotspots are those areas rich in endemic plants and animals, yet under immediate threat from impacts such as land clearing, development pressures, weeds and feral animals. The Pilbara-Hamersley Biodiversity Hotspot was classified for providing habitat for a number of threatened, endemic and fire sensitive species and communities. These include aquifers which support endemic stygofauna, habitat for the ghost bat, little red antechinus, the pebble mound mouse and endemic gecko species, all of which are found in the planning area. Significant threats include overgrazing from the cattle and sheep industry, which is exacerbated by other feral herbivores such as rabbits.

The Department has also developed a Good Neighbour Policy (DEC 2007a), designed to improve the Department's relationship with neighbours whose properties adjoin conservation reserves. This policy outlines a range of strategies the Department, in conjunction with its neighbours, uses to address issues including weed and

pest animal control, fire management, access to and activities on conservation reserves, off-reserve conservation programs and natural resource management. Strategies that address how the Department, with its neighbours, manages these issues within the planning area and on adjoining lands are detailed throughout the plan as relevant.

This chapter concentrates on describing the natural values, the major threats to these values, and actions proposed by the Department to mitigate the threats.

12. BIOGEOGRAPHY

The Interim Biogeographic Regionalisation for Australia (IBRA) provides a planning framework for selecting a CAR reserve system of protected areas to conserve and protect Australia's biodiversity (Thackway and Cresswell 1995).

The benchmark reservation level for a CAR reserve system is that at least 15 per cent of each region, and any subregions within it, should be managed as part of the public conservation estate (CALM 2003).

In addition to using the scientifically-based CAR criteria, areas that serve as buffers to terrestrial reserves, protect threatened species or otherwise assist with conservation management are also commonly included in parks and reserves. Natural areas with spectacular landforms and scenery subject to high public use may also be included.

Bioregions

The IBRA divides Australia into 80 separate regions, based on lithology, geology, landform, and vegetation. Definitions of each region and the predominant vegetation type are described by Thackway and Cresswell (1995). The planning area falls within the Fortescue, Chichester and Roebourne subregions of the Pilbara Craton Bioregion (Figure 2 and Table 3).

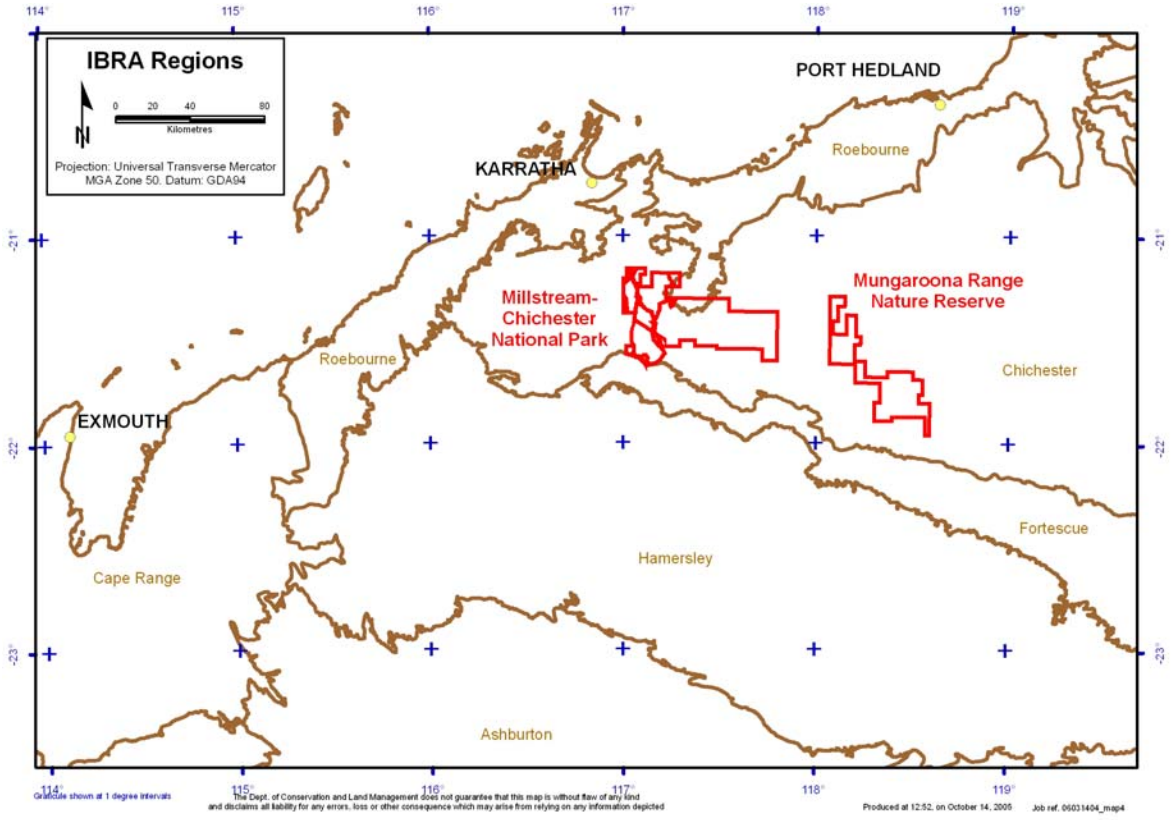

Figure 2: IBRA Sub-Regions in the Planning Area

The Pilbara Craton has a semi-desert tropical climate and contains the Fortescue River (*Yarnda Nyirranha*) which is one of three major river systems in this bioregion (McKenzie *et. al.* 2003). Approximately 28.3 per

cent of the Pilbara Craton bioregion is in a formal conservation reserve. This is well over the 15 per cent and therefore no further reservations would be required. However, at a sub region level, reservation is well under the 15 per cent. Therefore priorities for reserve additions focus on the sub-regional scale, rather than the regional scale.

Table 3: IBRA Sub-Regions in the Planning Area

Sub Region	Sub Region Characteristics	Percentage of Sub Region in a Conservation Reserve	Percentage of Sub region in Planning Area
Fortescue	A small part of the south-western corner of the Millstream Chichester National Park falls within this subregion. It is dominated by the Fortescue River (*Yarnda Nyirranha*). There are extensive salt-marsh, mulga bunch-grass and short grass communities in the east. Deeply incised gorge systems dominate in the western (lower) part of the subregion. The extensive Millstream aquifer feeds a number of permanent springs in the in the vicinity of the Millstream Chichester National Park, supporting large permanent wetlands and stands of rivergum and cadjeput (*Melaleuca*) woodlands. Drainage occurs to the north-west (May and McKenzie 2003). The representativeness of this subregion in the reserve system is extremely low; hence, reserve acquisition in this subregion is the highest priority within the Pilbara Craton Bioregion (Kendrick 2002).	0.9% of sub-region represented in conservation reserve system. Proposed additions to the south of the Millstream Chichester National Park will increase the amount of this subregion within the conservation reserve system	0.55%
Chichester	Most of the Millstream Chichester National Park and all of the Mungaroona Range Nature Reserve is located within the Chichester subregion. The basaltic Chichester Ranges are a significant landform, interspersed with Archaean granite and basaltic plains. Shrub steppes are the dominant vegetation association. Drainage occurs in a northerly direction via a number of rivers. The Chichester subregion is also poorly represented in the reserve system.	3.9% of subregion is in existing reserves, an additional 2.7% is in recently purchased reserves. Proposed additions to the northern part of the Millstream Chichester National Park will increase the amount of this subregion within the conservation reserve system.	3.9 % is in the planning area, the Millstream Chichester National Park comprises 2.69% and the Mungaroona Range Nature Reserve comprises 1.26%
Roebourne	A small section of the northern part of the Millstream Chichester National Park lies within the Roebourne IBRA subregion. This subregion comprises Quaternary alluvial and older colluvial coastal and sub coastal plains, with mixed bunched and hummock grasses and dwarf shrub steppe of *Acacia stellaticeps*, *A. pyrifolia* and *A. inaequilatera*. *Triodia* hummock grasslands dominate the uplands and *Eucalyptus victrix* and *Corymbia hamersleyana* woodlands dominate the ephemeral rivers and creeks. There are resident linear ranges of basalts occurring across the coastal plains with minor exposures of granite (Kendrick and Stanley, 2002).	6.57%	0.68%

The sum of the existing conservation reserves and proposed additions in both the Fortescue and Chichester subregions will still be well under the recommended level of reservation for a CAR reserve system and reinforces the need for (a) additions to the public conservation estate and (b) complementary off reserve conservation measures.

12 – Biogeography

Key Points:

- The planning area lies within the Pilbara Craton IBRA bioregion and within this, the Chichester, Fortescue and Roebourne subregions.
- Approximately 28.3 per cent of the Pilbara Craton bioregion is in a formal conservation reserve.
- 0.9 per cent of the Fortescue sub region, 6.6 per cent of the Chichester sub region and 6.57 per cent of the Roebourne subregion are in a formal conservation reserve.

The objective is to establish a comprehensive, adequate and representative reserve system to protect biodiversity within the planning area.

This will be achieved by:

1. acquiring lands to deliver a reserve system that meets criteria of comprehensiveness, adequateness and representativeness (CAR);
2. taking into account any refinements to the IBRA system over the life of this management plan; and
3. encouraging and facilitating off-reserve conservation and cross boundary management where it assists in the protection of the planning area and particularly where biogeography is under-represented.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
12.1 Percentage of IBRA regions and sub-regions represented in the planning area.	12.1 The percentage of IBRA regions and sub-regions represented in the planning area increases over the life of the plan.	Every five years.

13. WILDERNESS

The International Union for the Conservation of Nature (IUCN), now known as the World Conservation Union, defines wilderness as a:

'*...large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition*'.

The Australian Heritage Commission (now called the Australian Heritage Council) developed the National Wilderness Inventory (NWI) in 1986 following community concern over the decline in the area and quality of remote and natural land in Australia.

The Commonwealth Department of Department of Sustainability, Environment, Water, Population and Communities is the custodian of the NWI. This database uses four indicators to estimate the 'quality' of wilderness across the landscape. These are:

- remoteness from settlement - how remote a site is from permanent human occupation. Includes permanently occupied places and built up areas;
- remoteness from access - how remote a site is from established access routes. Includes all classes of road and vehicle tracks, railways, aircraft landing grounds and other access infrastructure;
- apparent naturalness - the degree to which a site is free from permanent structures associated with modern technological society. Includes all built infrastructure; and
- biophysical naturalness - the degree to which a site is free from biophysical disturbances caused by the influence of modern technological society. Includes a variety of human and biophysical landscape attributes.

This database can test different scenarios for mapping wilderness within the parameters of these four indicators. The NWI does not make any statements in relation to which areas qualify as wilderness, but rather provides an index rating of wilderness quality from 0 to 20, with 20 being the highest quality based on the above four indicators.

Guidelines for the identification and management of wilderness on Department-managed lands are outlined in the Department *Policy No. 62 – Identification and Management of Wilderness and Surrounding Areas* (CALM 2004). This policy incorporates the NWI criteria and specifies a NWI wilderness quality index of at least 12 and a minimum size of 20 000 hectares in arid and tropical areas. The policy does not place a limit on the number of areas or units of land that can be classified as wilderness areas across a tract of Crown land. The policy also recognises that the criterion of a NWI wilderness quality index of 12 or above may be achieved over time by rehabilitation of past disturbances. Areas within the external boundary of a wilderness area that do not meet the initial NWI criterion may be included within the gazetted wilderness area, as they will increase their NWI rating as they rehabilitate over time. Periodic re-assessment of NWI would be desirable to confirm this and monitor for any adverse changes to NWI rating of the wilderness area.

Areas of reserves are classified under section 62 of the CALM Act to establish management areas to which specific management prescriptions or regulations apply. Under section 62(1)(a) of the CALM Act a wilderness area can be established by the Minister on any Crown land (reserve) that is vested in the Conservation Commission.

The policy enables and provides unique opportunities for:

- the preservation and enhancement of landscape quality within and surrounding wilderness areas (see Section 32 – *Visual Landscape*);
- foot access for a number of low-impact activities, such as bushwalking, rock climbing, recreational fishing, minimal impact and remote camping, education and recreation expeditions, picnicking, and day-use, in wilderness areas (see Section 27 – *Visitor Activities*);
- water access by non-powered craft, such as canoes and kayaks, provided that access to watercourses is via existing tracks outside of the wilderness area (see Section 27 – *Visitor Activities – Boating*);
- flying in accordance with a 'Fly Neighbourly Advice' (FNA) for the planning area established with the relevant Federal and State air safety regulators, the Department, aero clubs and associations, and locally based scenic flight and charter operators. This FNA is an understanding to operate above the planning area in an agreed responsible manner; and
- Traditional Owners to maintain cultural responsibilities activities and Indigenous places and artefacts of significance are protected under relevant State and Commonwealth legislation (see Section 23 – *Indigenous and Non-Indigenous Heritage*). The policy does not restrict Native Title rights as defined in the Native Title Act 1993

The main points from the wilderness policy include:

- use of mechanised transport is not permitted within wilderness, except for emergency or essential management operations, or reasons of cultural importance;
- education and/or recreation expeditions will be permitted within wilderness. Commercial recreation and tourism is not permitted within wilderness (CALM Act leases and licences cannot be issued for wilderness classified under section 62 of the Act);
- constructed walk trails, signs, track markers and toilets will not be provided in wilderness;
- management of wilderness and surrounding areas will be consistent with the principles in the Malimup Communiqué[4];
- wherever possible, ground disturbing activities for fire management will be conducted outside of wilderness. This includes construction and maintenance of access roads, firebreaks, fuel-reduced buffers, and water points;
- prescribed burning within wilderness may be carried out for the protection and maintenance of natural values and processes as determined through the preparation of area and regional management plans and interim management guidelines;

[4]The Malimup Communiqué was developed between Indigenous communities, government authorities and non-government environmental groups in May 1998 at Malimup Springs in Western Australia. It is concerned with Indigenous people and the management of areas reserved/zoned as wilderness, primarily within national parks, or other lands reserved for conservation or recreational purposes.

- appropriate fire protection strategies according to established standards will be implemented in areas that surround wilderness where life, property and natural values may be threatened; and
- any existing vehicle tracks and constructed walk trails within wilderness that are not required for emergency and essential management purposes will be closed.

Wilderness areas will be managed to maintain and protect a number of values, including wilderness quality, biodiversity and ecological processes, and opportunities for solitude, inspiration and self-reliant recreation. Wilderness quality will be maintained using the NWI database and computer software to determine the effect that specific development or operational options would have on wilderness quality.

The NWI assessment indicates that the planning area contains significant areas of potential wilderness (see Map 5), with NWI wilderness quality values of 12 and above. Areas with wilderness quality of 12 and above and more than 20,000 hectares in size include;

- all of Mungaroona Range Nature Reserve; and
- the eastern portion of the Millstream Chichester National Park.

All of Mungaroona Range Nature Reserve is proposed to be gazetted as wilderness under section 62 of the CALM Act and will be managed according to the Department's policy on the *Management and Identification of Wilderness and Surrounding Areas*. All of this reserve warrants gazettal as a wilderness area for a number of reasons. Firstly, with 105 842 hectares of wilderness quality 12 or above, the reserve more than exceeds the minimum size criterion of 20 000 hectares and, once gazetted, may become one of the larger wilderness areas in the State. In fact, much of the reserve contains wilderness at the highest possible quality rating of 18-20 (see Map 5). Secondly, there is currently no vehicle access into the reserve, with no roads or tracks traversing the area and the reserve contains no built infrastructure. Visitation to the reserve is exceptionally low. Consequently, wilderness can be gazetted without the need for any on-ground modification such as the closure of roads or tracks and the rehabilitation of disturbed areas. By contrast, to meet the minimum size requirements for wilderness, particularly in temperate areas of the State, roads and tracks often require closure and rehabilitation. Thirdly, given the reserve's considerable remoteness and lack of impacts from modern technological society, much of the area's biodiversity and natural systems are likely to be intact and provide considerable opportunity for research and education. The reserve is one of the more truly remote areas in the State and by gazetting the whole reserve as wilderness, will acknowledge it as an area of very high wilderness quality and will provide an added layer of protection in addition to its status as a nature reserve.

Much of the eastern portion of the Millstream Chichester National Park also contains a significant amount of wilderness quality 12 or above and over 20 000 hectares in size. However, the area has potential for commercial tourism opportunities, particularly involving Indigenous people and currently the CALM Act does not allow for commercial leases and licences to be issued in wilderness areas (see Section 29 – *Commercial Operations*). The specific wilderness boundary and on-going management of this area as wilderness requires further analysis. Therefore no wilderness areas will be gazetted in the Millstream Chichester National Park as a consequence of this management plan. However, a precautionary approach to management of this area will be adopted until further analysis is undertaken. Extraordinary management operations, other than those compatible operations that have been normally undertaken in this area (fire, weed, feral animal and threatened species management) will not be permitted. This will allow the area to be managed over the life of the plan to enable future consideration of a wilderness area.

Tanberry Creek is has been identified as a 'wild' river and flows through the eastern portion of the Millstream Chichester National Park (see Section 16 – *Hydrology and Catchment Protection*). Management of the eastern part of the Millstream Chichester National Park in a way that will protect the wilderness quality of this area will also ensure the protection of the wild river values of Tanbery Creek.

None of the management proposals in this management plan are inconsistent with the above points and, consequently would not prevent the creation of a second wilderness area within the planning area.

The Department's *Policy Statement No. 18 – Recreation, Tourism and Visitor Services* (DEC 2006) contains a 'Caring Code for the Bush' which outlines a number of safety measures to prepare visitors for their visit to wilderness areas. In addition, a proposed registration system for visitors entering wilderness areas may assist the Department and emergency services in any search and rescue operation.

13 – Wilderness

Key Points:

- The NWI provides an index rating of wilderness quality from 0 to 20, with 20 being the highest quality based on four indicators.
- The planning area contains significant areas of high wilderness quality (NWI wilderness quality rating of 12 or greater) and all of Mungaroona Range Nature Reserve is proposed to be gazetted as wilderness under the CALM Act; and
- A second area in the eastern portion of the Millstream Chichester National Park has also been identified as having potential for a wilderness area. It is not proposed to be gazetted as a wilderness area in this management plan, although an approach of precautionary management in this area will ensure the protection of its wilderness values.

The objective is to provide statutory protection to the Mungaroona Range Nature Reserve wilderness area, to maintain the option for wilderness elsewhere and to maintain or enhance wilderness qualities within this wilderness area.

This will be achieved by:

1. gazetting all of the Mungaroona Range Nature Reserve as a wilderness area under section 62 of the CALM Act;
2. managing the proposed wilderness area according to the Department's *Policy Statement No. 62 – Identification and Management of Wilderness and Surrounding Areas* (CALM 2004);
3. managing the eastern part of the Millstream Chichester National Park over the life of this plan in a way that does not reduce its potential to be considered as a wilderness area;
4. maintaining wilderness qualities by monitoring the extent and level of wilderness quality and controlling impacts on wilderness areas; and
5. enhancing visitors' knowledge and appreciation of wilderness.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
13.1 Gazettal of a wilderness area under section 62 of the CALM Act	13.1 Gazettal of a wilderness area within 2 years from approval of the plan.	After two years
13.2 The extent and level of wilderness quality.	13.2 The extent and level of wilderness quality does not diminish from 2011 levels.	Every five years.

14. CLIMATE AND CLIMATE CHANGE

The planning area lies within a semi-arid area of Western Australia and is characterised by high temperatures, low and variable rainfall and high evaporation. Temperature ranges are greater inland away from the moderating effects of on-shore breezes near the coast. Between October and April, average temperatures in Karratha reach or exceed 32˚C every day. In the winter months, the average temperature is 28.2˚C. The average rainfall for the area is 200 to 350 mm, although this is highly intermittent and is generally associated with cyclones and thunderstorms which occur mainly in the summer months. February and March are generally the wettest months of the year while October and November are the driest.

Local thunderstorm activity can occur between December and June and generally relates to the convergence of moist tropical air at mid latitudes. Rainfall in May and June is generally caused by the interaction of tropical moist air with southern cold fronts.

December to March sees the formation of the tropical cyclones in the Indian Ocean and Timor Sea. The occurrence and paths of these are generally unpredictable and these may bring large amounts of rainfall to the area. When rainfall associated with these cyclones does occur, falls of 50-150 mm are not uncommon. Winds moderate as cyclones move inland.

Observed and Projected Climate Change

Recent research on climate change in Australia suggests that:

- rainfall will continue to decline (by approximately 10% in winter and spring rainfall by 2030) and temperatures will continue to increase;
- river flows will decline as a result of decreased rainfall;
- weather events may be more extreme, with more frequent and prolonged drought;
- there will be an increase in the number of days of very high and extreme fire danger; and
- there may be an increase risk of more frequent bushfires.

(Source: CSIRO 2007, Hughes 2003, Williams *et al.* 2001).

The Western Australian Greenhouse Taskforce (2004) and CSIRO (2007) listed the following changes evident in the Western Australian climate: rising daily average temperatures; consistent regional trends in rainfall changes with likely decrease in rainfall in the south-west and the trend in the northern regions being to wetter conditions; and changes in the Leeuwin current. Given the climatic characteristics of the Pilbara area in which the probability of occurrence of precipitation events is so important, magnitude/frequency considerations become especially significant.

Impacts of Climate Change

Climate change presents an additional pressure for native species and ecosystems as well as exacerbating existing pressures such as habitat fragmentation/modification, competition by introduced species and altered fire regimes. The *National Biodiversity and Climate Change Action Plan 2004-2007* (Department of the Environment and Heritage 2004) identifies potential impacts of climate change on Australian species and ecosystems as including:

- reductions in the geographic range of species;
- changes to the timing of species' lifecycles;
- changes in population dynamics and survival;
- changes in location of species' habitats;
- increases in the risk of extinction for species that are already vulnerable;
- increased opportunity for range expansion of invasive species;
- changes in the structure and composition of ecosystems and communities;
- changes in coastal and estuarine habitat due to rising sea levels; and
- changes in plant growth and ecosystem function arising from increased carbon dioxide concentration in the atmosphere.

Climate change is likely to bring increases in acidity of oceans and ambient marine temperatures leading to coral bleaching events, increases in storm surges and consequent damage to infrastructure and coastal habitat, and increased vectors carrying viruses leading to reduced human health.

Other species and communities that may be more vulnerable to climate change include those with:

- very limited or restricted climatic ranges;
- limited dispersal ability;
- very specialised habitat requirements; and
- small populations and/or low genetic diversity (DEH 2004).

Within the planning area there are a number of native flora and fauna species and communities that are endemic or at or near the limits of their range. These are likely to be particularly vulnerable to climate change. Therefore the planning area has the potential to become a focal area for monitoring the impacts of climate change. Although the effects of climate change may not be apparent over the life of this plan, it is important that effective monitoring programs be established to support the long-term regional-scale planning necessary to limit the potential impacts as much as possible.

Responses to Climate Change

In Western Australia a new climate change adaptation and mitigation strategy is being developed. The Department has also commenced development of biodiversity response modelling to investigate the potential vulnerability of Western Australia's plants and animals to climate change and a climate-biodiversity strategy.

At the individual reserve level, implementing strategies that create reserves, control pest animals and weeds, manage fire, and re-introduce threatened native plants and animals, will help improve the resilience of species and ecosystems and hence decrease their vulnerability to climate change. In addition, strategies that aim to rehabilitate vegetation and reduce overgrazing by introduced and native herbivores will assist in increasing the amount of carbon that is sequestered in the land. There is a need for research and monitoring to establish baseline data to enable measurement of changes over time. This will also enable managers to recognise when specific threatening climate circumstances are occurring and respond effectively.

14 – Climate and Climate Change

Key Points:

- The planning area has a semi-arid climate and is characterised by high temperatures, low and variable rainfall and high evaporation.
- Climate change projections for the North-West of Western Australia suggest an increase in summer rainfall, an increase in rainfall intensity and increases in evaporation. Hence species and communities associated with the Millstream aquifer and wetlands are likely to be particularly vulnerable to climate change.
- Reserve creation, introduced pest animal and weed control, fire management and re-introduction programs could help improve the resilience of the planning area's species and ecosystems, and decrease their vulnerability to climate change.

The objective is to better understand and adaptively respond to the effects of climate change on the planning area.

This will be achieved by:

1. continually reviewing and adapting management in response to new knowledge and understanding of climate change and its impact on biodiversity;
2. incorporating the potential for climate change impacts into threatened species and communities recovery plans or interim recovery plans for flora and fauna and developing effective response strategies;
3. where practicable, identifying climate thresholds and physiological responses to changed climate conditions for threatened and priority species and communities and in the planning area;
4. limiting non-climate stresses for all species and communities, including those that are vulnerable to climate change;
5. establishing climate and weather monitoring sites, in conjunction with long-term ecological monitoring sites, to measure the effect of climate in species distribution and ecosystem composition and health;
6. implementing strategies within this plan that increase the extent of vegetation and its ability to sequester carbon;
7. wherever possible, aiming to reduce greenhouse gas emissions and improve energy efficiency when designing infrastructure and facilities;
8. identifying and protecting climate refugia within the reserve system, providing adequate buffers and corridors between these and developing effective management strategies for these areas (e.g. implementing proposed additions to the public conservation estate as indicated in Section 9 – *Existing and Proposed Tenure*); and
9. supporting and encouraging climate-change related research focused on the natural values of the planning area.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

15. GEOLOGY, LANDFORMS AND SOILS

Geology

The planning area is located within the Fortescue Basin of the Pilbara Region (Map 6), which geologically, is one of the oldest regions in Australia. Rocks of the Fortescue Basin are between 2775 and 2630 million years old that formed when the Earth was very young during the Archaean period. Older rocks underlying the Fortescue Basin belong to the Pilbara Craton which includes rocks as old as 3660 million years. Due to their

age, rocks in the Pilbara are of international significance and geologists from all over the world come to the Pilbara to study the processes associated with the early history of the Earth (Copp 2005).

The base geology of the Chichester Range and Millstream area is of volcanic origin comprising the Fortescue Group. During this time, the underlying Pilbara Craton was part of a larger continent that began to break apart. At the time, the geology was dominated by a granite-greenstone terrain. The crust stretched, becoming thinner and forming an extensive rift running in a west-north-westerly direction. There was a huge eruption of molten rock from beneath, forming a 'sea of basalt lava' and burying the older granite-greenstone terrain. These eruptions lasted for over 100 million years, creating a thick layer of crust, comprised of sedimentary and volcanic rocks, known as the Fortescue Group. This process was an early example of a hotspot volcano and its considerable thickness contributed to its preservation today (Copp 2005, G Rundle pers. comm. 2007).

By 2630 million years ago, the stretching of the Earth's crust ended and the Hamersley Basin began to fill with sediments and the deposition of the Brockman iron formation, which makes up the Hamersley Ranges,

Geological units dip to the south, so that older units are exposed in the north, and younger units in the south. Within the Chichester Ranges and adjacent areas, these basalts, dolerites and volcanic tuffs have weathered to form extensive derived deposits of gilgai clays containing boulders and cobbles. Small exposures of Marra Mamba Iron Formation lie along the southern side of the Fortescue River (*Yarnda Nyirranha*). These are younger rocks and were deposited at a time when an immense marine basin formed in the Pilbara and filled with shallow seas, rivers and glaciers, between 2630 and 560 million years ago. At about this time, the atmosphere changed from a toxic one with high CO_2 concentrations to one with higher oxygen concentrations, resulting in the formation of increasingly sophisticated life forms. Small areas of older Archaean granites of the underlying Pilbara Craton are exposed in the north-eastern section of the Millstream Chichester National Park.

The Chichester Range contains fine examples of stromatolite fossils near Mount Herbert and patchily distributed in other locations on the northern slopes of the Chichester Ranges. Fossil stromatolites are found throughout the Pilbara and the area is recognised as one of the important regions internationally for studying these ancient life forms. They have attracted international attention from researchers, being the oldest known stromatolite examples (up to 3.48 billion years old) and are key fossils for understanding the evolution of life (Department of Mineral and Petroleum Resources 2002, A Hickman pers. comm. 2006). Stromatolites are constructed by cyanobacteria, the earliest form of life which dominated the fossil record until 1000 million years ago. Hence fossil stromatolites are significant in that they enable geologists to determine the environment in which rocks were formed, when they were formed and their role in mineral and petroleum formation (Copp 2005). Damage or unauthorised removal of fossils from protected areas is prohibited under the *Conservation and Land Management Regulations 2002*. All geological research undertaken within the planning area must be authorised (see Section 42 – *Research and Monitoring*).

Alluvial deposits lie to both the north and south of the Millstream Chichester National Park, derived from erosion in the Chichester and Hamersley Ranges respectively (see Map 6). Streams flowing northward from these two mountain ranges have laid down large alluvial and colluvial deposits.

The Millstream aquifer (see Section 16 – *Hydrology and Catchment Protection*) consists of dolomite, calcrete, silcrete and clay and is known as Millstream dolomite. Clay and dolomite were deposited in lakes in the plains of the Fortescue River (*Yarnda Nyirranha*) about 40 million years ago and the silcrete and calcrete was formed as a result of material being weathered by running water and cemented by calcium carbonate (calcrete) and silica (silcrete) (see Figures 3 and 4) (Dames and Moore 1975).

Landform and Soils

The present landforms of the Chichester Range and Millstream area are the result of very long periods of weathering and erosion. The major landform units are the Hamersley Range to the south, the Fortescue valley, the Chichester Ranges lying further north, the Chichester tablelands between the Hamersley and Chichester Ranges, and the Roebourne Plains. All of these major units lie along an east-west axis.

These major landform units rise in a series of steps from the coastal Roebourne Plains to the top of the Hamersley Ranges. The Roebourne Plains run inland until they strike the Chichester escarpment, which rises to about 350 m above sea level. This steep escarpment is defined by the dark brown jumbles and slopes of weathered basalts and granophyres, and is scenically very attractive.

Lying behind the crest of the Chichester escarpment is a broad tableland, which slopes gently to the south, until it runs into the Hamersley Range. The Chichester tablelands have extensive areas of gilgai crab-hole clays, as well as characteristic shaley hills. The Hamersley Range lies outside the planning area, but dominates views southward from the Chichester Ranges. They rise to up to 1245m above sea level in a continuous series of rolling peaks and ridges above the Fortescue Valley, and provide a spectacular view quite different to the Chichester Range. At the foot of the Hamersley Range, and running across the Chichester tablelands, lies the broad flood plain of the Fortescue River (*Yarnda Nyirranha*). The river valley narrows abruptly at Millstream, where the river becomes constricted and in filled with sand. This constriction has led to the formation of isolated hollows which have filled with spring water to form the Millstream pools. It then diverts to the north-west, entering a series of gorges incised through the Chichester Ranges, and flows through to the coastal plain at Mardie. The Fortescue Valley is comprised of soft Wittenoom dolomite which sits between the harder Brockman iron formation of the Hamersley Range and the volcanic rocks of the Chichester Ranges (see Figure 3 and 4). This resulted in the Fortescue Valley being carved out as a broad corridor (G Rundle pers. comm. 2007).

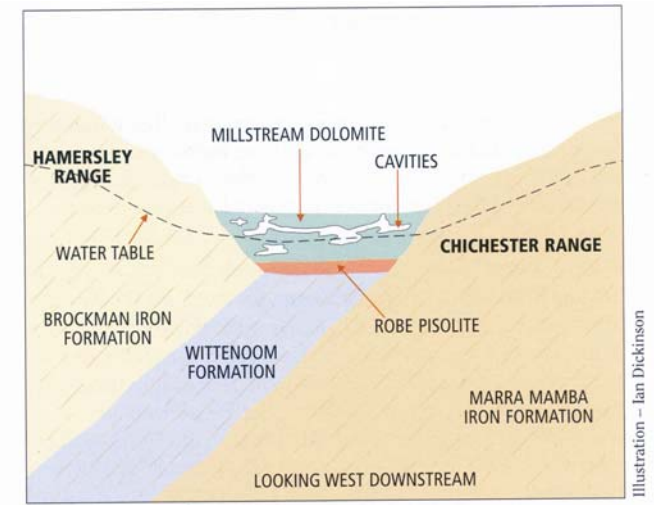

Figure 3: Geology Associated with the Millstream Aquifer (Copp 2005)

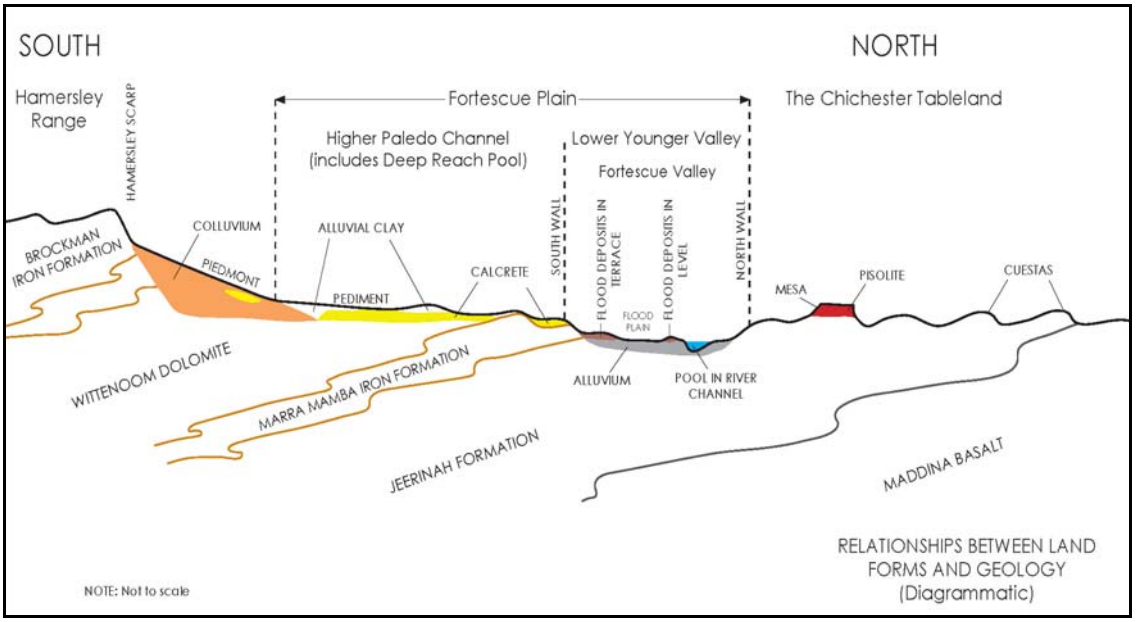

Figure 4: Diagrammatic Profile across the Fortescue River Valley, West of Deep Reach Pool

The soils of the Millstream Chichester area are a product of weathering of the underlying rocks. Bettenay *et al.* (1967) mapped the area's soils, describing the Chichester Range as mainly comprising shallow, porous, loamy

soils. The steeper slopes of basic lavas, dolerites, tuffs and banded iron formation, and some of the narrow valley plains are comprised of shallow, stony soils with large areas having no soil cover. These soils are usually brown loams with significant areas of earthy, loamy soils. Seasonally hard-setting soils occur on the lower slopes, and cracking clay soils with some organic material occur on the valley floors. These soils support kanji shrub steppe and mixed snappy gum steppe (see Section 17 – *Native Plants and Plant Communities*).

The tablelands behind the Chichester escarpment contain hard loamy soils with red clayey subsoils; on which short grasslands are the most common (see Section 17 – *Native Plants and Plant Communities*). Cracking clays are the chief soils on the gently undulating plain but some areas contain non-cracking clays and hard alkaline red soils (Beard 1975). The more dissected country contains low, stony hills capped by ironstone gravels, with hard alkaline red soils and shallow loams associated with rock outcrops. If this overlying mantle of stones is removed, these soils are particularly susceptible to erosion. Overlying the duricrust at shallow depths are gravelly loams and sands, and there are substantial areas without soil cover. These shallow soils and associated vegetation are susceptible to erosion.

In the Fortescue River (*Yarnda Nyirranha*) valley flats, the chief soils are earthy clays along with some cracking clays, shallow loams and hard red soils. Flood-out zones feature highly calcareous earths with minor areas of shallow calcareous loams, overlying pedologically deposited limestone and calcareous gravels (kunkar). There are minor areas of shallow, calcareous loams darkened by organic material, and hard red soils and cracking clays. The Fortescue Valley soils are dominated by sclerophyll riverine woodland of coolabah and rivergum (see Section 17 – *Native Plants and Plant Communities*). These soils are particularly susceptible to erosion such as sheeting and gullying.

Geoheritage

A register of State Geoheritage Sites for Western Australia is being developed. Nominated geoheritage sites are based upon the recommendations of the Geological Society of Australia and are defined by the Director of the Geological Survey of Western Australia as, "Geological features considered to be unique and of outstanding value within Western Australia and to have significant scientific and educational values for the good of the community."

The Pilbara Craton, of which the planning area is a part, has been surveyed for geoheritage sites and no registered sites have been located within the planning area (A Hickman pers. comm. 2006, A Thorne pers. comm. 2006). However, given the significant age of the geology (the formation of which began more than three billion years ago) in the planning area and the presence of significant geological formations such as stromatolites in the vicinity of the planning area, important sites of geoheritage may be present (Lane 2004).

Geological features and landforms can be impacted by a range of activities including unauthorised vehicle use, extraction of fossils and other materials of value, track construction and vandalism. Strategies to prevent, detect and deal with unauthorised activities impacting on geological features and landforms will be used to assist in their protection and conservation.

15 – Geology, Landforms and Soils

Key Points:

- The planning area lies in the Pilbara Craton, one of the oldest geological regions in Australia.
- Dominant landforms in and around the planning area include the Chichester Ranges and the Roebourne Plains to the north, the Fortescue Valley, the Hamersley Ranges to the south and the Chichester tablelands in between.
- The soils of the Chichester Ranges are predominantly shallow, porous, loamy soils. The tablelands behind the Chichester escarpment contain hard loamy soils with red clayey subsoils. In the Fortescue River Valley flats the chief soils are earthy clays along with some cracking clays, shallow loams and hard red soils.

The objective is to maintain and encourage the appropriate use of the geological features, landforms and soils of the planning area.

This will be achieved by:

1. identifying geological features and soil types vulnerable to environmental damage (such as alluvial

soils and cracking clays) and protecting such features from damage where possible;
2. assessing the potential impacts on sites with geodiversity values that may arise from scientific research, recreational or other proposed developments within the planning area, and permitting these activities where they are consistent with the conservation and protection of the values of the planning area;
3. liaising with government agencies and other relevant stakeholders as necessary and appropriate to minimise adverse impacts on geomorphology values of the planning area;
4. establishing guidelines for sound earthwork practices and using these for development works in the planning area;
5. providing appropriate information, interpretation and/or education opportunities for visitors to increase their knowledge, appreciation and understanding of geological values (see Section 39 – *Community Education and Interpretation*);
6. continuing to support the collection and recording of information about sites of geoheritage value in the planning area and seeking to protect these values; and
7. taking action as necessary to ensure that any specific geoheritage sites or values identified over the life of the plan are protected from potentially damaging land uses and activities.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

16. HYDROLOGY AND CATCHMENT PROTECTION

The Millstream Chichester area contains two major hydrological components: the surface drainage patterns (rivers and creeks) and the underground waters of the Millstream aquifer (see Map 7). Other groundwater aquifers also exist throughout the area.

Surface Water Hydrology

The planning area falls into two major river basins; the Fortescue River Basin and the Port Hedland Coast Basin. The latter comprises four river catchments in the planning area; the Harding, the George, the Sherlock and the Yule rivers (see Map 7).

Both past and present drainage is closely related to the landforms and land surface. Current drainage through the planning area occurs to the west and to the north. The Fortescue drains in a westerly direction, whereas the remaining four rivers that flow through the planning area drain in a northerly direction. The northerly draining rivers have formed deep embayments in the Chichester tablelands and their headwaters are in narrow gorges (Kriewaldt and Ryan 1967).

Fortescue River Basin

The Fortescue River (*Yarnda Nyirranha*) is the one of the major rivers in terms of mean annual flow within the Pilbara and has the largest catchment area of all rivers in the planning area. The headwaters of the Fortescue River are located in the Opthalmia, Eastern Hamersley and Southern Chichester Ranges and flow in a west-north westerly direction.

The total Fortescue catchment covers an area of 44,500 km^2 and has its source south west of the town of Newman. It comprises two sections; an upper catchment of 31,200km^2 and a lower catchment of 13,300 km^2. These catchments operate as two distinct systems, separated by the Goodiadarrie Hills. The upper system drains into the Fortescue Marshes, a flat area upstream of the Goodiadarrie Hills. These hills are significant in that they provide a barrier to water flow between the upper and lower systems. Evidence suggests there has been no water flow past these hills for the past 50 years. Consequently, the upper catchment area upstream of the Goodiadarrie Hills does not add flow to the lower section of the Fortescue River (*Yarnda Nyirranha*), nor contributes to recharging of the Millstream aquifer. The Millstream Chichester National Park is located in the lower catchment, which is comprised of two sections. The first section is from the Goodiadarrie Hills to Gregory Gorge where the catchment is flat and the river channel poorly defined. From Gregory Gorge (west of the planning area) to the coast, the river is relatively well-defined and has significant tributaries, large pools and a riverbed of coarse boulder gravel (Dames and Moore 1984, Sinclair Knight Merz 1999, Ruprecht and Ivanescue 2000).

Between the Goodiadarrie Hills and Gregory Gorge, the Fortescue River system is very old and is likely to have been active since the early Tertiary (60 million years ago). Once it would have been a short vigorous stream cutting inland from the coast and would have had similar flow characteristics to the northerly-flowing rivers in the Port Hedland Coast Basin (Kriewaldt and Ryan 1967). Later, the Fortescue River captured the headwaters of the Robe River and its course would have been south of its course today. River capture is an event where one river intercepts part of another. This is a natural process and can be caused by geological or tectonic earth movements or by erosion where the course of a river moves sideways or its headwaters cut down and backwards and eventually cuts into the course of another. River capture in the Pilbara occurs mainly through erosion, which occurs during flood events (see below, *Riverbed Scouring and Erosion*). This is supported by the presence of large alluvial deposits near the current headwaters of the Robe River, suggesting that, once, there must have been substantial river flow in this area (Davidson 1969). Over time, the course of the Fortescue River moved northwards towards its position today.

Four major permanent pools on the Fortescue River (*Yarnda Nyirranha*) are located in the Millstream Chichester National Park, in deeply eroded sections of the River. Up to 14m deep, these are: Deep Reach Pool (*Nhangghangunha*); Crossing Pool (*Murlunmunjurna*); Palm Pool (*Thaawuthungganha*); and Livistona Pool (see Figure 5). A smaller permanent pool, Chinderwarriner Pool (*Jirndawurrunha*) is located on the Millstream Creek, a tributary of the Fortescue River (*Yarnda Nyirranha*). These pools are significant for their size, variety and permanency and they support a wide range of flora and fauna species and important ecological communities (see Section 17 – *Native Plants and Plant Communities*, Section 18 – *Native Animals and Habitats* and Section 19 – *Ecological Communities*). They are also of considerable cultural significance for the Traditional Owners, with Deep Reach Pool (*Nhanggangunha*) being home of the mythological serpent or Warlu, whose presence is still strongly felt there (see Section 23 – *Indigenous and Non-Indigenous Heritage*). During the life of this plan, the State Government will nominate the Millstream pools in the Millstream Chichester National Park to be considered for listing under the Ramsar Convention (see Section 7 – *Legislative Framework*). The Millstream Pools are likely to meet six of the possible nine criteria.

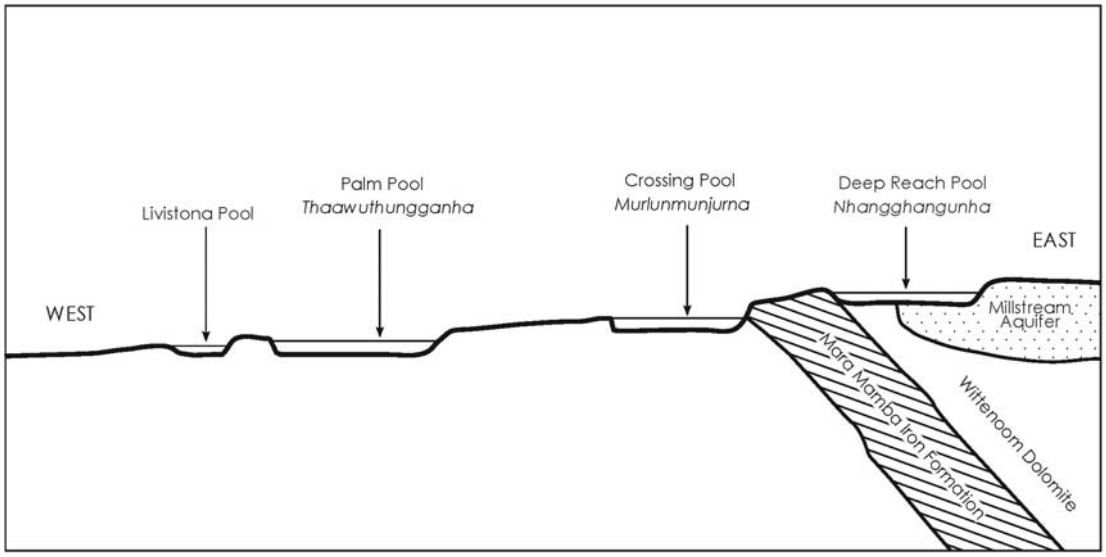

Figure 5: Conceptual Longitudinal Section through Pools on the Fortescue River

Upstream of Deep Reach Pool (*Nhangghangunha*) the river flows intermittently, mainly between December and March. Flows during the winter months may also occur as the result of winter rains. Downstream of Deep Reach Pool (*Nhangghangunha*), the Millstream aquifer discharges into the environment at springs, which feed

the Fortescue River (*Yarnda Nyirranha*), both directly and via small creeks including Palm Creek, Peter Creek, Woodley Creek, and Millstream Creek (which also includes the Millstream Delta distributary channels).

The consistent spring discharge maintains continuous 'base flow' in the Fortescue River (*Yarnda Nyirranha*) and normally flows beyond Gregory Gorge to the west of the planning area during the period January to October. In some years flow is maintained to Gregory Gorge continuously between 'wet' seasons (Ross Doherty pers. comm. 2002, Dames and Moore 1984.)

Port Hedland Coast Basin

This coastal drainage basin covers an area of 35,190 km^2 and comprises the catchments of six rivers, four of which are located in the planning area. These rivers predominantly flow northwards and are dominated by shrub steppe vegetation.

The north-western portion of the Millstream Chichester National Park is in part of the Harding River catchment and is comprised of three main tributaries – Western Creek, Harding River (which flows into the north western part of the park) and Harding River East (Ruprecht and Ivanescue 2000). The Harding River has a catchment area of 1,060 km^2. The Harding Dam is located 12 kilometres downstream of the confluence of these three rivers and provides part of the public water supply to the West Pilbara Water Supply Scheme (see Section 37 – *Water Extraction*).

The George River flows northwards through the centre of the Millstream Chichester National Park. This river has a highly distributed drainage and there are a number of significant pools and springs along its length (Ruprecht and Ivanescue 2000).

The Sherlock River has its headwaters on the Abydos Plain to the east of the Millstream Chichester National Park, which are bounded by the Chichester and Mungaroona Ranges. Its catchment area is 4,580 km^2. There are several springs at the headwaters and a number of large pools along the length of the river. Most of the river has a wide riverbed which is generally dry. Tributaries of the Sherlock River flow through the eastern part of the Millstream Chichester National Park (Ruprecht and Ivanescue 2000). The Yule River is the longest and largest river in the Port Hedland Coastal Drainage Basin (with a catchment area of 8,430 km^2), and, like the Sherlock River, has its headwaters in the Abydos Plain bounded by the Chichester and Mungaroona Ranges. Major tributaries of the Yule River, Pilbara Creek, Powdar Creek and the Pilbaddy Creek flow though the Mungaroona Nature Reserve. As the river flows northwards, it becomes highly braided with a wide alluvial riverbed. Pools are a lot fewer than on other rivers in the basin (Ruprecht and Ivanescue 2000).

These four northward flowing rivers have "captured" what were tributaries of the Fortescue River.

Rivers and wetlands in the planning area are impacted by a range of threats. Weeds such as Parkinsonia, waterfern and buffel grass have invaded riparian and wetland areas (see Section 20 – *Environmental Weeds*). Cattle straying into the planning area can cause trampling of riparian areas and vegetation, which can lead to the destabilisation of banks; increased sedimentation and reduced water quality (see Section 21 – *Introduced and Problem Animals*).

Approximately 26 wild rivers have been identified in Western Australia (V Klemm, *pers. comm.*). These are recognised as near pristine waterways and catchments ('Wild River' systems) and were assessed by the Australian Heritage Commission/Environment Australia and the then Water and Rivers Commission in 2002. These rivers have undergone no significant changes to their watercourse, despite past or present human activity within their catchments and are located mostly in sparsely populated parts of the State.

Tanberry Creek is the only wild river located in the Millstream Chichester National Park. This also flows through an area of pastoral lease, unallocated Crown land and other reserves.

Conservation guidelines for the management of wild rivers have been published by Environment Australia (1998).

Groundwater Hydrology

In the Pilbara, intermittent rainfall and high evaporation rates mean that all watercourses are ephemeral (i.e. they dry up for at least part of the year). Natural underground aquifers in the region are therefore important water sources. The Millstream aquifer, in the Millstream Chichester National Park supplies water to the pools in the

Fortescue River (*Yarnda Nyirranha*) and supports a diverse oasis environment (Water and Rivers Commission 2001).

The Millstream aquifer occupies a buried valley of the ancestral Fortescue River (*Yarnda Nyirranha*). The aquifer covers an area of 2,000 km^2 beneath the Fortescue River (*Yarnda Nyirranha*) to the east and the Robe River catchment to the west (see Map 7). The aquifer is mostly unconfined (i.e. water movement occurs freely in and out of the aquifer and the water is at normal atmospheric pressure) except to the east, where Kanjenjie clay confines it to a thickness of 47 m. The unconfined aquifer is comprised of Millstream dolomite (a combination of dolomite, calcrete, silcrete and clay) and has a saturated thickness of 33 m. Water readily passes through the aquifer due to its high secondary porosity and abundance of solution cavities (Water and Rivers Commission 1999).

The Millstream aquifer can be likened to a long dish with a chipped rim. A wet sponge (the Millstream dolomite) sits in the dish and, as long as the water level in the dish is high enough, water leaks out over the chips in the rim, forming natural springs, which keep the Millstream pools flowing. Recharge into the aquifer occurs in three different ways, mostly during flood events when water from the Fortescue River (*Yarnda Nyirranha*) crosses the aquifer upstream of Deep Reach Pool (*Nhangghangunha*). It also occurs as direct infiltration of rainfall onto dolomite outcrops, and via infiltration from small ephemeral creeks draining from the northern flank of the Hamersley Ranges. Water levels in the aquifer respond directly to any rainfall or a river flood event. Discharge from the aquifer occurs predominantly through a series of springs, the main one being where the Fortescue River (*Yarnda Nyirranha*) intersects the surface of the aquifer at the springs on Deep Reach Pool (*Nhangghangunha*) and Chinderwarriner Pool (*Jirndawurrunha*), Woodley Creek, Peter Creek and Palm Creek (Dames and Moore 1984).

Spring outflows from the aquifer support the large and biologically rich wetlands of the Millstream springs. The two largest of these are springs feeding into Deep Reach Pool (*Nhangghangunha*) and Chinderwarriner Pool (*Jirndawurrunha*), near the Millstream homestead. These springs sustain all of the wetlands in the Millstream Delta and in the bed of the Fortescue River (*Yarnda Nyirranha*) from Deep Reach Pool (*Nhangghangunha*) to Ganya (a locality some 30 kilometres downstream). Without spring flow and once river flows have ceased, pool volume would evaporate, resulting in pool level decline. In these circumstances, not all fringing vegetation would be supported. Evaporation may exceed 2 m in the larger pools.

Further details of the hydrology of the Millstream area, including the behaviour of the subsurface flows into Deep Reach Pool (*Nhangghangunha*), subsurface flows into and beneath the delta, and the hydrology of Palm Springs are described in the Millstream Water Management Plan (Welker Environmental Consultancy *et al.* 1998).

Water Quality

The *State Water Quality Management Strategy No.1* (Government of Western Australia 2001), as its response to the National Water Quality Management Strategy (ARMCANZ and ANZECC 1994), gives guidance for the management of water quality in creek and river systems of the planning area. The administration of water quality protection, and the conservation and management of Western Australia's water resources, is the responsibility of DoW. Under section 33(1)(dc) of the CALM Act, the Department also has responsibility for water protection and promotes the conservation of water, both in terms of quality and quantity, on land it manages.

Catchment Protection

The Millstream aquifer is an important water resource and water is extracted from the aquifer and piped to the coast, under licence, by the Water Corporation. Together with the Harding Dam, this makes up the West Pilbara Water Supply Scheme (see Section 37 – *Water Extraction*). Details about the management of water extraction from the Millstream aquifer (including Environmental Water Provisions) are outlined in Section 37 – *Water Extraction*.

Existing and future drinking water sources are protected by declaring water reserves and catchment areas. Water reserves are proclaimed over potential surface water and groundwater catchments or existing groundwater public drinking water source areas. These areas, established under the *Country Areas Water Supply Act 1947* (CAWS Act), are referred to as Public Drinking Water Source Areas (PDWSAs).

Drinking Water Source Protection Plans (DWSPP) establish the level of protection required within PDWSAs. These plans identify development pressures, the vulnerability of a water source to contamination, establish priority classification areas and set out programs to protect the resource. Water reserves are given a protection classification, which applies a level of protection to the reserve based on the strategic importance of the source. The three levels of priority classification are as follows:

- Priority 1 (P1): defined to ensure no degradation of the water source and declared over land where the provision of the highest quality public drinking water is the prime beneficial land use;
- Priority 2 (P2): defined to ensure that there is no increased risk of pollution to the water source and declared over land where low intensity development (such as rural) exists; and
- Priority 3 (P3): defined to minimise the risk of pollution to the water source and declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments.

In addition to priority classification, wellhead protection zones and reservoir protection zones are defined to protect the water source from contamination in the immediate vicinity of production wells and reservoirs. Wellhead protection zones are usually circular, with a radius of 500 metres in P1 areas and 300 metres in P2 and P3 areas. These zones do not extend outside water reserves. Additional restrictions apply within these zones.

Guidance on the type of land uses appropriate within these priority areas is provided by the Water Quality Protection Note '*Land use compatibility in Public Drinking Water Source Areas*' (Department of Environment 2004a) and *Policy 13 – Policy and Guidelines for Recreation within Public Drinking Water Source Areas on Crown Land* (Water and Rivers Commission 2003).

The major threats to the water quality include fuel storage, chemical storage, mechanical servicing, ablution facilities at recreation sites including any septic tanks and sewerage treatment plants, and the migration of leachate from rubbish tips.

The Department applies appropriate site planning and construction as well as a risk management approach to the protection of water resources. In particular, certain recreation activities can have a negative impact on water quality, especially water-based activities.

There is an existing water reserve and an associated PDWSA overlaying parts of the Millstream Chichester National Park proclaimed under the *Country Areas Water Supply Act (1947)* to protect the Millstream water source (see Map 14). Within this water reserve DoW uses by-laws to control potentially polluting activities as well as regulate land use, inspect premises and take steps to clean up and control pollution. Land uses associated with purposes of a national park are compatible with the purposes of a water reserve.

The Millstream Water Reserve has two levels of classification. A P1 classification exists over the highly permeable dolomite and its direct recharge area and a P2 classification exists for the remainder of the water reserve (Map 14). There are no P3 areas in the water reserve. There are wellhead protection zones around each of the production bores.

The major threats to the water quality in the Millstream Water Reserve, in particular, are activities which take place over the dolomite. These include fuel and chemical storage, mechanical servicing, septic tanks and sewerage treatment at the Water Corporation and the Department's depots, chemical storage at the Millstream Airstrip, ablution facilities at recreation sites, staff accommodation and nearby communities, recreation activities such as swimming, fishing and boating, the migration of leachate from the Millstream rubbish tip and pastoral activities on surrounding pastoral leases. All of these activities occur on the Priority 1 area and the potential impacts range from high to low and the likelihood from medium to low. Most of the risks of contamination of the aquifer are associated with the development and management of recreation sites and activities. Some broad principles to protect the public water supply from these threats are outlined in the preamble to Part E: *Caring for Country: Managing Visitors*. Strategies to address these threats are detailed throughout the plan as relevant.

River Bed Scouring and Erosion

Scouring (also known as river capture, see above) is a natural, but dramatic phenomenon that occurs in many Pilbara rivers. Most rivers are dry along their length, with occasional permanent pools, maintained by groundwater flow or inflow of water stored in sandy river beds. These pools are scoured during flood events, preventing sedimentation. Scouring maintains the pools, although sometimes extends them downstream after flooding.

Millstream is the site of current dynamic river capture, where the Fortescue River operates as two quite different systems. Crossing Pool and other pools to the west are part of a system of rapids where the younger river draining towards the coast has captured an older river system. Upstream of Deep Reach is a different system where the river follows a paleochannel. A band of Marra Mamba Iron Formation forms a barrier between the two systems (see Figure 4 and Figure 5). Due to the marked difference in gradient between these two systems, riverbed scouring or erosion has occurred below Deep Reach Pool, Crossing Pool, Palm Pool and Livistona Pools following flood events in the past. Crossing Pool comprises a pool and a delta area of three braided channels to the west of the pool. At Crossing Pool, erosion in the delta channels in the past has resulted in a drop in water level of the pool of about 2 m. Erosion and the subsequent concentration of water outflow have also resulted in a drop of groundwater levels downstream and adjacent to the pool. This has also contributed to some vegetation loss between Crossing Pool and Deep Reach Pool in the last ten years. Scouring also results in the deposition of material in other pools. The effect of a decline in water level in Crossing Pool has also increased the grade and velocity of the channel upstream and increased the risk of erosion accelerating towards Deep Reach Pool.

The rate of erosion is influenced by factors such as geomorphology, topography, hydraulics, and hydrological and human activities. How these factors interact is unknown. Although a natural process, DC Blanford and Associates (1999) suggest that the erosion in Crossing Pool is exacerbated by factors such as:

- cattle grazing and associated impacts;
- the development of recreation facilities and the associated use of the area for camping and other recreation activities;
- construction of low-level weirs;
- bushfires;
- construction of roads across the delta;
- water stress in vegetation; and
- the presence of pre-existing channels.

This erosion also appears to be cyclical, where there are short bursts of erosion activity, followed by long steady periods, allowing wetland ecosystems to stabilise. The current erosion cycle is probably the first since European settlement of the area (G Rundle pers. comm. 2007).

Erosion on such a scale as now exists at Millstream has had localised impacts upon vegetation (tree deaths and the thinning of the understorey). This scouring and erosion also has a significant impact upon the recreation amenity of the affected pools with shallower water exposing snags and logs, bank slumping and a thinning vegetation canopy.

Hydrogeological investigations into the behaviour of the Millstream aquifer and its interaction with the pools on the Fortescue River have been the subject of a number of investigations dating back to 1969. Recent assessments of scour at Crossing Pool are provided in the reports Chester (1998), DC Blanford and Associates (1999) and Sinclair Knight Merz (1999).

In the past, management options have involved attempting to re-establish water levels by raising pool outlets with fill material. These have been largely unsuccessful. An intensive study of management options for the scoured area between Crossing Pool (*Murlunmunjurna*) and Deep Reach Pool (*Nhangghangunha*) is detailed in *River Management Options for Crossing Pool on Fortescue River at Millstream* (Sinclair Knight Merz 1999).

D.C. Blanford and Associates (1999) suggest the presence of a palaeochannel (ancient river or stream bed system) that is incised into the calcrete layer which exists below the Crossing Pool (*Murlunmunjurna*) delta. The process of erosion and scouring that is occurring in Crossing Pool (*Murlunmunjurna*) is suggested to be the result of the rejuvenation process of this palaeochannel, the control of which is beyond reasonable human intervention. This process is natural and will continue until a state of equilibrium is reached for the prevailing flow conditions. If there is no intervention, then the water level is likely to drop in the various pools (including Crossing Pool - *Murlunmunjurna*), resulting in erosion on the highest sections and an eventual reduction in the water flow rate across and along the delta. This would stabilise the system and may take several years if flood events are frequent or up to 50 years if there are fewer large rainfall events.

Given that the process of erosion and scouring of Crossing Pool (*Murlunmunjurna*) is a natural one, that any engineering works (even the more minor options) will require considerable resources for establishment and maintenance and, even then, may not be successful, the Department believes that enabling the system to return to its natural state option is the most viable and cost-effective at this stage. During cyclone events, the pool often

bursts its banks, flooding existing recreation facilities. For this reason, the camping and parking facilities at Crossing Pool (*Murlunmunjurna*) will be moved away from the edge of the pool and infrastructure close to the pool edge will be kept to a minimum (see Section 28 – *Visitor Accommodation*). Interpretive signage, explaining the erosion process to visitors will be provided. A monitoring program to assess the vegetation around the pool will be important to determine the impacts of flooding and erosion on riverine vegetation health. Encouraging research into the process of erosion at Crossing Pool will be another strategy proposed in the management plan. The Department will also focus on better-controlling the factors which exacerbate the erosion process such as trampling by cattle, visitor activities, the impacts of weir and road construction and bushfire management.

16 – Hydrology and Catchment Protection

Key Points:

- The planning area lies in the Fortescue River Basin and the Port Hedland Coast Basin.
- The Fortescue River (*Yarnda Nyirranha*) is the most significant in the planning area and originates in the Hamersley and Chichester Ranges. It comprises two sections; an upper catchment and a lower catchment which operate as two distinct systems.
- Other rivers in the planning area include the Harding, the George, the Sherlock and the Yule Rivers.
- Tanberry Creek is a wild river in the planning area.
- Springs that discharge water from the Millstream aquifer support the biologically rich wetlands of the area, which have been nominated for Ramsar listing. Areas of major spring discharge are Deep Reach Pool (*Nhangghangunha*), Chinderwarriner Pool (*Jirndawurrunha*), Woodley Creek, Peter Creek and Palm Creek.
- Recharge mostly occurs when the Fortescue River (*Yarnda Nyirranha*) floods, when rainwater infiltrates the dolomite, and from the infiltration of creeks draining from the Hamersley Ranges.
- A water reserve and associated Public Drinking Water Source Area within the Millstream Chichester National Park protects the Millstream water source from polluting activities and allows the regulation of land use in the area by DoW.
- Two levels of priority classification are allocated to the reserve to protect the water resource according to its strategic importance.
- Major threats to water quality at Millstream include fuel and chemical storage, mechanical servicing at the Water Corporation and Department depots and ablution facilities.
- River bed scour has had significant impacts at Deep Reach Pool (*Nhangghangunha*), due to past flood events, resulting in water level declines in this areas.
- River bed scour has also occurred at Crossing Pool (*Murlunmunjurna*), Palm Pool (*Thaawuthungganha*) and Livistona Pool.
- River erosion is a natural phenomenon in rivers such as the Fortescue. Engineering options have been examined and the most cost-effective management is to enable the system to return to its natural state.
- The Department supports the proposal to recommend the Millstream wetlands for listing under the Ramsar Convention.

The objective is to protect and conserve the quality and quantity of water and to maintain hydrological regimes in the planning area.

This will be achieved by:

1. protecting water sources, wetlands and hydrological processes within the planning area from damage or disturbance that may affect water quality or quantity;
2. implementing the Department's responsibilities for management, monitoring and investigations as documented in the Millstream Water Management Plan (or a revision thereof) and report as required to the Conservation Commission, the Millstream Park Council and the Millstream-Harding Consultative Committee;
3. utilising technology to prevent aquifer contamination and optimise groundwater use in the planning area as appropriate (e.g. appropriate waste management and pollution controls, low water usage and water recycling techniques);
4. engaging with relevant authorities (e.g. DoW) and adjacent landholders regarding water quality/quantity and providing advice and direction as necessary to ensure values of the planning area are protected;
5. liaising with other Government departments, organisations, landholders and neighbours, the Pastoral Lands Board, local authorities, mining companies and the community to facilitate effective, coordinated management of wild rivers in the planning area;
6. applying the conditions and criteria for P1areas as guidelines for areas as described in the Millstream

Water Reserve Water Source Protection Plan (1999);
7. ensuring any further developments in the Millstream Water Reserve meet the water quality protection objectives set by DoW;
8. engaging with relevant authorities (e.g. DoW) and adjacent landholders regarding water quality/quantity and providing advice and direction as necessary to ensure values of the planning area are protected;
9. investigating and supporting further quantitative research associated with erosion, river flow and vegetation health in Crossing Pool (*Murlunmunjurna*), Deep Reach Pool (*Nhangghangunha*) and Palm Pool (*Thaawuthungganha*). Developing a monitoring program to be undertaken cooperatively by the Department, DoW and the Water Corporation;
10. assessing the potential effects of Departmental operations, proposed developments and other activities on the rate and extent of riverbed scouring at Crossing Pool (*Murlunmunjurna*) and implementing appropriate strategies to minimise these impacts;
11. developing a communications plan and continuing to provide interpretive information to visitors to explain the erosion processes at Crossing Pool (*Murlunmunjurna*); and
12. siting recreation facilities at Crossing Pool (*Murlunmunjurna*) away from impacts of flooding and scouring (see Section 28 – *Visitor Accommodation*).

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
16.1 Compliance of Departmental activities with the by-laws of the CAWS Act.	16.1 There are no cases of non-compliance of Departmental activities with the by-laws of the CAWS Act.	Annually.

17. NATIVE PLANTS AND PLANT COMMUNITIES

The planning area is located in the Fortescue Botanical District within the Eremaean Botanical Province, as described by Beard (1975). The Eremaean Botanical Province occupies approximately 70 per cent of Western Australia and is typically an arid zone, with dry, barren, rocky and sandy country, with sufficient rainfall to maintain vegetation. The Eremaean Botanical Province supports 3977 plant species, making it less diverse than the botanically rich South-West Botanical Province (5710 species), but more diverse than its neighbouring Northern Botanical Province (2140 species) (Paczkowska and Chapman, 2000). The Fortescue Botanical District covers about 178 000 km^2 and consists of tree (*Warndangarli*) and shrub steppe communities with eucalypts (*Gurlimba, Majgan, Muyiling, Wirranggaa, Yayin, Wirlu*), acacias (*Marruwa, Warndayin, Burduwayi, Burlurru, Barbirrny, Gurrarra, Murnungu, Yirringan, Ganyji, Gurganyan, Muwarlingu, Garrga*) and spinifex (*Baru, Yalhi*). Mulga (*Wirndamarra*) is also present in the valleys and plains of short grasses are found in alluvial areas. There is an estimated 1500 to 2300 species in the Fortescue Botanical District (CALM 1999a).

Flora surveys in the planning area have been limited and patchy. To date, most have been associated with development proposals and many species have been recorded for the first time. Furthermore, these have been restricted to the Millstream Chichester National Park and understanding of the vegetation and flora of the Mungaroona Range Nature Reserve is only very limited. However, vegetation surveys are one component of the Pilbara Region Biological Survey and it is likely that this will increase understanding of the flora (particularly rare and priority species) and vegetation associations within the planning area.

Native Plants

There are 435 native plant taxa that have been recorded within the planning area, representing 70 families, and 173 genera. This compares with about 1730 plant species described for the Pilbara. This does not include the 31 environmental weed species (see Section 20 – *Environmental Weeds*). The largest number of species belong to the Poaceae family (grasses – 51 species), the Papilionaceae family (pea family - 47 species), the Mimosaceae family (acacia family – 34 species), the Amaranthaceae family (amaranth family – 24 species), the Malvaceae family (the mallow family - 21 species) and the Cyperaceae family (sedges – 20 species). Acacias are one of the major genera (31 species) and this is a reflection of the Pilbara being a major centre of species richness for this genera in Western Australia (over 100 taxa have been recorded in the region) (Maslin and van Leeuwen, 2005). Other significant genera are *Ptilotus* (15 species), *Heliotropium* (10 species), *Euphorbia* (10 species) and *Goodenia* (10 species).

The flora of the planning area is important to the Yindjibarndi and Ngarluma people, comprising a significant part of their diet, providing medicine (*Jamingarli*), materials, shelter (*Mayangarli*), wood for making implements, weapons, ornaments (*Wirrangarli, Yarrangarli, Murrudungarli, Walbarrangarli, Gujadangarli, Wanungarli*), decoration for ceremonies (*Janyjin Nhundayarndu*) and a range of other uses. Many of the plants found in the planning area are an integral part of the skin system of Traditional Owners, in which people, plants and animals are interrelated. During ceremonies and rituals, songs are sung to remind Yindjibarndi and Ngarluma people of the significance of various flora species in the planning area (Juluwarlu Aboriginal Corporation 2003).

Rare and Priority Flora

All flora native to Western Australia is protected under the Wildlife Conservation Act. Protected flora that is likely to become extinct or is rare or otherwise in need of special protection can be declared to be 'rare flora' under section 23F of the Wildlife Conservation Act (these species are commonly referred to as 'threatened') and is currently managed in accordance with the Department's draft *Policy Statement No. 9 – Conserving Threatened Species and Ecological Communities* (subject to final consultation). In addition, species that do not meet criteria for listing as threatened because of insufficient information, species that have been recently removed from the threatened list, or that are near threatened and require monitoring, are placed on the Department's Priority Flora list. Species on this list are grouped into Priority categories 1 through to 5. Priority species do not have the special legislative protection provided to rare flora, but a priority flora list is maintained as a mechanism to highlight flora of special conservation interest and encourage appropriate management activities. Although no Declared Rare Flora species have been recorded within the planning area, Priority 2, 3 and 4 species are known to be present (Appendix 2).

The Commonwealth EPBC Act provides a listing of nationally threatened species and ecological communities. While threatened species legislation is broadly similar across jurisdictions, there are different approaches to species listing, and therefore inconsistencies exist between State and National threatened species lists. The Australian Government and the Department are currently in partnership to align the threatened species listed under the EPBC Act with flora listed under the Wildlife Conservation Act.

There is no provision under existing State legislation to recognise and protect threatened ecological communities (only individual taxa are afforded special protection), although this is proposed to change when the proposed Biodiversity Conservation Act is enacted (see *Legislation* in Section 7). Some protection is also provided under other State legislation, such as the Environmental Protection Act.

As a result of only limited flora survey work in the planning area, there is little understanding of the status and condition of populations of priority flora species and the threatening processes. It is likely that, with further survey of the planning area, more DRF and Priority flora species will be identified and a better understanding of existing populations will be developed.

Endemic and Relictual Flora

The presence of the permanent pools (*Nyindangarli*) at Millstream has created refuges for water-dependent flora, uncommon in arid parts of the Pilbara and subsequently species with a high degree of endemism have evolved. Plants more typical of tropical habitats further north are found growing around the Millstream wetlands. For example, the planning area supports large stands of the Millstream palm (*Jirriny, Livistona alfredii*) which is locally endemic and restricted mainly to the Fortescue Valley around Millstream. It is also significant being a relict of a humid tropical paeleoclimate in the area and is dependent on a high water table. Other relictual plants include the soft fern *Caeratopteris thalictroides* and *Potamogeton octandrus* is found in the still pools. Areas of damp mud support *Lobelia quadrangularis* and *Peplidium maritimum* (Morton *et al.* 1995).

Plant Communities

Patterns of vegetation distribution within the Pilbara have been broadly mapped by Beard (1975). Map 8 shows the basic vegetation units of the area.

Large scale patterns of vegetation distribution are determined by soil and landform distribution and water availability. The major vegetation units recognised by Beard (1975) are:

- Mixed hummock grass savanna of spinifex (*Baru, Triodia wiseana*). This unit occurs below Mt Herbert where a minor extension of the Roebourne Plains extends into the Millstream Chichester National Park, and

along the Fortescue River (*Yarnda Nyirranha*) south-east of the park. The non-hummock grass species are dominated by *Aristida latifolia*, (*Bawuny*) but *A. contorta* and *Iseilema vaginiflorum* also occur;

- Short grassland. Areas of soft tussock grasslands are found on the Chichester tablelands dominated by *Aristida latifolia* (*Bawuny*). Forbs include *Ptilotus carinatus* (*Murlumurlu*), and *Crotalaria dissitiflora*. The *Ptilotus* at times becomes dominant and is extremely colourful when in flower. This vegetation association typically grows on clays (gilgai and cracking clays) and hard loamy soils (see Section 15 – *Geology, Landforms and Soils*). Although this vegetation association is fairly well represented within the planning area, there are few cracking clay communities within the Pilbara and each has different floristic characteristics (see Section 19 – *Ecological Communities*). These communities are located high in the landscape, sometimes on hilltops and plateaus. They are significant in that they can provide habitats for a range of specialised vertebrates such as the Lakeland Downs mouse and Ingram's planigale. Tussock grasslands are highly preferred by livestock and have been heavily grazed and degraded. Soil erosion can be a problem if vegetation cover is severely depleted. Seeking to include these areas into the planning area where possible will ensure a greater protection of these vegetation associations. For example, there is an area of alluvial plains with tussock grasslands or grassy shrublands on cracking clay soils to the south-west of the Millstream Chichester National Park. This area, known as the Brockman Land System, is currently part of a Water Reserve (Van Vreeswyk *et al.* 2004). Including this vegetation association within the park would offer it greater protection;
- Mixed snappy gum tree steppe and kanji shrub steppe. The Chichester Range is characterised by *Eucalyptus leucophloia* (*Majgan*) - *Triodia wiseana* (*Baru*) tree steppe on the steeper and stonier ground, and kanji (*Ganyji, Acacia pyrifolia*) – *T. pungens* shrub steppe on the gentler slopes. A large area of this vegetation unit runs along the length of the more rugged Chichester country into the Mungaroona Range Nature Reserve;
- Kanji shrub steppe (*Ganyji A. pyrifolia*) over spinifex (*Baru, T. wiseana* and *T. pungens*). The more dissected southern flank of the plateau, including most of the Mungaroona Range Nature Reserve, is covered generally with *A. pyrifolia* (*Ganyji*) – *Triodia* shrub steppe, the spinifex (*Baru*) alternating between *T. pungens* on the deeper soils and *T. wiseana* on the more rocky sites. Both this and the mixed snappy gum tree steppe are associated with shallow porous loamy soils;
- Snappy gum (*Majgan, E. leucophloia*) and bloodwood (*Bunaangu, Corymbia hamersleyana*) tree steppe over spinifex (*Baru, T. wiseana*). This mixed tree steppe occurs on the upper slopes and stony mesas on the northern side of the Fortescue floodplain between Millstream and Mt Florence (*Yirryinha*). Similarly, this vegetation type is associated with shallow porous loamy soils; and
- Sclerophyll riverine woodland of coolabah (*Wirlu*) and rivergum (*Wirranggaa*). The Fortescue River (*Yarnda Nyirranha*) and pools (*Wundungarli*) near Millstream are lined by well-grown rivergum (*Wirranggaa, E. camaldulensis*), cadjeput (*Marba, Melaleuca argentia*) and coolabah trees (*Wirlu, E. victrix*). The flats besides the rivers and creeks (*Wundungarli*) contain some unusual plants, notably the Pilbara endemic Millstream palm (*Jirriny, Livistona alfredii*). Other species include the white dragon tree (*Biyangarra Sesbania formosa*), and the shrubs *Hibiscus panduriformis, Samolus repens, Stemodia grossa* (*Minyjarra*) and *Stylobasium spathulatum*. This vegetation type was identified as a high priority for future reservation and is associated with earthy clays, cracking clays, shallow loams and hard red soils.

The riparian zone vegetation around the Fortescue River (*Yarnda Nyirranha*) is significant and dependent on the underground aquifer. Vegetation loss around the Fortescue River (*Yarnda Nyirranha*) has occurred in the past, possibly as a result of the over-extraction of water from the Millstream aquifer (see Section 16 – *Hydrology and Catchment Protection*). However, further survey work is required to establish the extent of this and the possible management actions required.

The Millstream wetlands and the Chichester gorges also provide refugia for fire sensitive plant species.

17 – Native Plants and Plant Communities

Key Points:

- Knowledge of the flora and plant communities in the planning area is limited.
- Approximately 440 plant taxa (173 genera), from 70 families and have been recorded within the planning area.
- While no declared rare flora have been recorded in the planning area, several priority species have been identified.
- The Millstream wetlands support important plant communities and provide a refuge for endemic and relictual water-dependent flora more typical of tropical areas further north.

The objective is to protect the diversity and distribution of specially protected and other native plants and plant communities within the planning area.

This will be achieved by:

1. identifying the native plants and plant communities that may require special protection (such as the Millstream wetlands), and implementing appropriate strategies to minimise the impacts from threatening processes;
2. identifying native plants and plant communities with important cultural significance and implementing appropriate strategies to minimise the impacts from threatening processes;
3. listing declared rare flora under the Wildlife Conservation Act and/or EPBC Act;
4. managing native plants and plant communities according to Department Policies;
5. encouraging and supporting research into native plants and plant communities and the traditional Indigenous use (*Ngardangarli*) and knowledge of flora and adapting management accordingly;
6. assessing proposed operations and developments and considering their effect on flora and plant communities in the planning area. Using this information to assess the level of threat to these species and communities and to determine appropriate management actions;
7. for scientific and Indigenous cultural reasons, seeking to include more areas containing vegetation units not well represented in the planning area, such as the extensive cracking clay communities to the south-west of the Millstream Chichester National Park;
8. conducting surveys, especially for rare, priority and poorly known flora, in the planning area, recording their location and opportunistically collecting voucher specimens for the Western Australian Herbarium and the Pilbara Regional Herbarium;
9. mapping additional vegetation associations and condition assessment within the planning area, to a scale more appropriate than Beard (1975);
10. using fire to maintain and enhance flora biodiversity as required, exercising special care where buffel grass dominates (see Section 22 – *Fire*);
11. rehabilitating degraded areas with species natural to the area where disturbance is severe and natural regeneration is less likely to occur (see Section 35 – *Rehabilitation*);
12. identifying flora species particularly at risk from climate change (e.g. endemic and relictual species) and implementing conservation strategies where practical (e.g. germplasm storage);
13. liaising with neighbouring land managers to promote compatible management on adjoining lands;
14. providing opportunities for visitors to improve awareness, understanding and appreciation about the importance of native plants and plant communities and impacts of threatening processes; and
15. applying knowledge and understanding gained from the Pilbara Region Biological Survey to improve on-ground management.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
17.1 Populations of priority or otherwise significant flora species, subject to natural variation.	17.1 No decrease in the number of populations of priority or otherwise significant flora species, over the life of the plan, subject to natural variation.	Every five years or as per recovery plans, if applicable
17.2 Changes in species composition and structure within the Millstream wetlands.	17.2 Maintain or improve the species composition and structure within the Millstream wetlands, subject to natural variation.	Every five years

18. NATIVE ANIMALS AND HABITATS

Fauna

Understanding of the vertebrate fauna of the planning area is known from several surveys carried out predominantly in the Millstream Chichester National Park (Burbidge 1971, Ride 1959 and Whitlock 1923). Surveys associated with development proposals have also further expanded understanding of the fauna of the Millstream Chichester National Park. Knowledge of the fauna of the Mungaroona Range Nature Reserve is limited.

The most significant habitats within the planning area are hummock grasslands and vegetation associated with the Millstream wetlands. The hummock grasslands provide shelter from predators and extreme temperatures for small mammals and reptiles. The Millstream wetlands support a diverse and complex flora, which also attracts a high diversity of fauna not normally found in arid or semi-arid environments.

It is often a challenge for animals to inhabit semi-arid areas such as the planning area. Infertile soils often mean that the abundance of edible plants is often limited, therefore limiting fauna populations. Rainfall can be variable, unpredictable and the incidence of drought can further restrict fauna to small patches of suitable habitat, increasing the risk of localised extinction for species. Exacerbating these factors is a range of other threats to native fauna and their habitats within the planning area. Habitat loss associated with the mining industry and pastoralism has had a significant impact on the native fauna in the planning area as well as habitat degradation associated with the introduction of environmental weeds, pest animals and changes to groundwater levels and quality. The advent of pastoralism also saw fire regimes in the planning area change from frequent burning by Indigenous people producing a mosaic effect to infrequent and large fires following settlement. As with Western Australia generally, these impacts have seen a dramatic change in the vertebrate fauna of the planning area and the Pilbara, and current trends show that populations are either static or declining. In addition, more than 15 per cent (11 species) of the Pilbara's original mammal fauna is now thought to be extinct (McKenzie *et al.* 2002).

The fauna of the planning area is of significance to the Traditional Owners (*Ngardangarli*). Animals provide food, clothing, decorations for ceremonies and they are kept as pets and for hunting companions. Animals are also important spiritually and different species have a place in the Yindjibarndi kinship system (*Galharra*) to which every person belongs. People sing songs about animals and they feature in Dreaming stories which describe the creation of the world (*Ngurra Nyujugamu*). Indigenous people (*Ngardangarli*) would also move around their country to ensure that not too many animals were hunted in one place (Juluwarlu Aboriginal Corporation 2005).

During the life of this plan, the Millstream wetlands within the Millstream Chichester National Park are proposed to be nominated for listing under the Ramsar Convention. Preliminary work for this nomination suggests that the Millstream wetlands meet a number of the Ramsar criteria for listing, predominantly those associated with the wetlands' fauna, these being that:

- they support populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region;
- they support plant and/or animal species at a critical stage in their life cycles, or provide refuge during adverse conditions;
- they support a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contribute to global biological diversity; and
- they regularly support 1 per cent of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

Mammals

There are 36 species of mammals that have been recorded in the planning area, excluding introduced species (Western Australian Museum, 2003). Bats (*Waramurrungga*) have the greatest diversity, with 16 species from 5 families being recorded. There is also a high diversity of dasyurid marsupials (*Yirriwardu*) with 10 species being recorded, four of which are endemic to Western Australia. In addition, there are 3 kangaroo species (*Bayuwanarra, Bajarri*), five rodents, one possum species (*Warrgi*) and the echidna.

Many of the ground dwelling mammal species have a preference for the hummock grassland areas, in particular the dasyurids. The Pilbara ningaui (*Ningaui timealeyi*) and the little red antechinus (*Dasykaluta rosamondae*) are common in the hummock grassland areas, where these small animals shelter from extreme temperatures and predators under spinifex hummocks. Cat predation is likely to be the primary threat to these small mammal species.

Of the 36 mammal species, 3 are endemic to the Pilbara IBRA bioregion (the little red antechinus, Rory's pseudoantechinus and the pebble mound mouse, [*Gurdi*]). A further three mammals are endemic to Western Australia.

A number of animal species in the Pilbara are now considered rare or extinct over their former range. Among mammals, this is most apparent among those of intermediate size (35 g to 5.5 kg adult body weight), known as the critical weight range (CWR). Species that are likely to have disappeared from the planning area (but present

elsewhere) include the long-tailed dunnart (*Sminthopsis longicaudata*), the Western barred bandicoot (*Perameles bougainville*), the bilby (*Garduwarli, Macrotis lagotis*), the burrowing bettong (*Garduwarli, Bettongia leseur*) and the spectacled hare-wallaby (*Warrgi, Lagorchestes conspillatus*) (Strahan 1995). Changed fire regimes (see Section 22 – *Fire*) and predation by cats (see Section 21 – *Introduced and Other Problem Animals*) are two factors implicated in the decline of these animals, so fire management and feral predator control in the planning area may have significant implications for existing and future populations of CWR mammals.

Birds

There have been 146 species of bird recorded in the planning area, including 38 species of waterbirds (Western Australian Museum 2003, Burbidge 1971). Many of the waterbirds are uncommon in inland parts of the Pilbara and at leaset 8 species use the wetlands for breeding (Jaensche 2001). Some species include the white faced heron, the Australian pelican (*Jiruna*), the little black cormorant (*Buwaa*), the glossy ibis, and the sacred kingfisher (*Jurdirri*). The diversity of bird species (*Gagingarli*) is high due to the presence of arid-adapted species and water birds found around the coolabah and rivergum woodlands (*Wirlu* and *Wirranggaa*) of the Fortescue River (*Yarnda Nyirranha*).

Endemism is low amongst the birds (*Gagi-ngarli*) with all 146 species found over widespread parts of Australia.

Reptiles and Amphibians

Like much of the Pilbara, the diversity of reptiles in the planning area is high, with ninety-seven species of herpetofauna recorded (Western Australian Museum 2003, Burbidge 1971). Skink species (*Yujurli*) are the most diverse with 27 species being recorded, while the diversity of geckoes (*Thaawu-ngarli*) and elapid snakes (*Warlu-ngarli*), (14 and 12 species) is also high. There is also a wide range of dragon and monitor lizards (*Garjadi-ngarli*). A number of species are dependent on the permanent pools at Millstream, such as the flat-shelled turtle (*Ngarrawirri, Chelodina steindachneri*), the Pilbara Olive Python (*Bargunyji, Morelia olivaceae barroni*) and *Lerista frosti*. Eight species of frog (*Jarraarn-ngarli*) have been recorded in the planning area. As with many of the small mammal species, many reptiles are found in the hummock grasslands where the spinifex hummocks (*Baru*) provide shelter from the heat and predators. Due to the importance of these grasslands as habitat for small mammals and reptiles, management will need to ensure their protection from habitat loss associated with factors such as environmental weeds, inappropriate fire regimes, pest animals and inappropriate developments or activities.

Of the 97 reptile and amphibian species, 15 are endemic to the Pilbara. These include two species of gecko (*Jagajagara*), two legless lizards (*Jinawarrmarnda Gajadi-ngarli*), 6 skinks (*Yujurli-ngarli*), two elapid snakes (*Warlu*) and one monitor lizard (*Gajadi*). In addition, five other reptiles (two geckoes and three skinks) are endemic to Western Australia (May and McKenzie 2003).

Fish

As a result of the size, variety and permanency of the wetlands at Millstream, the planning area contains a rich diversity of freshwater fish species (*Balingu*) with 11 species being recorded in the planning area (Western Australian Museum, 2003). Most of the species found at Millstream are found in other rivers in the Pilbara, although rivers of southern Pilbara are much more depauperate, collectively containing only four species. Most species of the planning area are found in other rivers in northern Australia, with only *Leipotherapon aheneu* being endemic to the Pilbara. No species of introduced fish have been recorded in the planning area.

Invertebrates

There is only a limited understanding of the invertebrates of the planning area. The planning area is known to contain a high diversity of dragonfly species (*Garlawirrura*) with 14 taxa collected (May and McKenzie 2003). Approximately 100 000 invertebrate specimens have been collected to date in the Pilbara Region Biological Survey across the Pilbara and initial examination by the Western Australian Museum suggest that at least 85 per cent of the species collected are new to science. Early results from the Pilbara Region Biological Survey have also indicated the region is incredibly rich in aquatic invertebrates and permanent wetlands such as the pools and streams at Millstream are the most species rich (S van Leeuwen pers. comm. 2006). These generally contain large numbers of beetles (*Birna, Gumbujuja, Murrunmurrun, Ngardawinkura, Nguyawinkura, and Nhankamirndij*) and water mites (*Gurndi*).

Invertebrates in the Pilbara are highly endemic. Although the understanding of invertebrate fauna in the planning area is limited, studies in other parts of the Pilbara suggest that many invertebrate species in the region have highly restricted distributions. For example surveys of land to the south of the planning area near Tom

Price (100 kilometres from the Millstream Chichester National Park) revealed a number of short range endemic species (i.e. those that have naturally small ranges of less than 10,000km^2). This included 2 millipede taxa, four species of land snail (*Guurruwa*) and two taxa of trapdoor spiders (*Ganbarr-ngarli*), which were identified as belonging to groups known to include short range endemics (Biota Environmental Sciences 2005, Harvey 2002). In addition, the black and gold damselfly (*Warra-ngarli, Nosostica pilbara*) is known only from the Pilbara and the larvae are found in the Millstream wetlands. These species with small ranges typically have poor dispersal capabilities, are confined to disjunct habitats and have low reproductive capabilities (Harvey 2002). It is possible that similar short range endemic species are present in the planning area, and, given their importance to biodiversity, further assessment of their status in the planning area is required.

Preliminary results from the Pilbara Region Biological Survey suggest that the region is a hotspot for stygofauna and results from the Millstream Chichester National Park indicate a significant and previously undetected stygofauna within the Millstream aquifer. Stygofauna are subterranean fauna found in groundwater (Biota Environmental Sciences, 2005). This biological richness of stygofauna in the Millstream aquifer and the Pilbara as a whole has been attributed to the region's geological history. The inland Pilbara has remained above sea level for more than 550 million years while the remainder of the continent has merged and separated from other land masses. Species that originated in the Pilbara radiated out to other continents when Australia was part of a larger "supercontinent". Therefore species in the Pilbara share many biogeographical similarities with those from other parts of the world. Conservation of this stygofauna is of considerable importance.

The stygofauna thought to be present in the Millstream aquifer are also likely to be highly endemic and relictual. To date, 275 species of subterranean amphipod have been described in the Pilbara from sites including Cape Range, Barrow Island, Ethel Gorge (also located on the Fortescue River - *Yarnda Nyirranha*, but outside the planning area) as well as Millstream. Examination of the genetic diversity of these suggests that different catchments contain a unique suite of species, probably due to catchment boundaries limiting the dispersal of species between catchments (Finston and Johnson 2004). Hence, it is likely that the Millstream aquifer contains a suite of unique species of stygobites. Subterranean fauna also has relictual value, having descended from the time prior to the break-up of the Gondwanan supercontinent 120 million years ago. Stygofauna from the Millstream aquifer has been found to have affinities with an order of crustaceans previously only found in South Africa and Brazil (Humphreys 2003). The diversity and abundance of these species are unknown. Consequently, the possible diversity of these species in the Millstream aquifer would be of value in improving understanding of zoogeography and the evolution of the biota of the Pilbara and its landscape. Even though it is possible that the diversity of stygofauna in the Millstream aquifer is high, their genetic distance from the dominant modern fauna makes them important for biodiversity and conservation. They may also play an important role in maintaining water quality through bioturbation (the disturbance of sediments) (Water and Rivers Commission 2001). In addition, because of their restricted habitats, reliance on high rainfall and low dispersal rates, Gondwanan relicts may suffer the most as a result of climate change (Pouliquen-Young and Newman 2000). Subterranean fauna dependent on groundwater would also be highly susceptible to changes in the water level of the aquifer.

Threatened and Other Specially Protected Fauna

At a State level, the Wildlife Conservation Act (section 14 (2) (ba)) provides for the Minister to declare species of native fauna as 'rare or likely to become extinct' (commonly referred to as threatened) or 'other specially protected fauna'. The Department's (Draft) *Policy Statement No. 9 – Conserving Threatened Species and Ecological Communities* (subject to final consultation) provides management direction for fauna thus declared.

There are two species (The Pilbara olive python [*Morelia olivaceae barroni*] and the peregrine falcon [*Falco peregrinus*]) of fauna declared under section 14 (2) (ba) currently recorded for the planning area. These are listed as specially protected.

Species that do not meet criteria for listing as threatened because of insufficient information, species that have been recently removed from the threatened list, or that are near threatened and require monitoring are placed on the Department's Priority Fauna list. Species on this list are grouped into Priority categories 1 through to 5 (see Appendix 2 for definitions of these). There is currently one Priority 1, one Priority 2 and 10 Priority 4 species recorded for the planning area. A description of habitat requirements and specific threatening processes for specially protected and priority fauna is included in Appendix 3.

Feral predators, namely cats and foxes, are the main threat to priority fauna within the planning area, particularly for priority birds. The ghost bat is also threatened by human disturbances and, in particular, risks getting caught in wire fencing.

International Conventions and Agreements

There are thirty-one bird species that have been recorded within the planning area that are listed on the national *List of Migratory Species* and/or are covered under various international conventions or agreements (see Section 7 – *Legislative Framework*). The fork-tailed swift (*Apus pacificus*) is listed under JAMBA, CAMBA and ROKAMBA. The glossy ibis (*Plegadis falcinellus*), which is found in the planning area is listed solely under CAMBA and the cattle egret (*Ardea ibis*) is listed under JAMBA and the Bonn Convention. Twenty-five species found in the planning area are listed under the Bonn Convention and some of these include the collared sparrowhawk (*Accipiter cirrocephalus*), the wedge-tailed eagle (*Aquila audax*), the wood duck (*Garandarri, Chenonetta jubata)*, the peregrine falcon (*Garlamarna, Falco peregrinus*) and the pied cormorant (*Buwaa, Phalocacrocorax varius*). Twenty-five species that occur within the planning area are also migratory species under the EPBC Act, some of which include the brown songlark (*Cincloramphus cruralis*), the rainbow bee-eater (*Merops ornatus*) and the black kite (*Milvus migrans affinis*).

18 – Native Animals and Habitats

Key Points

- There are 36 mammal, 146 bird (*Gagi-ngrli*), 97 reptile and amphibian and 11 fish (*Balingu*) species found in the Millstream Chichester National Park. Fauna of the Mungaroona Range Nature Reserve is not well known.
- There are two specially protected species listed under the Wildlife Conservation Act.
- There are 31 migratory bird species listed under the Bonn Convention or under JAMBA, CAMBA or ROKAMBA.
- Habitat loss associated with the mining industry and pastoralism has had a significant impact on the native fauna in the planning area as has habitat degradation associated with environmental weeds, inappropriate fire regimes, pest animals and changes to groundwater levels and quality.
- The Millstream wetlands provide an important habitat for birds, fish, invertebrates and subterranean fauna, are nationally significant and are to be nominated for listing under the Convention on Wetlands (Ramsar Convention).
- The Millstream wetlands and aquifer supports a diverse range of invertebrates and subterranean fauna of high scientific significance including endemic and relictual species.

The objective is to identify, protect and conserve specially protected and other native fauna and their habitats within the planning area.

This will be achieved by:

1. encouraging and supporting research and further survey into vertebrate and invertebrate fauna and their habitats, to increase knowledge in particular of traditional Indigenous use (*Ngarda-ngarliyarndu*) and knowledge of fauna, the effect of fire management strategies on the fauna of hummock grasslands and the habitat requirements of subterranean fauna, invertebrates and specially protected and priority fauna species;
2. protecting fauna and fauna habitats from threatening processes such as environmental weeds, inappropriate fire regimes, introduced and problem animals, and changes in groundwater levels and quality. Priority should be given to threatened species;
3. providing statutory protection for specially protected species by listing them under the Wildlife Conservation Act and/or EPBC Act, subject to satisfaction of the criteria for listing;
4. managing native animals and habitats according to Department policies
5. assessing proposed developments and management activities for their potential impact on faunal values, including surveying for the occurrence of specially-protected and priority species. Use this information to assess the level of threat to these species and to determine appropriate management action;
6. maintaining inventories (e.g. location records) of fauna values for specially protected and priority fauna species and reporting sightings of threatened or restricted fauna, and maintaining records in the State database;
7. preparing and implementing recovery and re-introduction/translocation plans for specially protected species and, where necessary, other species in decline or locally extinct;
8. considering the requirements of fauna species within the planning area and, where possible, applying fire to promote biodiversity;
9. providing opportunities for visitors to increase their knowledge and appreciation of the native fauna of the planning area, in particular their Indigenous significance;
10. ensuring that special fauna conservation values (e.g. subterranean fauna values associated with the

Millstream aquifer and small mammal and reptile values of hummock grasslands) are considered in negotiations regarding areas proposed for addition to the public conservation estate (see Section 9 – *Existing and Proposed Tenure*); and

11. identifying fauna species at particular risk from climate change and implementing conservation management strategies where practicable (e.g. maintaining captive populations).

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
18.1 Diversity of native fauna species and habitats.	18.1 No decline in known species or habitat diversity over the life of the plan.	Every five years.
18.2 Population numbers and range of specially protected or otherwise significant fauna species.	18.2 Remains stable or increases over the life of the plan subject to natural variations.	Every five years or as per recovery plans if applicable.

19. ECOLOGICAL COMMUNITIES

An 'ecological community' is a naturally occurring biological assemblage that occurs in a particular type of habitat. All ecological communities serve an important ecological function and so are intrinsically significant. However, ecological communities that are particularly vulnerable include those with the following characteristics:

- a community that is restricted in its extent;
- particular habitats or ecosystems that contain sensitive species;
- communities that are threatened (e.g. Threatened Ecological Communities); and
- communities that are species-rich or contain aggregations of endemic, disjunct or relictual flora species (see Section 17 – *Native Plants and Plant Communities*).

The planning area contains a number of different types of ecological communities and, given the size and location of the planning area, many of these are very important for local, regional, state and international biodiversity conservation.

Threatened Ecological Communities

The Commonwealth's EPBC Act provides protection for ecological communities listed as threatened. Under current State legislation, threatened ecological communities (TECs) are not afforded special protection (unlike individual flora and fauna species), although this is proposed to change if and when the proposed Biodiversity Conservation Act is enacted.

The Department maintains a list of informal priority ecological communities as well as Ministerial-approved TECs. Some protection is provided under other State legislation, such as the *Environmental Protection Act 1986*.

There are currently no State or Commonwealth Ministerial-approved TECs within the planning area. However, priority ecological communities (PEC) of conservation significance have been identified in the planning area, which are possibly at risk and require further survey and investigation before they can be considered as TECs. These include:

- hummock grassland areas which provide refuge for reptile and small mammal communities;
- cracking clay communities of the Chichester Range and Mungaroona Range;
- *Heliotropium, Eragrostis* community on seepages near Mt Montagu in the Chichester Ranges;
- stygofauna communities of the freshwater aquifers within the Millstream Chichester National Park. These have also been identified as a priority for classification as a threatened ecological community, which may occur over the life of the plan.

These PECs are at risk from a range of threats. For example, the *Heliotropium, Eragrostis* community is threatened by grazing and trampling from feral donkeys and cattle (see Section 21 – *Introduced and Problem Animals)*. Likewise, the cracking clay communities of the Chichester Range and Mungaroona Range are also threatened by feral donkeys and cattle as well as activities associated with the construction and management of

mining infrastructure such as roads and railways (see Section 36 – *Utilities and Services*). The stygofauna communities of the freshwater aquifers in the Millstream Chichester National Park are threatened by groundwater drawdown, which, in the past, has resulted from water extraction from the Millstream aquifer (see Section 37 – *Water Extraction*).

The Millstream wetlands on the Fortescue River within the Millstream Chichester National Park are a significant ecological community in that they support an important diversity of flora species and provide an important habitat for a range of fauna, particularly subterranean fauna, invertebrates and freshwater fish. Although not proposed for consideration as a TEC or PEC, their protection will ensure the maintenance of a range of important species and habitats. The Millstream wetlands are threatened by a number of factors, including:

- grazing and trampling from feral cattle, donkeys and horses that occur in the planning area (see Section 21 – *Introduced and Problem Animals*);
- invasion by environmental weeds, particularly date palms, buffel grass, Parkinsonia and water fern (see Section 20 – *Environmental Weeds*);
- human impacts from recreation along the Fortescue River (see Part E. *Caring for Country – Managing Visitor Use*); and
- changes to the ground and surface water hydrology as a result of water extraction from the Millstream aquifer (see Section 16 – *Hydrology and Catchment Protection*).

The then Department of Agriculture conducted an inventory and condition survey of the Pilbara in 2004 which identified the Wona Land System as being significant. There are significant areas of this land system in the Millstream Chichester National Park and extending east beyond the park boundary. The Wona System contains areas of a variety of cracking clays at risk from pastoralism and may be a candidate for consideration as a threatened ecological community (Department of Agriculture 2004).

Threatened ecological communities are afforded protection by the Department through endorsement procedures, the development and implementation of recovery plans.

19 – Ecological Communities

Key Points

- There are a range of ecological communities at risk in the planning area, which may become TECs over the life of the plan.
- The State Government proposes to recommend the Millstream wetlands for listing under the Ramsar Convention over the life of this plan.

The objective is to identify, protect and conserve ecological communities of conservation significance.

This will be achieved by:

1. identifying and protecting potential TECs or communities at risk in the planning area by listing them under appropriate legislation, such as the Commonwealth's EPBC Act or the proposed State Biodiversity Conservation Act;
2. assessing proposed developments that may impact on the natural values of potential TECs, communities at risk or communities of other conservation significance;
3. managing factors that can lead to loss or degradation of ecological communities (e.g. environmental weeds, introduced and problem animals, and changes in groundwater levels and quality);
4. supporting and encouraging research into the habitat and ecology of potential TECs, PECs and other communities susceptible to threatening processes; and
5. providing information to visitors about the importance of ecological communities and significant habitats in the planning area, and their vulnerability to human impact.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

20. ENVIRONMENTAL WEEDS

Introduced plants, pest plants, invasive plants or environmental weeds are defined in the *Environmental Weed Strategy for Western Australia* (EWSWA) (CALM 1999b) as being plants that establish themselves in natural ecosystems and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade. Environmental weeds displace native plants, particularly on disturbed sites, by competing with them for light, nutrients, water and space. They also change nutrient conditions, hydrological patterns, soil erosion patterns, light distribution, geomorphological processes, and biomass distribution and substantially reduce regeneration of native plants. Environmental weeds can also have a significant adverse impact on other natural values by altering animal habitats, harbouring pests and diseases, and increasing fire hazard.

An integrated approach to environmental weed management was developed in the EWSWA. As part of this Strategy, environmental weeds are rated as high, moderate, mild or low in terms of their environmental impact on biodiversity. The criteria used to determine the rating for each weed were:

- *Invasiveness* - ability to invade bushland in good to excellent condition or ability to invade waterways;
- *Distribution* - current or potential distribution including consideration of known history of wide spread weeds elsewhere in the world; and
- *Environmental Impacts* - ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community.

The Department's (Draft) *Policy Statement Environmental Weed Management* (subject to final revision) is used in conjunction with the Environmental Weed Strategy (EWS) to guide the approach and priority setting for the control of environmental weeds on lands and waters managed by the Department. Priorities for action are to first control any weed that impacts on threatened or priority flora, fauna or ecological communities, or that occurs in areas of high conservation value, and then address high, moderate, mild and low EWS-rated environmental weeds in decreasing priority as resources allow. The impacts of weeds and their potential spread in local conditions should also be considered.

Options for environmental weed management include prevention, eradication, control, containment, asset protection, monitoring or limited action. It is the preferred option to prevent the introduction of environmental weeds through appropriate management, as eradication is rarely feasible. Methods of control include managing disturbance, the use of herbicides, biological control, manual control, and control through the application of fire. Effective control programs encourage the growth of native species and the suppression of weeds with the overall aim of boosting the area's resilience to further weed invasion.

The process undertaken for the EWSWA provided a statewide ratings list. In 2008, the Department commenced a weed risk management project that will prioritise weeds within each of the 26 IBRA bioregions. This project will involve the prioritisation of weed species through the assessment of their invasiveness, impacts, potential and current distribution and feasibility of control. It will also investigate the use of an asset protection based approach for the prioritisation of established weeds. This approach looks at prioritisation of management actions aimed at protection of environmental assets from the threat posed by established weeds within each bioregion.

Landholders, including the Department, are legally responsible for eradicating plants declared under the *Agriculture and Related Resources Protection Act 1976* (ARRP Act), however the *Agriculture Protection Board Act 1950* (APB Act) takes precedence over the ARRP Act to the limit of any inconsistency between the two Acts and preserves the Department's right to decide priorities and the level of control according to resources. Control of such declared weeds is subject to inspection and penalty if control is not undertaken to the required standard. Declared species in the planning area are the spinyhead sida (*Sida acuta*) and Parkinsonia (*Parkinsonia aculeata*). Parkinsonia is also listed as one of 20 Weeds of National Significance. Mexican poppy (*Argemone ochroleuca*), which also occurs in the park, is a declared species but not in the Pilbara.

Both the ARRP Act and the APB Act are being replaced by the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Provisions of the BAM Act were progressively implemented from 1 July 2009.

The Agricultural Protection Board (APB)[5] is a statutory State body, which sets policy and priorities relating to Declared Plants and Animals and advises the Minister and Director General of the Department of Agriculture

[5] With the implementation of the BAM Act, the APB is under review and it is possible that this will be replaced by a Biosecurity Council.

and Food on a broad range of biosecurity issues. The APB is supported by a network of currently 20 statutory advisory committees called Zone Control Authorities (ZCAs). The role of the ZCAs is to monitor the service delivery of the management of Declared Plants and Animals, advise the APB on issues of concern within each zone, advise APB on the views of stakeholders within the zone and increase the awareness of stakeholders in each zone of agricultural protection and biosecurity issues. Currently, the Pilbara ZCA coordinates the integrated management of weeds and pest animals across a range of tenures and stakeholders. It is likely that ZCAs will become "Recognised Biosecurity Groups" under the BAM Act. The Department supports this type of integrated management of weeds and pest animals on Department-managed lands.

Weeds in the Planning Area

The last 135 years has seen 31 different weed species introduced to the area (see Appendix 4). The most significant include buffel grass (*Cenchrus ciliaris*), Parkinsonia (*Parkinsonia aculeata*), date palm (*Phoenix dactylifera*), water fern (*Ceratopteris thalictroides*) and ruby dock (*Acetosa vesicaria*). Some were planted because of their economic benefit to the pastoralists, others for aesthetic reasons, and some were introduced unintentionally.

Weeds within the planning area have been prioritised based on local management issues, the small or discrete nature of the infestation and for their potential invasiveness, distribution and environmental impacts (see Appendix 4). In several instances the weeds with a high priority for management in the planning area, differ quite markedly from those with a high rating in the Environmental Weed Strategy. Weeds rated as 'high' in the planning area are given higher priority than those rated as 'high' in the Environmental Weed Strategy, due to the broad nature of this list and the current process of prioritisation based on the level of threat posed by weeds in different bioregions. The four priority weed species for management in the planning area are Parkinsonia, date palm, water fern and ruby dock.

Buffel grass, a tough perennial tussock grass, was actively spread by the pastoral industry throughout the Pilbara. Buffel grass displaces native species and can rapidly establish a monoculture. It favours lighter sandy soils, particularly along water courses. The impact of buffel grass within the Pilbara has been significant and it has become widely distributed across the region. Buffel grass was planted at Millstream for its fodder value as a stock feed during the 1880s and is now established along almost every water course. It spreads through dispersal of its fluffy burrs (seeds) by wind, water and animals, particularly along drainage lines and roads, with its spread along roads being assisted by vehicle draughts and movement of soil by graders and other vehicles. It is also known to reproduce vegetatively, via rhizomes and stolon sprouts, and is capable of rigorous establishment after fire (Tu 2002). Control of buffel grass is difficult, with no single control method being effective, particularly in light of the landscape scale of control required in the planning area. Hence, the eradication of buffel grass within the planning area is likely to be impossible. The key to management of this species is the prevention of new infestations or control of small infestations where management can be effective.

Kapok bush (*Aerva javanica*) has spread throughout the Pilbara, favouring areas of soil disturbance. Its direct effects on native flora are unknown. Within the planning area, kapok bush has followed road and rail construction, and is present throughout the Pilbara.

Ruby dock was first recorded in the 1890s from the Pilbara, and has since spread throughout the region. It is an annual whose full ecological effects are unknown. Ruby dock is common in the planning area due to infestation along the Pilbara Iron access road and railway line and is becoming a very big problem in the Millstream Chichester National Park. A concerted effort will be required during the construction of the sealed Karratha-Tom Price Road to ensure that this does not result in the greater spread of ruby dock through the Millstream Chichester National Park. Recent research by the Botanic Gardens and Parks Authority has improved understanding about the germination, dormancy, longevity and soil seed banks of this weed and made recommendations about effective chemical control methods (Anthony and Dixon 2006). However, there is still limited understanding of the impact of fire on ruby dock.

Introduction of the date palm has had the biggest effect on the Millstream Chichester National Park in the last 135 years. The palms were spread along transport routes in the north-west wherever there was permanent water. Pastoralists planted dates at Millstream to harvest the fruit. In the last 40 years the palms have multiplied so much that they now spread along the Fortescue River (*Yarnda Nyirranha*) from Deep Reach Pool (*Nhangghangunha*) to Gregory Gorge. Date palms seriously compromise the biodiversity values of these important ecosystems through out competing and replacing native riparian flora, salinisation, watercourse modification and introduction of severe fire regimes.

Parkinsonia, one of 20 Weeds of National Significance, is a serious weed in the Pilbara and Kimberley and is found along the Fortescue River, forming dense thickets. It was introduced to pastoral areas for shade and ornamental purposes. The seed pods float, so are readily dispersed by floods. Like the date palm, Parkinsonia can choke riparian and wetland ecosystems (Hussey *et al*, 1997).

The start of the 1900s saw the introduction of species that would make the Millstream homestead area more attractive and appear less isolated than it was. Athel pine (*Tamarix aphylla*) and albizia (*Albizia lebbeck*) were planted in dry areas, and cotton palms (*Washingtonia filifera*), date palms (*Phoenix dactylifera*), giant reed (*Arundo donax*) and yellow oleander (*Cascabela thevetia*) were planted near the springs and streams. Water lilies (*Nymphaea* sp.) and water fern (*Ceratopteris thalictroides*) were put into Chinderwarriner Pool (*Jirndawurrunha*) and spread to other wetland areas with the watercourses themselves providing a vector for spread. Other species spread into the area by the movement of stock, vehicles and people. These include Mexican poppy (*Argemone ochroleuca*), khaki weed (*Alternanthera pungens*), Parkinsonia and Gallon's curse (*Cenchrus biflorus*).

Weeds in the planning area have had a significant impact on some of the natural values of the planning area. Many species (such as the date palm) have been aggressive invaders of riverine and wetland habitats. In some instances colonisation has seen the total replacement of native vegetation, significantly altering the ecology of the Millstream wetlands. Stream flow and wetland habitats can be altered by weeds such as date palms and water fern. Large infestations of weeds can also promote large intense wildfires that can kill native species such as *Melaleuca* and *Eucalyptus* species which may take many years to regrow.

Several major weed eradication or control programs have been undertaken in the Millstream Chichester National Park. Targets have included yellow oleander, morning glory (*Ipomoea* sp.), Parkinsonia, stinking passion flower (*Passiflora foetida*), Gallon's curse, cotton palm, date palm, water fern, water lilies and khaki weed, as well as various garden plants in the homestead surrounds. Joint control programs with the Department of Agriculture and Food continue around the delta and along the edges of the pools and river. This includes a trial of the release of biological controls to reduce the Parkinsonia infestations, which has only had limited success to date.

Exotic palm control has been undertaken according to the Department's Interim Management Guidelines (1996). The control program aims to remove exotic palms to reduce the risk of fire damage in key areas, eliminate the seed source upstream and rehabilitate treated areas. Controls on a small scale were carried out in the mid-late 1980s. About the same time, Perth-based landscape architects showed an interest in transplanting large palms and many hundreds of mature palms were transported to Perth for landscaping. Removal of exotic palms from delta drainage channels since 1997 has significantly improved water flow back to the Millstream delta area.

Given the presence of date palms around the Millstream Homestead for over 100 years, they have important cultural values associated with the European settlement of the area. In addition, visitors are attracted to the "oasis" created by the palms. In order to retain these cultural values, male date palms will be kept around the Millstream Homestead and Chinderwarriner Pool (*Jirndawurrunha*) and the area rehabilitated with native species. Once these male date palms die, they will be removed and the gaps replanted with native species.

Due to limited access into Mungaroona Range Nature Reserve, the impacts of weeds in the area are low.

20 – Environmental Weeds

Key Points

- Buffel grass, ruby dock and kapok bush are widespread throughout the Pilbara.
- Major weed eradication programs have been implemented in the Millstream Chichester National Park for yellow oleander, morning glory, Parkinsonia, stinking passion flower, Gallon's curse, cotton palm, date palm, water fern, water lilies and khaki weed.
- Parkinsonia is a declared weed under the Agriculture and Related Resources Protection Act and is one of 20 Weeds of National Significance.
- The four priority weed species for management in the planning area are Parkinsonia, date palm, water fern and ruby dock.
- Date palms have had a considerable impact upon aquatic communities in the Millstream Chichester National Park and a significant control program has been implemented.

The objective is to minimise the impact of environmental weeds on values of the planning area.

This will be achieved by:

1. considering the *Environmental Weed Strategy for Western Australia* and local knowledge to assess weed invasiveness, distribution and environmental impact;
2. managing environmental weeds according to relevant legislation and Department policies;
3. preparing and implementing a priority environmental weed management plan, where impacts on natural values are found to be negative, based on:
   - the invasiveness of the species;
   - the existing and potential impact of the species;
   - the efficiency and effectiveness of control measures;
   - location and availability of resources;
   - level of participation of stakeholders; and
   - the capacity for long-term control and monitoring of the program.
4. monitoring and evaluating environmental weeds in accordance with the weed management plan;
5. undertaking (and maintaining) baseline weed mapping as part of the preparation and implementation of a prioritised weed management plan cognisant of the Environmental Weeds Strategy for Western Australia or appropriate system and local knowledge;
6. eradicating new and emerging weeds before they become established;
7. limiting the opportunity for weeds to be introduced and established within the planning area by minimising disturbance to soil while carrying out management activities, particularly in areas adjacent to sources of weeds. Applying entry hygiene controls as required;
8. identifying and mechanically removing or poisoning all immature date palms and mature female date palms from the planning area. This will be an ongoing process due to the presence of a seed store in the ground. Mature male trees will be retained for their historical value at selected sites (see Section 23 – *Indigenous and Non-Indigenous Heritage*), however, as these die out, they will replaced with native vegetation;
9. using fire for both weed control (for example burning heaps of poisoned exotic palms) and fuel reduction following weed poisoning programs in the Millstream delta area, where and when appropriate;
10. containing and controlling ruby dock along all road and railway corridors in conjunction with mining companies and Main Roads WA;
11. supporting and encouraging research into the effects and control of buffel grass. Adapting weed control management if appropriate in response to findings;
12. supporting and encouraging research into the relationship between fire, buffel grass and native species;
13. liaising with other Government departments, the Pilbara Zone Control Authority (or equivalent), local government, the Water Corporation landholders and neighbours, the Pastoral Lands Board, local authorities, mining companies and the community to facilitate effective, coordinated and integrated weed management in the planning area and on adjoining lands that ensures integration with relevant management agreements;
14. providing appropriate information and interpretation to visitors and other stakeholders on the adverse impacts of environmental weeds on key values to promote greater awareness, appreciation and understanding of this management issue;
15. rehabilitating disturbed areas with native flora species (using only local seed) in accordance with Department policy. Maintain a nursery at Millstream to grow small numbers of plants for rehabilitation work in the planning area.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
20.1 Area of Parkinsonia, date palm, water fern and ruby dock treated in the planning area.	20.1 The area of Parkinsonia, date palm, water fern and ruby dock treated in the planning area increases over the life of the plan.	Every five years
20.2 Changes in the area covered by Parkinsonia, date palm, water fern and ruby dock in the planning area.	20.2 Reduction in the area covered by Parkinsonia, date palm, water fern and ruby dock over the life of the plan.	Every five years

20.3 The introduction of new environmental weed species to the planning area and the response to these.	20.3 No new introductions of environmental weed species to the planning area. Ensuring that where there are new introductions, there is a rapid response.	Every five years

21. INTRODUCED AND OTHER PROBLEM ANIMALS

Problem animals may be either introduced feral species that have become established as wild or naturalised populations, or native species, which for some reason, have altered their natural distribution and populations to the detriment of other native species. They have potential for serious impact on natural systems through direct effects such as predation, habitat destruction, pollution of wetlands and waterways, competition for food and territory, introduction and spread of disease and through environmental degradation.

A primary objective of the Department is to achieve the systematic and safe control of introduced and problem animals on the lands that it manages. The Department's (Draft) *Policy Statement – Management of Pest Animals on CALM-managed Lands* (subject to final consultation) provides guidance for this by identifying State-wide priorities and strategic approaches to management.

The Department also has responsibilities for control of declared animals on the lands it manages under sections 39 to 41 of the *Agriculture and Related Resources Protection Act*, vis "a Government Department shall control declared plants and animals on or in relation to public land under its control".

As with environmental weeds, the Department supports the integrated management of introduced and problem animals on Department-managed lands through ZCAs or "Recognised Biosecurity Groups" as they are likely to become known under the Biosecurity and Agricultural Management Act. Provisions of the BAM Act have been progressively implemented from 1 July 2009.

Introduced and problem animals in the planning area are identified in Table 4.

Table 4: Introduced and Problem Animals Recorded in the Planning Area

Common Name	Species
Black rat	*Rattus rattus*
Feral cat	*Felis catus*
Fox*#	*Vulpes vulpes*
Wild dog*	*Canis familiaris familiaris*
Feral horse*	*Equus caballus*
House mouse	*Mus musculus*
Cattle	*Bos taurus* and *Bos indicus*
Feral donkey*	*Equus asinus*
Feral honeybees	*Apis mellifera*
Camel*	*Camelus dromedarius*

*Declared species under the Agriculture and Related Resources Protection Act (as of November 2004).
These animals are recognised as nation-wide problems and are the subject of threat abatement plans developed through the Commonwealth Department of Environment and Heritage.

Declared Species

Foxes and Cats

The fox is a major threat to medium-sized ground dwelling mammals and ground-nesting birds (Burbidge and McKenzie 1989). Currently, foxes are present in all parts of Western Australia with the exception of the Kimberley and most off-shore islands. In the Pilbara foxes are present in coastal areas, but not known in the planning area. However, given the proximity of the planning area to the coast, the fox may become established in the future. The feral cat is thought to have been responsible for the extinction of small to medium sized ground dwelling mammals in the arid areas of the State (Burbidge and McKenzie 1989) and is known to be present in the planning area.

Predation by foxes and cats are listed as key threatening processes under the EPBC Act. Five-year threat abatement plans have been prepared for both threatening processes to provide national coordination, with the emphasis on local control programs to ensure recovery of endangered species. The Department implemented the Western Shield program in 1996 in order to control predators such as the fox and feral cat. The program involves aerial baiting of selected lands managed by the Department using 1080 poison (sodium fluoroacetate) baits to (a) enable native wildlife population to recover and (b) allow the reintroduction of native animals to former habitats once foxes and cats have been controlled. Sodium fluoroacetate occurs naturally in Western Australia in native *Gastrolobium* plants, which has enabled native animals to develop a natural tolerance to the poison. Foxes and feral cats in arid zones are a component of the program and have been the subject of on-going research.

As foxes do not currently pose a major threat to fauna in the planning area no control programs for foxes have been implemented; although this may be required should the planning area become a site for the reintroduction of native fauna. A degree of fox control probably occurs when aerial baiting for wild dogs occurs. Dingoes within the planning area may play a role in controlling fox and cat numbers. The use of 1080 meat baits for cat control is currently being researched with the view to potential broader application in the future.

Wild Dogs

Wild dogs are defined as all wild-living dogs (including dingoes and hybrids). Wild dogs prey on native fauna and compete with native predators, such as quolls, for food and other resources. In addition, they are one of the major pest species of the livestock grazing industry in Western Australia. Wild dog control will accord with most aspects outlined in the *Western Australian Wild Dog Management Strategy 2005* (Department of Agriculture and Agriculture Protection Board of WA 2005). The aim of this strategy is not to eliminate wild dogs, but to control their impact on domestic stock.

Dingoes are thought to have been present in Australia for approximately 5000 years. They have an important biological and ecological function in natural systems in that they control herbivore species and probably prey on cats and foxes in areas where they retain their numbers and social organisation. Dingoes are protected on Department-managed lands. Even though dingoes are declared under the *Agriculture and Related Resources Protection Act 1976*, they are not controlled on the conservation estate unless there is a significant risk to adjacent pastoral activities (usually sheep). Wild populations of dingoes are best protected from genetic mixing with wild domestic dogs by allowing the wild packs to remain intact and undisturbed. Dingo packs often kill strange dogs, whereas fragmented packs are more likely to breed with them.

The *Western Australian Wild Dog Management Strategy 2005* recognises that dingo and wild dog control depends on the level of risk to the land use of the area. In areas where sheep are farmed, baited buffers may be required in protected areas. This may apply to the planning area where adjoining pastoral leases run sheep. Furthermore, only dingoes living within or close to stocked paddocks are likely to pose a threat to livestock. The main control measures for wild dogs within the planning area are aerial baiting and ground trapping. 1080 baits are used for wild dog control, to ensure that native species are not inadvertently targeted.

The Department of Agriculture and Food coordinates wild dog control through an agreement with the Department. The Department is responsible for wild dog control on Department-managed lands and adjoining lands through the Good Neighbour Policy and the ARRP Act. Control occurs in areas where wild dogs are considered to be a problem and baits are dropped aerially up to 10 kilometres inside the boundaries of the Millstream Chichester National Park and along creek lines, creating a baited buffer between the park and the pastoral lease and preclude the need for baiting any further into the reserve. In the Fortescue area, control best occurs when these buffer zones are kept free from wild dogs. Wild dogs dispersing from their home ranges keep moving until they find adequate food and water supplies in areas where they will not be attacked by resident territorial wild dogs. Where wild dog free buffers exist, dispersing wild dogs are likely to settle before reaching sheep paddocks.

Donkeys and Horses

Donkeys are present in the Chichester Range and adjacent Roebourne Plain and tableland areas. Feral horses have an impact on riparian vegetation along parts of the Fortescue River (*Yarnda Nyirranha*). They are controlled by aerial shooting coordinated by Department of Agriculture and Food on behalf of landholders. The Department contributes to the cost of shooting programs where possible.

Other Introduced and Problem Animal Species

The Department has considerable responsibility in the control or eradication of pest animals that are not declared. Most pest animal problems within the planning area are caused by feral stock, particularly cattle. Hoofed animals pose a problem by increasing the rates of erosion in areas where the soils are fragile. Feral cattle have been eradicated from the Millstream area and the Mungaroona Range Nature Reserve by aerial shooting in the past, but feral populations still exist in the gorges throughout the Chichester Ranges. Section 108C of the CALM Act allows for the Department to deal with unbranded cattle over 12 months of age as if they were the property of the Crown. These should be destroyed by aerial shooting after owners have had the opportunity to muster them.

During the public submission period to the draft management plan, a number of submissions were received regarding the use of Langwell Block, a proposed addition to the Millstream Chichester National Park, for the movement of stock. Langwell Block is currently UCL, but is proposed to be added to the national park (See Maps 2 and 4). This area is currently used by neighbouring pastoral lessees to move stock between Pyramid and Mallina Stations. This will be allowed to continue, with the permission of the Regional Manager.

Introduced species such as house mice and black rats are now resident throughout the Millstream Chichester National Park, and are not subject to any systematic control operations. Systematic control is unlikely to be initiated in the future.

Honeybees (*Apis mellifera*) were introduced to Western Australia in 1846 from England to pollinate plants grown by early settlers for food. Swarm dispersal from managed hives has resulted in feral honeybees being established across many parts of the State. Honeybees reached Millstream in August 1995 after spreading down the Fortescue valley from the east over many years. They have now established in tree hollows and in palm trees throughout the Millstream Chichester National Park, in close proximity to surface waters.

Generally, honeybees impact on the natural values of the planning area in the following ways (Scheltema 1981, Matthews 1984, Paton 1993, Gross and Mackay 1998, New South Wales National Parks and Wildlife Service 2002, Schwarz and Hogendoorn 1999):

- via competition for tree hollows. Many birds and tree-dwelling mammals use tree hollows for breeding sites and shelter and are already a limited resource;
- via competition for floral resources, such as pollen and nectar. Feral and managed hive honeybees can remove 80 per cent or more of the floral resources produced (Paton 1996, 2000). Native species can be displaced which can thereby affect all other dependent or related flora and fauna. Native bees may also be forced to forage for greater periods of time, thereby exposing nest brood to more predators in their absence. Native birds that depend on nectar resources may also be forced to occupy larger territories, thereby excluding smaller birds from these resources;
- via affecting pollination and seed set of native species due in part to inefficient transfer of pollen; and
- via increasing seed-set in some weeds.

Large numbers of honeybees increase the risk of visitors to the planning area being stung. Feral honeybees seek water during hot weather and alternate food sources when nectar and pollen become scarce.

Given that the feral honeybee has been present in the Millstream Chichester National Park only until fairly recently, the impacts are likely to be low. However, should honey bee swarms increase, a control program may be required. The complete eradication of honey bees from reserves is generally not feasible as localised eradication is usually followed by re-colonisation from new swarms invading the area (Gross 2001). Honeybees can temporarily be eliminated from areas after unfavourable conditions, such as drought or fire, as long as there is not a constant supply of managed hive bees swarming into the wild (which is highly unlikely in the planning area) (Sheltema 1981). Control programs should be developed to protect species at most risk from competition within the planning area. Any control program also needs to be safe for native insect populations.

Veronicellid slugs are a common garden pest in Pilbara gardens. They are transported in soil, particularly pot plants. These slugs have not yet been recorded in the Millstream wetlands, but would be expected to thrive if introduced, consuming native aquatic vegetation. To prevent the establishment of species in the Millstream wetlands, no soils should be imported into the Millstream Chichester National Park unless sterilised. The importation of garden plants in pots will be banned.

The conservation of protected flora and fauna can be impacted by the release of introduced alien species, such as the intentional release of introduced fish into wetlands. Strategies to prevent, detect and deal with unauthorised activities impacting on protected flora and fauna will be used to assist in their protection and conservation.

21 – Introduced and Other Problem Animals

Key Points

- Introduced and problem animals that occur in the planning area include wild dogs and dingoes, cattle, sheep, foxes, donkeys and horses, cats, mice, rabbits and rats and honeybees.
- Declared species present in the planning area are donkeys, horses, foxes, wild dogs and rabbits.
- Most problem animal issues are caused by feral stock, especially cattle.
- Wild dogs include dingoes and hybrids. Dingoes are protected in the planning area, but wild domestic dogs are baited where they are considered a problem.

The objective is to minimise and, where possible, negate the impacts of introduced and problem animals on the values of the planning area.

This will be achieved by:

1. preparing a priority introduced and problem animal management plan, where impacts on natural values are found to be negative, based on:
   - the existing and potential impact of the species;
   - the efficiency and effectiveness of control measures;
   - location and availability of resources;
   - level of participation of stakeholders; and
   - the capacity for long-term monitoring of the program;
2. managing introduced and other problem animals according to relevant legislation, Department policies and operational guidelines;
3. maintaining information on introduced and other problem animals including a register of animals, details of distribution, relevant biological information and history of control;
4. developing monitoring guidelines that include details of distribution, relevant biological information and a history of control measures;
5. removing cattle from the planning area, with due consideration for ownership, as required in section 108C of the CALM Act, except where permission is granted by the Regional Manager for the movement of stock between neighbouring pastoral leases. Establish a strategic fencing program to protect natural values such as wetlands and to prevent stock from trespassing;
6. maintaining baited buffers around the boundary of the planning area, where necessary, in accordance with the *Western Australian Wild Dog Management Strategy 2005*;
7. investigating the control of donkeys and horses using strategies such as ground or aerial shooting, and trapping;
8. undertaking and/or supporting research programs into the control and impacts of introduced and problem animals;
9. eradicating feral colonies of honeybees from around recreation sites once appropriate methods have been identified;
10. preventing further introductions of non-native animals in the planning area;
11. liaising with other Government departments, the Pilbara Zone Control Authority (or equivalent) local government, the Water Corporation, landholders and neighbours, the Pastoral Lands Board, local authorities, mining companies and the community to facilitate effective, coordinated and integrated introduced and problem animal management in the planning area and on adjoining lands that ensures integration with relevant management agreements;
12. providing appropriate information and interpretation on the adverse impacts of introduced and other problem animals and their impacts on key values to promote awareness, appreciation and understanding;
13. not allowing pets in the planning area, with the exception of;
    - guide dogs,
    - dogs associated with search and rescue operations; or
    - with the approval of the Regional Manager (see Section 31 – *Domestic Animals*); and
14. restricting the importation of soil into the planning area to only those sources with strict soil quarantine procedures. This includes restricting importation of garden plants in soil, as problem animals, including the veronicellid slug may be introduced.

Key Performance Indicators (see also Appendix 1):		
Performance Measure	**Target**	**Reporting Requirements**
21.1 Area of the planning area significantly impacted by cattle.	21.1 Decreases over the life of the plan.	Every three years.

22. FIRE

Fire History

Indigenous Use of Fire

For thousands of years fire has been a common, natural phenomenon in the Australian arid zone. The impact of fires started by lightning strikes is mitigated by patterns of burning imposed on the country by humans.

Prior to European settlement, fire was, and in parts, still is, an integral part of land use practiced by Indigenous people. Indigenous people used fire in a variety of ways. Although not specific to the Millstream area, a number of studies document the use of fire by Indigenous people in similar arid environments (Nicholson 1981, Burrows and Christensen 1981, Haynes 1991, Pyne 1991, Latz 1994, Burrows *et. al.* 2000). Such studies suggest that fire was used regularly and purposefully across the landscape. Indigenous people used fire to improve hunting and foraging opportunities, by encouraging the growth of economically important recolonising species. Fire was used for communication, for ceremonial purposes and to "clean up the country" by removing dead or senescent vegetation (Burrows and Christensen 1991).

The precise ecological effects and patterns resulting from traditional Indigenous burning were never documented in the Millstream area and details are therefore unknown. However, studies in other spinifex-dominated communities (Burrows *et al*. 1991, Burbidge 1985, Griffin *et al*. 1983) have shown frequent small fires result in a mosaic of spinifex at differing stages of senescence, which is important for providing a range of habitat types for flora and fauna. Evidence suggests that the change from traditional burning has created substantial changes across the landscape, particularly to the range and structure of vegetation types. Much of this evidence is circumstantial and based on fragmented observations of explorers, pastoralists, travellers and amateur naturalists following the ending of Indigenous burning after European colonisation. Limited experimental information on the ecological impacts of traditional burning is available (Tropical Savannas CRC 1997). However, it is well accepted in the scientific community that the biota evolved under the adaptive pressure of over 40 000 years of burning prior to the arrival of Europeans. Indigenous burning still occurs in the Pilbara (whether for cultural or other reasons) but contemporary fire regimes have changed considerably compared to the regimes that existed prior to European occupation and the depopulation of Indigenous people from the landscape.

Fire Management Following Settlement

The arrival of Europeans brought considerable changes to the burning patterns of the land. Whether this was significantly different to burning previously imposed on the Millstream area is unknown. In other parts of northern Australia dominated by hummock grasslands, fire was used by pastoralists to encourage the regrowth of grasses for stock, to assist in mustering and to protect their pastoral leases against the devastation of large wildfires (Pyne 1991, Bushfires Council of the Northern Territory 1997). Pastoralists employed Indigenous people, so it is possible that traditional burning techniques were incorporated into pastoral burning. However, the pattern of fire associated with traditional travel routes through the country is likely to have changed. The advent of pastoralism, together with the absence of Indigenous people and the subsequent changes to fire regimes in arid areas has had a detrimental impact upon the flora, fauna and biodiversity in these areas (Burrows *et al*. 1991).

Pastoralism and the introduction of exotic and invasive species such as buffel grass as a dominant pasture species has contributed significantly to changing the natural fire regimes. It is likely that under pastoralism, areas of hummock spinifex savanna, as occurs over much of the Millstream Chichester National Park, were burnt on a regular basis both to encourage the spread of exotic buffel grass and to promote the growth of younger, more palatable native plants.

The advent of pastoralism, together with the departure of Indigenous people from their homelands has resulted in a change in the fire regimes of arid areas. The contemporary regime has still maintained a certain degree of patchiness, although wildfires have generally been larger and more intense than previously occurred. This altered fire regime, together with introduced predators and herbivores, is implicated in the alarming declines of

arid zone mammals and some plant communities and has probably impacted adversely upon natural values in these areas.

Fire Ecology

Present-day fires within the Pilbara are typically large; many burning areas of tens of thousands of hectares. Fires within the planning area are no exception. Fires in the Chichester Ranges have generally been smaller than those that have occurred in the Hamersley Ranges, but still large enough to have dramatic impacts on the planning area (S. van Leeuwin, pers. comm., 2006). To date, wildfires within the planning area have mainly been caused by lightning. There has also been a program of prescribed burning implemented across the planning area. Most of the planning area has been burnt, predominantly by unplanned fires, in the past 15 years. Nearly all of the Mungaroona Range Nature Reserve has been burnt by wildfire in that time. About half to three quarters of the Millstream Chichester National Park has been burnt by wildfire, although the key assets around Millstream and Python Pool have been well protected. Although wildfires in the planning area have been large, both wildfires and prescribed burning have resulted in a degree of mosaic of vegetation ages classes.

Many of the plant species of the planning area show characteristics which allow them to persist under a regime of frequent fire. Many plants have a thick corky bark, and the ability to grow epicormic shoots (*Eucalyptus* spp., *Acacia pyrifolia, A. coriacea*). Some plants (mostly *Acacia* species) are often killed by fire but regenerate from seed afterwards (Beard 1975). There is little information on fire sensitive species and communities in the planning area. The presence of these species is unlikely in areas that have historically been burnt frequently (C. Muller pers. comm. 2002). Such species are likely to be confined to areas that are not often visited by fire due to the scarcity of fuels, their protected position in the landscape or their occurrence in the moisture gaining sites such as the Millstream wetlands or bare rocky areas such as the gorges of the Fortescue River (*Yarnda Nyirranha*) within the Chichester Ranges. The planning area contains the most northern population of mulga (*Acacia aneura*) and snakewood (*Acacia xiphophylla*) which together are generally termed mulga woodlands. These woodlands are considered to be "fire sensitive" where adult plants are killed if the entire canopy is burnt during very hot fires (Latz, 1995). Smaller fires do not cause as extensive damage. Some plant species found in the Millstream wetlands and gorges in the Chichester ranges may be fire sensitive as it would not be expected that these species would have been exposed to frequent fire during their evolution.

Spinifex will normally only carry a fire again after about five years once plant growth provides the density and continuity of fuel bed that is required. This interval can be much shorter under severe fire conditions, or following high growth periods after significant rainfall events (Burrows *et al.* 1991). In years of high rainfall and subsequent high growth, spinifex will burn more readily than at times when rainfall has been low and growth has been limited. Spinifex is usually dry enough to burn under most weather conditions and fire behaviour is particularly sensitive to wind strength and relative humidity. Fire management aimed at providing a fire induced mosaic of fuel ages and vegetation structure is needed to enhance and maintain species diversity in spinifex-dominated communities.

Fire Management in the Planning Area

It is generally accepted that a fine grain mosaic of vegetation age classes promotes biodiversity. As a result, fire management in the planning area aims primarily to deliver biodiversity outcomes by establishing and maintaining such a mosaic and to prevent large, damaging wildfires. The Department's fire planning in spinifex grasslands is guided by 16 management principles (Burrows 2004). These principles are stated in Appendix 5.

Setting clear fire management objectives for the protection of biodiversity and other values is fundamental in the development of fire management plans and standards and in determining appropriate strategies and tactics. In order to protect biodiversity, the Department will need to consider fire regimes at a range of different spatial scales. These include:

- the landscape scale (>100 000ha);
- the vegetation complex scale (1000 – 100 000 ha); and
- the local/habitat scale (<1000 ha).

The fine grain mosaic will result from a combination of planned and unplanned (predominantly lightning ignition) fires. It is important that biodiversity conservation is considered at the landscape scale to maintain flexibility within the burn regime. The scale and the patch size of the mosaic is important in determining the size of the boundary habitat (and hence the extent of the edge effects) and the extent of connectivity (allowing

dispersal and recolonisation). The behaviour and life histories of the local biota should be used to provide indications as to the appropriate grain size and temporal variety of the fire history mosaic.

Biological indicators and other vital attributes (e.g. juvenile period of obligate seeders, habitat requirements of key fauna species) will be used to estimate the range of desirable seral states (i.e. the time since the last fire) and temporal patterning of fire in the landscape. This will mean that the more flammable, drier habitats may be burnt quite frequently and less flammable or fire sensitive habitats less frequently according to these vital attributes. Implementing fire regimes that promote spatial and temporal diversity will protect threatened species and communities. The regime will vary depending on the life history of the key species present and may involve strategies such as attempting to maintain areas with long periods of fire exclusion, sustained frequent burning and further experimental burning. Given that a better understanding about these biological indicators and vital attributes in the planning area is still required, achieving this fully may be difficult.

In recent years, Millstream Chichester National Park has been subject to a formal burning plan designed to reduce the spread of wildfires and to protect life, property, natural, cultural other key values in the park. This strategy was based upon a series of strategic buffers of regularly burnt country, which either protect areas with high concentrations of values, or which break up large areas of the park into smaller areas of approximately 50 000 ha. This strategy mitigated the risk of extremely large areas of land being burnt in the event of wildfires.

A fine grain mosaic is most appropriate in the Millstream Chichester National Park; however the use of buffers is an effective risk management strategy that may mimic to some degree traditional practices. Although there is limited knowledge about traditional Indigenous burning practices in the Millstream area, it is likely that burning occurred in small patches and relatively frequently as people moved through the country. It is unlikely that all the country was regularly burnt, but regular burning along travel corridors would have created a barrier to the spread of major fires.

The protection of valuable assets such as the Millstream Homestead and Python Pool precincts can be achieved by burning fine grain mosaics for biodiversity. Establishing fine grain mosaics breaks up large areas of old vegetation, resulting in less severe fire behaviour, a reduction in the size of fires and the greater likelihood of successfully protecting fire vulnerable assets.

Consultation and involvement of Traditional Owners in jointly developing appropriate fire regimes in the planning area is important. Burning by Indigenous people will be permitted in the park, but will require permission from the Regional Manager, compliance with the Bush Fires Act and this management plan.

The Department will develop a ‘rolling three-year’ indicative burn program together with an ‘annual’ burn program, which incorporates conservation and protection objectives and is reviewed on an annual basis. In developing the burning program, the Department will use all available information gathered at both the landscape and vegetation complex scale. This takes into account local factors such as:

- time since the last burn of surrounding areas – it is important for burn security that adjacent areas do not carry high fuel loads that could increase the chances of a burn escaping, and that adjacent areas have sufficient habitats to allow animals to disperse from and back into a planned burn;
- access – surrounding accessible roads or tracks assist in the management of a planned burn. These need to be maintained prior to a burn;
- values to be protected – some threatened species and communities require fire management at a very local level;
- values at risk;
- operational factors influencing the implementation of a burn; and
- community interest, including those of neighbouring landholders and other relevant stakeholders.

The development of a ‘rolling three-year’ indicative burn program together with an ‘annual’ burn program for the Millstream Chichester National Park would be of considerable value in creating a fine grain, fire induced mosaic of fuel ages with a range of patch sizes. Initially the burning units (the area treated with fire) should be no more than 20 000 hectares in extent (C. Muller pers. comm. 2005) and the burnt patches within the burning unit should be in the order of 100 to 1000 ha. Such a program will achieve the aim creating fire diversity that promotes biodiversity and the protection of biodiversity, cultural and recreational values.

A ‘rolling three-year’ indicative burn program allows sufficient lead-time for planning and preparing annual burn programs well ahead of the operation. This program also provides the public and local stakeholders with an opportunity to see what is being planned and provide their input into program planning. Programs will be

reviewed and updated each year to account for work completed, the occurrence of wildfire and improving conservation knowledge. Fire management in the planning area will, as far as practicable, be integrated with fire management on adjoining lands. Close liaison with FESA, adjoining landholders and the wider community will also be important in achieving an appropriate mosaic across the landscape.

A Prescribed Fire Plan will be developed for each burn to be undertaken. The plan will specify burn objective(s), implementation and post-burn inspection requirements (relative to achievement of the burn objectives) and any monitoring requirements. The Prescribed Fire Plan involves substantial documentation including endorsements and approvals, pre-burn and day-of-burn checklists, supporting documentation and prescriptive documents.

Buffel grass complicates fire management in the planning area. Buffel grass is found across the extensive alluvial plains within the planning area and in the fire sensitive wetland ecosystems (see Section 20 – *Environmental Weeds*). Buffel grass creates the ideal fuel source for wildfire – it is invasive, suppresses the growth of other plant species (allelopathic), burns readily even when green, rapidly regenerates after fire (Tu 2002) and is capable of encouraging and carrying wildfires through communities that are not adapted to frequent fire. Many of the recreation sites in the Millstream vicinity are also adjacent to the wetlands. Strategies for asset protection around the pools and wetlands of the Fortescue River (*Yarnda Nyirranha*) will need to consider the added flammability provided by buffel grass. Knowledge of the interaction between fire and buffel grass is limited and further research and adaptive management is required to better understand the ecology of this weed.

Active wildfire suppression is generally not feasible in the remote parts of the Millstream Chichester National Park and all of the Mungaroona Range Nature Reserve, due to inaccessibility.

There is limited historical and cultural information about fire in the planning area. There is also limited knowledge concerning the area's natural values and their interaction with fire. Further survey work and monitoring is required, to improve knowledge of the ecological assets of the area and the effects of fire. Consultation regarding research findings about fire management in spinifex and other arid communities and adopting an adaptive management approach will be important. Further application of emerging technologies (such as satellite remote sensing and GIS) is also required to gain improved knowledge of fire spread and behaviour within the planning area and its effects upon various ecosystems.

Managing Fire in Wilderness Areas

The Department's Policy No. 62 – *Identification and Management of Wilderness and Surrounding Areas* aims principally to maintain biodiversity in wilderness areas by protecting it from threatening processes and maintaining ecological processes. Fire in wilderness areas is acceptable to achieve these biodiversity outcomes and strategic protection of conservation values in and outside of wilderness areas. The Department will apply prescribed fire to wilderness areas. A range of fire management strategies (above) and tactics will be considered during the life of the plan for the conservation of biodiversity values within and adjacent to wilderness areas. As wilderness areas do not have any internal access, they must be considered as a much larger single unit which means that:

- no mineral earth boundaries within the prescribed burn which will reduce disturbance and the risk of weed introduction (Muller 2001);
- a larger perimeter will need to be established to ensure that a prescribed burn can be conducted safely and securely;
- a prescribed burn may be undertaken using aerial ignition; and
- where possible, fuels within surrounding areas will be managed so that the risk of a fire entering the wilderness or escaping from the wilderness area into surrounding area is minimised and the values of the wilderness area are protected.

In the event of a wildfire occurring within a wilderness area, the Regional Manager will determine on a case-by-case basis whether to allow a wildfire to burn out to existing roads and tracks or to carry out ground disturbing activities to contain the wildfire. In many cases, the former may be the more acceptable option. However, if the latter is judged to be the best option, then approval for mechanised access for wildfire suppression will be sought from the Department's Director General.

22 – Fire

Key Points

- Frequent, large scale, high intensity fires have occurred in the planning area resulting in a form of mosaic of burnt and unburnt areas. Fire diversity promotes ecological diversity.
- Indigenous people in the Pilbara use fire. The full extent and ecological effects of this burning within the planning area is not known with certainty.
- Pastoralists use burning on lands adjacent to the planning area to encourage the growth of pasture for their stock.
- Fire management in the planning area will focus on the achievement of biodiversity conservation.
- Greater involvement by Traditional Owners and other stakeholders in burning programs for the planning area is required.
- Liaison with reserve neighbours, the wider community, local government, bush fire brigades, FESA and other State Government agencies will be necessary to ensure effective fire management across jurisdictions.

The objectives are;

1. **to enhance biodiversity by establishing and maintaining a fire induced mosaic of fire history at a landscape and vegetation complex scale;**
2. **to reduce the frequency and extent of wildfires; and**
3. **to protect life, property and community assets and natural and cultural values of the planning area from wildfire.**

This will be achieved by:

1. consulting the Millstream Park Council regarding the use of traditional burning, fire management and cultural values requiring protection from fire;
2. managing fire in the planning area according to relevant legislation, Department policies, principles, guidelines and available knowledge;
3. maintaining appropriate fire regimes to maintain biodiversity, taking into account the requirements of 'fire regime-specific' species communities such as the Millstream wetlands;
4. developing a rolling 3 year fire management program for the planning area (and reviewing this on an annual basis) that incorporates the aspirations of the Millstream Park Council and is coordinated with fire management undertaken by stakeholders associated with lands adjacent to the planning area;
5. encouraging the development of fine grain mosaics in the planning area, using prescribed burning;
6. maintaining data on burn area and season for the planning area, and adjacent areas;
7. initiating suppression of wildfires where significant assets and values are threatened;
8. maintaining fire suppression equipment and trained personnel in the Millstream Chichester National Park;
9. monitoring the impacts of fire on natural and cultural values of the planning area, such as fauna habitat, vegetation complexes and ecosystems;
10. applying research findings and an adaptive management approach to fire management operations, particularly with reference to the fire ecology and fire behaviour in spinifex-dominated communities;
11. integrating fire management with weed control programs in the Millstream delta;
12. providing the public with information on the effects of fire on the natural environment, the need to prevent wildfires and best practice in fire management;
13. continuing to liaise with FESA, local government, local bush fire brigades, landholders and neighbours and other appropriate authorities to encourage cooperative fire management arrangements, ensure community protection from fire is at an appropriate level and to encourage pastoralists adjoining the planning area to implement fire protection measures commensurate with the level of bush fire hazard; and
14. managing fire in wilderness areas through the Master Burn Plan process and in accordance with Department policies by implementing a range of strategies and tactics, including consideration of longer inter-fire intervals within wilderness areas and shorter inter-fire intervals in surrounding areas.

Key Performance Indicators (see also Appendix 1):		
Performance Measure	**Target**	**Reporting Requirements**
22.1 The impact of wildfire on life, property or significant community assets.	22.1 No loss of life, property or significant community assets or serious injury attributable to the Department's fire management.	Annually.
22.2 Number of hectares burnt and patchiness of prescribed fire for biodiversity protection.	22.2 An increase in the number of hectares burnt and patchiness of prescribed fire for biodiversity protection.	Annually
22.3 Size of large intense wildfires in the planning area.	22.3 Limit the size of large intense wildfires to $50km^2$ or a more appropriate size based on biological parameters.	Annually.

PART D. CARING FOR COUNTRY: MANAGING OUR CULTURAL HERITAGE

Management and protection of Australia's heritage was strengthened in 2004 by the introduction of a new heritage system under the Commonwealth EPBC Act. This system includes the World Heritage, National Heritage List and Commonwealth Heritage List.

The National Heritage List is a list of places with outstanding heritage value to the nation, including places overseas. The Commonwealth Heritage List is a list of places managed or owned by the Australian Government. Actions that are likely to have an impact on the heritage values of a National or Commonwealth heritage listed place require approval from the Commonwealth Minister for Environment. The Register of the National Estate (RNE) is a record of natural, cultural and Indigenous heritage places of national value, but offers no statutory protection. The amendments to the EPBC Act in February 2007 will see the phasing out of the RNE as a statutory register within five years, after which it will be retained as an archival record only. No new places will be assessed or added to the RNE in this time.

In Western Australia, the Department of Indigenous Affairs is responsible for the administration of the Aboriginal Heritage Act. The Act provides for the protection of sites and objects used by or traditional to, the original inhabitants of Australia and the management of Aboriginal sites in consultation with the Aboriginal community. All Aboriginal sites and objects are protected, including those sites not yet registered with the Department of Indigenous Affairs (DIA). Under the Act, it is an offence for anyone to alter in any way an Aboriginal site or object without the relevant Minister's permission. Prior to any development or activity that involves disturbing the land, DIA recommends that suitably qualified consultants be engaged to conduct ethnographic and archaeological surveys of the area to ensure that no site is damaged or altered that would result in a breach of section 17 of the Act. In order to avoid a possible breach of the Act, a Notice under section 18 of the Act should be submitted to the Aboriginal Cultural Material Committee seeking the Minister for Indigenous Affairs prior written consent to use the land.

The *Heritage of Western Australia Act 1990* provides for the registering and protection of sites of historic interest as 'heritage places'. These sites are registered on the Western Australian 'Register of Heritage Places' database. Sites listed on this register are afforded statutory protection and must not be damaged or altered unless a permit to do so has been granted by the Heritage Council of Western Australia. The Act also requires local government authorities to maintain an inventory, referred to as the 'Municipal Inventory', of places of heritage significance in their area. This should be the initial register consulted by managers as it may contain sites which are not registered on the 'Register of Heritage Places', but which the Department should consider in management. Local government may also include these registered heritage places on their town planning schemes (planning laws created by local government), to ensure that future developments under local government control do not impact on the cultural values of the area.

The Department manages non-Indigenous cultural heritage according to the (Draft) *Policy Statement - 'Management of non-indigenous cultural heritage on lands and waters managed by the Department of Conservation and Land Management*', or revision thereof. This policy, and accompanying guidelines, ensures that places on lands managed by the Department with cultural heritage value are identified, recorded, assessed and managed according to best practice. In addition, the draft policy statement and guidelines meet the management requirements of a range of State and Commonwealth legislation.

Many sites may also have some historic interest, but may not have been assessed or are not considered significant enough to be worthy of listing under the legislation. These sites are entered on the Department's 'Recreation and Tourism Information System' (RATIS) database, which helps to build up knowledge of cultural sites and historic events, including their location, condition and significance to the community. Information located on all heritage registers and databases should be considered prior to any management operations.

Obligations and Agreements

In 1979, Australia adopted the Burra Charter (Australia/ICOMOS 1999), which provides for 'the conservation of places of cultural significance' and has a series of guidelines for managing cultural heritage.

23. INDIGENOUS AND NON INDIGENOUS HERITAGE

Before European Settlement

Indigenous people are thought to have lived in the Pilbara for at least 30 000 years (Quin, 2003). Tindale (1974) identified nearly 30 language groups in the Pilbara and currently there are 33 distinct Indigenous communities within the Pilbara, many of which overlap. Hence, Indigenous people within the Pilbara have an incredibly diverse and rich cultural heritage.

The planning area is part of the tribal country for people of two different language groups. The Yindjibarndi people's homeland stretches from the foot of the Hamersley Ranges, across the Fortescue River (*Yarnda Nyirranha*) through to the Chichester escarpment. Ngarluma people's lands run from the Chichester escarpment northward to the sea.

The Millstream Chichester area is one of the most, if not the most significant Indigenous cultural and mythological site of importance in northern Western Australia (Rijavec *et al.* 2005). Cultural and mythological importance stems from thousands of years of occupation, and Millstream being the home of the mythological serpent or Warlu, whose presence is still strongly felt at Deep Reach Pool (*Nhanggangunha*) (See *The Story of the Warlu*).

Aside from its highly important spiritual significance, the Fortescue River (*Yarnda Nyirranha*) provided food and water, particularly during drier months. Along the river, Indigenous people had a varied diet of red meat, fish, reptiles, grubs, eggs, honey, fruits and root vegetables. Extensive areas were burnt to create natural paddocks and attract kangaroos. The dry climate meant that knowledge of the locations of waterholes was important. The Indigenous people (*Ngardangarli*) were skilled in land management and were nomadic within their traditional boundaries.

From birth, Indigenous Traditional Owners have always had a sense of duty, are responsible for, and obligated to protect, preserve and manage areas, sites and objects of cultural significance. The locations, ceremonies and songs tell the story of the spirit and the substance of the land and its people. Deep Reach Pool (*Nhanggangunha*) is particularly significant as the source of the other pools, and within which the serpent's presence is still strongly felt. All the pools are significant in this regard and warrant a high level of respect because of their spiritual and mythological importance to Indigenous people.

There have been numerous Indigenous heritage surveys carried out in the Pilbara as a result of resource and infrastructure developments. Within the planning area, two surveys were carried out in the late 1970s and the mid 1980s (Department of Aboriginal Sites 1978, Kee 1985). Since then, no broad scale surveys have been conducted in the planning area to document the Indigenous cultural heritage sites. Any future proposals to conduct surveys within the planning area will be considered by the Millstream Park Council.

Throughout the Millstream Chichester National Park are traces of past Indigenous occupation, such as flaked stone artefacts, grindstones, mollusc shells and rock art, many of which have been recorded by the Western Australian Museum (Ngurawaana Community 1995). There are 36 sites in the planning area registered with the Department of Indigenous Affairs and protected under the Aboriginal Heritage Act. These include mythological places, burial grounds, ceremonial sites, scarred trees, water sources, quarries, artefact scatters and engravings. Two Indigenous sites are listed on the Australian Register of National Estate, although, for the protection of these cultural sites, no further details are available. As well as Deep Reach Pool (*Nhanggangunha*), features with important Indigenous cultural values include Crossing Pool (*Murlunmunjurna*), Python Pool, Palm Pool (*Thaawuthungganha*) and the Mt Herbert area. Regardless of their listing on State or Commonwealth registers, all Indigenous sites are protected and permission to disturb the sites requires legal authority from the relevant Minister.

Under traditional law, the Indigenous Traditional Owners are responsible for, and obliged to protect, preserve and manage areas, sites and objects of Indigenous significance associated with the Millstream area and surrounding country. In traditional terms, management also includes the protection and preservation of traditional knowledge pertaining to them.

Under the *Aboriginal Heritage Act 1972*, the Minister may appoint honorary wardens to work under the Act. Department staff can be appointed as honorary wardens and given authorisation to protect registered sites within the planning area.

Following European Settlement

Following European settlement in Western Australia, Francis Thomas Gregory visited the Millstream area during his expedition into the Pilbara in 1861. On his journey he travelled down the west coast from Hearsons Cove on the Burrup Peninsula, up the Fortescue River (*Yarnda Nyirranha*) and across the fertile plains (where he named the Chichester Downs), before coming to and naming Millstream and the Fortescue River (*Yarnda Nyirranha*) close to where Millstream is today. His party travelled on towards the ranges he called the Hamersley Range.

A quote from Gregory's journals of the time reads "7th June - a quarter of a mile up the river brought us to a fine tributary from the south, running strong enough to supply a large mill." This area was later called the 'Mill Stream' by Alex McRae, one of the first pastoralists in the area.

Mr W. Taylor was the first pastoralist to take up land on the Fortescue River (*Yarnda Nyirranha*) for sheep grazing in 1865. In 1866, Taylor sold the lease to the partnership of Alex McRae and T. R. McKenzie who operated the station, successfully cultivating a large vegetable garden near the homestead. They in turn sold the lease to Messrs Padbury and Loton in 1879 for £16 500. Chas Elliot managed the station for Padbury and Loton, increasing stock numbers to about 25 000 sheep, 1000 cattle and about 500 horses. Padbury and Loton later sold the lease to the Cookson brothers, two English men who chose to have the lease managed for them from 1912 until they sold it in 1950. Claude Irvine managed the station for the Cooksons from 1912 until 1923 and supervised the building of the present homestead in 1919. In 1923 his nephew Mr Les Gordon took up the position of manager of the station and he and his family operated the station and managed a large garden growing bananas, grapes, rice and at one time tobacco. In 1950 the Cooksons sold the lease to the Gordon family. Shortly afterwards Les Gordon died and his two sons, Doug and Stewart, managed the station until they sold it to the Kennedys in 1964.

While Millstream operated as a pastoral lease, many Yindjibarndi and Ngarluma people were employed by pastoralists, enabling Traditional Owners to remain on country and practice traditional customs. This continued until the late 1960s when many Ngarluma and Yindjibarndi people moved into towns.

The area which is now covered by the Millstream Chichester National Park consisted of a number of small leases as well as some larger ones. Over the years some of these smaller leases were found to be unviable and were either surrendered or sold to larger leaseholders. By this process, Millstream Station grew until it was close to 1 million acres (just over 400 000 hectares) and ran up to 50 000 sheep, during which time the owners won prizes for their wool clip.

In 1956, part of the cadjeput forest on the northern side of the river at Crossing Pool (*Murlunmunjurna*), was thought to need protection so the area was declared a timber reserve. It became national park in 1967. Part of the Chichester Range also became national park at the same time. In 1982 the lease for Millstream Station was purchased from the Kennedys by the Public Works Department for water supply. Part of the station was used to join the Millstream National Park with the Chichester National Park to form the present Millstream Chichester National Park. The Chichester Range National Park (1977 boundary), the Millstream National Park (1977 boundary) and the Mungaroona Range Nature Reserve are all listed on the *Register of National Estate*. Together with two Indigenous heritage sites, these are the only listings on the National register in the planning area.

Several remnants of the pastoral era, such as stock yards and fences, wells, stock routes, shepherds' huts and out-camps occur in the Millstream Chichester National Park. Most of these are situated on the tableland at places such as Daniel's Well and the stone shepherd's hut on the upper Harding River, where sheep were run on the soft grasses. These out-camps and huts were used by shepherds when they were working with sheep or protecting them against dingo attack. These dingo attacks caused the pastoralists to make the change from sheep to cattle in the 1950s. Extensive remains also occur outside the park such as the Kanjenjie homestead and shearing shed to the south-east; Dawson's Well on the Roebourne-Wittenoom Road, the camel track though the Chichester Range and Hick's Gap, and the old bridges and culverts on the main road through the Chichester Range.

Two of Millstream station's buildings, the homestead and the kitchen, both built early this century, are used as the visitor centre and office. The Millstream Homestead is listed on the Shire of Ashburton's Municipal Inventory and the Department's RATIS Cultural Heritage Site Database, together with the Chichester Range

National Park (1977 boundary) and the Mungaroona Range Nature Reserve. Interpretation of these significant heritage sites assist in maintaining a sense of place and informing visitors about the area (see Section 39 – *Community Education and Interpretation*).

Date palms were planted at Millstream and in other parts of the Pilbara during the early 1900s, and, although a significant environmental weed (see Section 20 – *Environmental Weeds*), they have a historic significance associated with the early European settlement of the area. Mature male date palms will be retained in the vicinity of Chinderwarriner Pool (*Jirndawarrunha*) and the Millstream homestead for their historical significance and progressively replaced with native palms as they die out.

23 – Indigenous and Non-Indigenous Heritage

Key Points:

- Two groups of Indigenous people have tribal country within the Millstream Chichester National Park; the Yindjibarndi people and the Ngarluma people.
- The Millstream Chichester area is of considerable cultural significance and Deep Reach Pool (*Nhangghangunha*) is of particular importance as the home of the mythological serpent, the Warlu.
- All Indigenous cultural sites are protected, whether they are recorded or not. Permission to disturb sites requires legal authority of the relevant Minister.
- Exploration of the area first occurred by Francis Thomas Gregory in 1861.
- Between 1865 and 1964 the area was used for the grazing of cattle and sheep and the cultivation of vegetables, fruit, rice and tobacco.
- Part of the area was gazetted as a national park in 1967. The Chichester Range and the Millstream area were joined by the addition of land to the park in 1982.
- Important heritage sites in the planning area include the Millstream homestead and kitchen and relics from the pastoral era such as stockyards, fences, wells and out camps.

The objectives are;

1. **to protect the Indigenous cultural heritage and cultural resources of the planning area;**
2. **to provide a mechanism whereby the significance of the planning area to the Traditional Owners may be better appreciated by others; and**
3. **to protect the non-Indigenous cultural heritage of the planning area.**

This will be achieved by:

1. identifying, protecting and maintaining Indigenous and non-Indigenous sites of cultural heritage significance according to State and Commonwealth legislation and the Burra Charter;
2. complying with Commonwealth and State legislation and Departmental policies prior to commencing any potentially damaging operations, to prevent damage to known or identifiable culturally significant Indigenous and non-Indigenous places and objects;
3. wherever possible, promoting the Indigenous cultural heritage values of the planning area;
4. on an ongoing basis, consulting with the Millstream Park Council, the local community and relevant organisations and referring to the State Aboriginal Site Register, the Register of Heritage Places and other relevant registers for sites of Indigenous and non-Indigenous heritage significance, to improve the protection and conservation of cultural heritage;
5. continuing to consult with Native Title representative bodies (such as the Pilbara Native Title Service) the Department of Indigenous Affairs and the Office of Native Title in relation to Indigenous cultural heritage in the planning area;
6. promoting the awareness, appreciation and understanding of the spiritual and mythological significance of the planning area and surrounding areas to the Ngarluma and Yindjibarndi community;
7. encouraging research and ethnographic/archaeological surveys across the planning area to increase and contribute to the knowledge and understanding of Indigenous and non-Indigenous heritage of the area and adapting management accordingly;
8. consulting with the Millstream Park Council to identify areas for Indigenous cultural and ceremonial purposes based on traditional occupation and use;
9. subject to the approval of the Millstream Park Council, recommending that Department staff become honorary wardens under the *Aboriginal Heritage Act, 1972*;
10. encouraging connection to country by way of hunting, camping and other cultural activities through the Millstream Park Council;

11. encouraging training, employment and economic development of the Ngarluma and Yindjibarndi community through the Millstream Park Council;
12. permitting the use of campfires for cultural and ceremonial purposes;
13. collating and updating information on cultural heritage sites located in the planning area and maintain a current register of sites;
14. protecting non-Indigenous cultural heritage prior to the commencement of any new developments or potentially damaging operations;
15. preparing conservation plans to guide the future conservation, interpretation and use of Indigenous and non-Indigenous cultural heritage values; and
16. providing information and interpretation to the public in relation to Indigenous and non-Indigenous cultural heritage within the planning area.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
23.1 Protection of known or identifiable Indigenous and non-Indigenous heritage sites.	23.1 No disturbance without formal approval and consultation.	Annually

24. INDIGENOUS LIVING AREAS

Spending time on country is of critical importance to the Traditional Owners of the planning area in order to maintain social and spiritual links to their homeland and to pass this onto their children. The Millstream Park Council has expressed a strong desire for living areas within or outside the planning area, where people can spend time on country (either temporarily or permanently) and engage in cultural and spiritual activities. The development of living areas within the Millstream Chichester National Park will also have the advantage of allowing Millstream Park Council members to more effectively carry out their role in the joint management of the planning area with the Department.

The Department and the Conservation Commission agree in principle to the establishment of residential lease areas for Traditional Owners within the planning area. Under Section 100 of the CALM Act, the Director General of the Department may grant leases on Department-managed land on such terms and conditions as he thinks fit, with the approval of the Minister for Environment. The development of living areas within the planning area will be subject to the provisions of the management plan, the deliberations of the Millstream Park Council and approval by the Department's Director General, the Conservation Commission and the Minister for Environment. They will be agreed between the Minister and the Indigenous community and formalised as specific lease agreements between the Traditional Owners and the Department's Director General.

Any future proposals for living areas within water source protection areas in the planning area will be discouraged (See Section 37 – *Water Extraction*).

To date, no particular areas have been formally proposed within the planning area or on lands adjacent to the planning area. Temporary accommodation has been provided in the Ranger's headquarters/accommodation precinct. This is proposed to be expanded to accommodate Park Council members more comfortably while spending time on country (see Section 28 – *Visitor Accommodation*). However, the Millstream Park Council has expressed the desire for a more permanent living area. Further consultation with the Millstream Park Council, planning and environmental assessment is required before a site within the planning area is recommended as a living area. At present, the Department supports the development of a living area within the Millstream Chichester National Park, but a recommendation on a particular location is subject to further consideration by the Millstream Park Council and other stakeholders.

The Ngurrawaana Aboriginal community is located to the west of the Millstream Chichester National Park. The community has a school and housing and also provides facilities for Yindjibarndi and Ngarluma people wanting to spend time on country in and adjacent to the planning area. The use of this community as an additional living area for Traditional Owners to reside on country will be encouraged.

A site known as the Corroboree Ground, an unmarked area between the Millstream Homestead and Crossing Pool (*Murlunmunjurna*) has been used successfully for special Indigenous meetings in the past. It is a large relatively flat area which will continue to be used for gatherings and meetings of the Indigenous community. The Indigenous community maintains a long association with this site as a meeting place, and facility

development will depend on how the community chooses to use the site. This site has also been identified as a potential living area. Links to the Fortescue River (*Yarnda Nyirranha*) walking system will also be provided.

24 – Indigenous Living Areas

Key Points

- Living areas may be granted as leases and will be subject to the management plan, the agreement of the Park Council and approval by the Department's Director General, the Conservation Commission and Minister for Environment.
- The nearby Ngurrawaana Aboriginal community provides facilities for Yindjibarndi and Ngarluma people wanting to spend time on country in and adjacent to the planning area.
- No living areas within or adjacent to the planning area have been proposed and further consultation, planning and assessment is required prior to the recommendation of particular locations.
- The Corroboree Ground, in the Millstream Homestead precinct, is used for gatherings and meetings of the Indigenous community.

The objective is to provide the opportunity for Indigenous Traditional Owners to return to live and camp in their traditional lands for cultural, spiritual and management reasons.

This will be achieved by:

1. upgrading accommodation within the current Millstream Ranger's residence/accommodation precinct to accommodate Park Council members while spending time on country;
2. promoting the Ngurrawaana Aboriginal community as a living area for Yindjibarndi and Ngarluma community members wanting to reside on country;
3. granting leases for living areas subject to consultation with the Millstream Park Council and approval of the Minister for Environment, Conservation Commission and the Director General. The leases will include suitable terms and conditions which secure Indigenous aspirations while taking into account management objectives for the planning area as defined in this management plan;
4. providing appropriate access to living areas for Indigenous residents;
5. referring all planning, design and construction criteria for sites and access to the Millstream Park Council. These will be subject to an environmental assessment procedure consistent with Department requirements;
6. the Indigenous community assuming the responsibility for community development plans, including provision of housing, facilities and other services; and
7. the Millstream Park Council supporting the Indigenous community in its establishment of appropriate community facilities and assisting in the implementation of plans (including landscape planning, safety, design and site suitability criteria).

Key Performance Indicators:

There are no Key Performance Indicators for this section.

PART E. CARING FOR COUNTRY: MANAGING VISITORS

The number of visitors to the State's reserve system has increased markedly over the past decade, from 5.7 million visits in 1995-6 to over 12 million in 2006-2007. The reason for such significant human interest is simple: the conservation estate managed by the Department (as at 30 June 2007) covers an area of more than 27 million hectares of lands and waters protecting unique landscapes, geological formations, plants and animals, and cultural sites. In addition, there is a worldwide recognition that healthy outdoor activity is good for people physically and psychologically. For these reasons, the planning area provides opportunities for local communities, as well as regional, national and international tourism.

Conserving these lands and waters for future generations, and managing them for use by the present one, is a complex process. Firstly, public expectations are as diverse as the environments the Department manages. Secondly, the desire to interact with these unique environments can lead to impacts on the natural and cultural environment. This management plan addresses these issues, at the same time ensuring that visitors gain an appreciation and understanding of the area's values which should, in turn, foster an appreciation and understanding of conservation.

A number of policies provide guidance for recreation and tourism management, including:

- *Policy Statement No. 18 – Recreation, Tourism and Visitor Services* (DEC 2006);
- *Policy Statement No. 34 – Visual Resource Management of Lands and Waters Managed by CALM* (CALM 1989);
- *Policy Statement No. 53 – Visitor Risk Management*' (CALM 1997); and
- *Policy Statement No. 62 – Identification and Management of Wilderness and Surrounding Areas* (CALM 2004)

These are available from the Department on request.

The Millstream Chichester National Park contains a diverse and unique terrestrial and aquatic natural environment. This provides a broad range of land and water-based recreational opportunities. Visitors enjoy the park's natural and undeveloped qualities and the rich cultural links with traditional Indigenous people. It is important that these qualities be retained for present and future generations to enjoy.

The wetlands in the Millstream Chichester National Park attract activities such as swimming, camping, canoeing and fishing. The area also displays a great diversity of birdlife that attracts birdwatchers and photographers. Other users visit the park to sightsee, bushwalk and view the seasonal wildflowers. The popularity of these activities and the remoteness of the park, indicates a need for a variety of support services and infrastructure.

A wide range of recreational activities occur in the Millstream Chichester National Park in two main recreation precincts: (1) the Millstream Homestead and the pools of the Fortescue River (*Yarnda Nyirranha*), and (2) Python Pool and its surrounds. While recreation activities occur throughout the remaining portions of the park, use is usually dispersed, limited in user numbers, often seasonally focused on water holes and most suited to bushwalkers and adventurers. The implementation of a 'zoning system' is proposed to ensure these activities are catered for (see Section 25 – *Visitor Opportunities – Visitor Management Settings*).

Within the Millstream Homestead precinct, recreation facilities and activities are focussed on the pools of the Fortescue River (*Yarnda Nyirranha*). The Fortescue River (*Yarnda Nyirranha*) is a highly dynamic river system, prone to significant and frequent flood events (particularly during summer cyclones), resulting in large-scale erosion in the river pools, reducing the stability of river banks. This has a significant impact on where developments can occur and the scale of these developments. Consequently, careful site planning for developments and facilities proposed in this plan will be essential to ensure the safety of visitors, the longevity of site facilities and the continued protection of natural and cultural values of the park.

Within the Millstream Homestead precinct, the development and management of recreation facilities will need to consider the implications of being located within a Water Source Protection Area. A series of principals will used to guide the management of recreation within a Priority 1 (P1) Public Drinking Water Source Area,

including: (a) locating proposals for recreation sites downstream of extraction bores, (b) use of non-discharge toilets, (c) hardening high-use sites as required and direction visitors to these sites, (d) encouraging visitors to remove their own rubbish, (e) improving management of fuels and rubbish with the Ranger's quarters and the Department's depot, (f) implementing strategies for more sustainable energy use, (g) upgrading existing visitor facilities, especially toilets, to reduce the risk of contamination, (h) upgrading visitor facilities within the Python Pool precinct to encourage visitors away from P1 areas; and (i) improving education and interpretation about ways visitors can reduce their impact on the Millstream aquifer.

Low impact activities and those that increase awareness, appreciation and understanding of the natural and cultural environment will be encouraged in the Millstream Chichester National Park. Better provision of information is required to inform visitors of the key values of the planning area and the recreation opportunities and facilities available. New recreational opportunities, facilities and experiences for visitors are required to provide a broader range of opportunities and to take visitors away from culturally and environmentally sensitive areas. Areas degraded by present use will be upgraded by providing new facilities, rehabilitating old ones, or a combination of both.

Currently, no recreation facilities are provided and no recreation opportunities have been developed in the Mungaroona Range Nature Reserve. Access to the area by vehicle is not possible, given the lack of roads or tracks into the reserve. Walk-in access is the only way for visitors to get to the area, but given the considerable distance of the reserve from roads and tracks, these opportunities are limited. In addition, due to its status as a nature reserve, recreation development is neither appropriate nor suitable for the area. Due to this and the little or no demand for recreation in the reserve, current management will remain and no recreation facilities or opportunities will be developed in the area.

The Department's *Policy Statement Number 18 – Recreation, Tourism and Visitor Services* (DEC 2006) outlines principles, operational guidelines, procedures and administrative controls in relation to facilitating recreation and tourism on the public conservation estate. This management plan applies guidelines from Policy Statement 18 where applicable.

The major foci for recreation and tourism for the period of this management plan are to:

- improve opportunities for visitors to appreciate the Indigenous cultural heritage of the area;
- develop more opportunities for Indigenous people to be involved in providing visitor services, facilities and contribute towards enhancing visitor experiences, therefore increasing employment opportunities for Indigenous people;
- provide for changes in visitor numbers, types and demands due to improved access to the Millstream Chichester National Park with the proposed construction of the Karratha –Tom Price Road;
- develop visitor opportunities that protect culturally sensitive areas such as Deep Reach Pool (*Nhangghangunha*) and environmentally sensitive areas such as Crossing Pool (*Murlunmunjurna*);
- increase the use of the Millstream Homestead Visitor Centre as a hub for visitor activities in the Millstream Chichester National Park; and
- consolidate recreational and interpretive opportunities at existing sites and consider new developments where existing facilities are not likely to meet expected increases in demand.

25. VISITOR OPPORTUNITIES

Regional Recreational Context

In the Pilbara, tourism makes a contribution the regional economy. An estimated 339 000 visitors stayed in the Pilbara Region in 2004 and 2005. Domestic tourists make up the greatest proportion of visitors to the region, comprising nearly 92 per cent (310 500 visitors per annum) of visitors in 2004 and 2005. Overall, tourism generated an average of nearly $225.9 million towards the economy of the region over 2004 and 2005 (thirty-nine percent of this expenditure related to visitors on holiday or people visiting friends and relatives, whereas 53 per cent of people visited for business reasons). This compares with just over $115 million in 2002/03 and $152 million in 2001/02 (Pilbara Development Commission 2006).

In 2004, Tourism Western Australia released destination development strategies for each of the five tourism regions within the State. The planning area lies within Tourism Western Australia's North West Region and the destination development strategy for this area identified the Millstream Chichester National Park as a 'focus area' – that is, an area perceived to be iconic and, despite being market ready for niche-segments of the tourism

market, requiring product or infrastructure gaps to be addressed before it could be widely marketed. These will only be provided if they do not compromise other values of the planning area.

The *Destination Development Strategy for Tourism Western Australia's North West Region* (Tourism Western Australia 2007) recognises the region to be one of the most iconic holiday experiences in Western Australia. Specifically, the region can provide: (1) rugged outback experience, which can include adventure travel, four-wheel driving and camping (2) comfortable scenery experience, which can include relaxing on beaches, swimming in gorges and organised tours and (3) Indigenous experience, which can include Indigenous arts and crafts, cultural displays and visiting Indigenous sites. All three of these experiences can be provided in the Millstream Chichester National Park. The Millstream Chichester National Park was identified as having iconic significance that requires further development to address the gaps in infrastructure, attractions, accommodation and other tourism facilities to meet current and future market demand. The tourism potential of the construction of the Karratha-Tom Price Road, between Karratha and Barowanna Hill in the Millstream Chichester National Park is identified as a key strategy. Stage 2 was opened in August 2008, but the completion of Stages 3 and 4 has not yet been determined (see Section 26 – *Visitor Access*). Other strategies identified include the construction of a new campground in the Millstream Homestead precinct, which has commenced (see Section 29 – *Visitor Accommodation*) and the provision of more visitor amenities such as toilets, refreshments and signage.

The region offers a variety of tourism opportunities. The mining industry in the region has created a tourist attraction in itself, with many people visiting the port in Dampier, the gas project on the Burrup Peninsula and the iron ore mines at Newman and Tom Price. The towns of Cossack, Roebourne and Marble Bar have an interesting cultural heritage. Aside from Millstream, Karijini National Park is the other major attraction in the region. This park contains dramatic gorges and Western Australia's two highest peaks, Mount Bruce and Mount Meharry. The Dampier Archipelago consists of 42 islands, some of which are used by visitors for fishing, diving and camping. The abundance and diversity of rock art on the Burrup Peninsula also attracts many visitors. Recreational activities in the region have a strong nature-based and remote focus. The national parks, including the Millstream Chichester National Park, offer numerous hiking and overnight trekking opportunities. These national parks also promote Indigenous cultural activities, which have great potential for expansion (Western Australian Tourism Commission 2003). In addition, there is good access to the region, with regular daily flights into Karratha, Port Hedland, Paraburdoo and Newman. The North West Coastal Highway and the Great Northern Highway provides road access into the region for independent travellers and those travelling by bus and on coach tours. The "Warlu Way" (see Section 39 – *Community Education and Interpretation*) is an 1800 kilometres tourist route interpreting Indigenous cultural heritage, the natural and landscape values of the Pilbara and linking the Millstream Chichester National Park with other destinations such as Broome, the Burrup, Karijini National Park, Cape Range National Park and Ningaloo Marine Park. This drive trail provides visitors with access to these destinations, as well as providing business and employment opportunities for Indigenous people.

The Millstream Chichester National Park also provides good opportunities for the development of Aboriginal tourism. The participation of Indigenous Traditional Owners in promoting aspects of culture and lifestyle is of enormous interest to visitors. Guided walks, activities, vehicle-based tours, camping and nature study tours, with reference to Yindjibarndi and Ngarluma language, stories and songs, are some of the activities which could be developed in the park. Tourism Western Australia's also recognises the importance of sustainable Aboriginal involvement in the tourism industry as outlined in *listening, looking, learning: An Aboriginal Tourism Strategy for Western Australia 2006-2010*. This strategy aims for Aboriginal people to add cultural and commercial value to the WA tourism industry, while developing their employment and business opportunities.

Visitor Profile

Visitor Numbers

Visitor numbers to the Millstream Chichester National Park have been declining slowly over the past six years. Visitor numbers to the park have been counted since 1999 when traffic counters were installed into the area. In 2006/07, 18 896 visits were made to the park[6]. This compares with 27 540 visits in 2002/03 and 33 566 visits in 2001/02. Prior to 1999, visitor numbers were estimated at 68 000 visits per year. This dramatic drop in visitor numbers could be attributed to a number of factors. Firstly, figures prior to 1999 were simply estimates and probably did not reflect the true numbers of visitors in the park. Secondly, the Millstream Chichester National Park experienced quite bad flood seasons during 2000 and 2001, resulting in roads to the park being closed. During these years, visitor numbers to the park were 20 000 and 16 600 respectively. Similarly, Cyclone Monty

[6] A "visit" is defined here as the average number of visitors per car times the number of vehicles at monitored sites.

caused large-scale flooding in early 2004 and roads and camping areas were closed for some months and visitor numbers dropped to 14 916. Figures around 20 000 probably reflect the true visitor numbers during years without significant floods. By comparison, the other major national park in the Pilbara Region, Karijini National Park, has seen a steady increase in visitor numbers between 1999 and 2006 from 50 000 to 120 000 visits. This park is all weather accessible; hence visitor numbers are not as linked to flood events.

Visitation to the Millstream Chichester National Park is also highly seasonal, with 80 per cent of visits occurring between April and September in 2004/05. These figures are also reflected in Tourism Western Australia data for the seasonality of visitors to the North West. Considering domestic visitors only (who make up 90 per cent of visitors to the Pilbara), three year rolling averages from 2001-2004 show that most (60 per cent) visited between April and September (Tourism Western Australia 2005).

Stage 2 of the Karratha-Tom Price Road was opened in August 2008, allowing easy access on a sealed road part-way into the Millstream Chichester National Park (see Section 26 – *Visitor Access*). This, together with completion of stages 3 and 4, which will see sealed access through the park and south to Tom Price, will result in a dramatic increase in visitor numbers over the life of the plan.

Due to its very limited access, visitation levels to Mungaroona Range Nature Reserve are extremely low. Although there are no traffic counters in the reserve, it is estimated there are less than 100 visits per year.

Visitor numbers are largely dependent on the quality of access and facilities at recreation sites. The Millstream Homestead recreation precinct is the most developed and includes camping facilities, gas barbecues, toilets, picnic tables, drinking water and visitor information. The Python Pool area includes toilets, picnic tables and some visitor information. A camping area with pit toilets is also provided at Snake Creek (to the south of Python Pool – see Map 12).

A visitor survey was carried out in 2001 to gain an understanding of visitor perceptions of the current facilities provided in the planning area and what facilities and activities should be provided in the future. Information was also collected on group sizes and other locations visitors had visited. A total of 156 visitors were surveyed. People visiting the Millstream Chichester National Park generally visited as part of an organised group (40 per cent), followed by couples and families (32 per cent and 21.8 per cent respectively) and the average group size was 2.56 people. Ninety-one percent of visitors did not live in the Pilbara and most visitors (42.3 per cent) stayed 1 night in the park or only visited for the day (20.5 per cent). Some other common places visited in the Region included Karratha, Dampier, Karijini National Park, Port Hedland and Roebourne.

Visitor surveys were also carried out in the Millstream Chichester National Park in early 2004 and in 2005. Twenty-two people responded in 2004 and 109 in 2005. Most people visited with family and friends (86 per cent and 90.8 per cent in 2004 and 2005 respectively). Most visitors did not live locally (91 per cent in 2004 and 88.1 per cent in 2005) and most of these were from interstate (45 per cent and 43.1 per cent in 2004 and 2005). Overseas visitors made up 5 per cent and 10.1 per cent in 2004 and 2005.

Visitor Trends

A 1992 Stanford Research Institute study (cited in WATC and CALM 1997) predicted worldwide growth of nature-based tourism of 25-30 per cent over the decade, and the prediction for nature-based tourism growth in Western Australia approximates this figure. Although not quite at the rate estimated, between 1994-95 and 2004-05, the number of visits to national parks, State forests and other reserves in Western Australia has nearly doubled from nearly six million visits to nearly 11 million visits. Although, visitor numbers to Millstream Chichester National Park have declined, visitation is predicted to increase in the future, due to: continued demand for nature-based tourism destinations; improved recreation facilities; and, most significantly, the result of improved access to the park, due to the construction of the Karratha-Tom Price Road (see Section 26 – *Visitor Access*).

The visitor survey completed in 2001 indicated that most visitors (42.3 per cent) stayed for 1 night in the Millstream Chichester National Park and 20.5 per cent visited for the day. Improved access to the Millstream Chichester National Park as a result of the construction of the Karratha-Tom Price Road is also likely to result in a reduction in the amount of travel time from the population centres of Karratha, Dampier, Roebourne and Wickham (it is estimated the travel time from Karratha to the Millstream Chichester National Park will be halved from 2 hours to an hour). The ability for visitors to get to the park more quickly may result in more day visitors, placing greater pressure on day-use sites.

The prediction of continued increases in visitor numbers over the life of the plan and beyond will lead to significant challenges for management. This will have both physical impacts on the environment, as well as on visitor experiences. In addition, with an overall ageing population across Australia, the average age of visitors to the Millstream Chichester National Park is likely to increase and hence the demand for higher quality services is also likely to increase.

Given that no access to the Mungaroona Range Nature Reserve will be developed as part of this management plan, visitation to the reserve is likely to remain at very low levels.

Planning for Visitors

Visitor Management Settings

A recreation setting is the combination of social, physical, biological and managerial conditions that give value to a natural area. Factors that affect settings include: access; other non-recreational resource use; on-site management; social interaction; impacts of visitor use; and acceptable levels of control.

Typically, as the use of natural areas such as national parks increases, conditions change until the character of the setting has been modified to a point where it no longer has the attributes that originally attracted people to the area. The initial visitors are then displaced by other people who are more tolerant of the changed resource conditions, with the process continuing until perhaps all the opportunities being provided within the natural area are of a similar developed nature. Prosser (1986) describes this concept as 'recreational succession'. The Department proposes the use of 'visitor management settings' to manage recreational succession in natural areas such as national parks.

The 'Recreation Opportunity Spectrum' (ROS) (Clark and Stankey 1979) has been applied as a standard planning tool in natural areas to address 'recreational succession'. The Department has adapted the ROS and proposes the use of 'visitor management settings' to manage recreational succession in natural areas to provide the greatest range of recreation opportunities in a given area, while limiting unintended incremental development. The establishment of visitor management settings across the planning area contributes towards minimising visitor impacts through preventing beyond a specified level, recreational succession at sites and incremental development of natural areas.

The five setting classes used are, from most to least developed, 'Highly Modified, Recreation, Natural-Recreation, Natural and Wilderness (see Appendix 6). These are applied according to assessment against six standard criteria:

- access standards and type of transport required/used;
- the degree of site modification (i.e. the extent, type and design of infrastructure, facilities and amenities);
- density of users and degree of social interaction;
- probable recreation experiences;
- degree of self-reliance required; and
- the level of on-site management, site constraints and regulations.

The Department and Conservation Commission aim to provide local residents and visitors with a wide range of nature-based experiences within the planning area whilst ensuring that impacts on the environment are managed within acceptable limits. The system of visitor management settings will guide the Department in determining what sort of recreation development may be appropriate within the settings. This application of visitor management settings within the planning area is consistent with the Department's State-wide approach. It is important to note that the allocation of a part of the planning area to a particular setting does not necessarily mean the full extent of the setting has to be met. Map 9 shows how these settings have been applied to the planning area and include both existing and proposed recreation sites.

Site Hierarchy

A recreation site hierarchy is used in conjunction with the Visitor Management Settings where it is specifically desired not to develop all sites within an area to the full extent of the setting. It provides a controlled (site by site) mechanism to cap the level of development and maintain a diversity of experiences within a setting.

The proposals for visitor use in this management plan provide an overview for visitor services and facilities within the planning area. With this direction in mind, a Millstream visitor services plan will be prepared during the life of this management plan, in consultation with the community and stakeholders. Preparation of this plan

will consider a number of criteria to determine future visitor facilities development in the Millstream Chichester National Park, including:

1. existing visitor use facilities;
2. predicted patterns of use;
3. existing and future recreation opportunities;
4. visitor expectations; and
5. visitor safety.

Site Recreation Planning

In the absence of clear guidelines from the visitor management settings and site hierarchical planning that has occurred as part of a preparing a visitor services masterplan, the Department applies a range of recreation planning principles and other factors. The Department aims to provide visitors with a wide range of nature-based experiences on public conservation estate whilst ensuring that impacts on the environment are managed within acceptable limits. The Department's Policy Statement 18 outlines a number of techniques for managing visitor impacts under three categories:

- site management (eg. hardening the site, channelling the use, and developing facilities);
- direct regulation of use (eg. increasing policy enforcement, the use of zones, restriction of the intensity of use and the restriction of activities); and
- indirect regulation of use (eg. altering physical facilities, education and interpretation, advertising/marketing, setting eligibility requirements and through others).

Prior to the development of recreation sites, the Department uses a detailed process of planning and design to assess the potential visitor impacts on recreation sites. Proposed developments are assessed using a variety of environmental, social and cultural factors. The environmental factors include geological, topographic, soil condition and type, water (surface and groundwater) quantity and quality, vegetative cover condition and significance, other biota (such as flora and fauna and their significance) and visual quality. The social factors are determined using questions relating to the condition of recreation sites found in the Department's Visitor Satisfaction Survey which are distributed to visitors at major recreation sites within the planning area. The cultural factors include Indigenous and non-Indigenous heritage sites, artefacts and records.

25 – Visitor Opportunities

Key Points:

- The planning area lies within Tourism Western Australia's North-West Region, which contains a wide range of tourism destinations such as Karijini National Park and the Dampier Archipelago and provides for a range of opportunities with a strong nature-based focus such as bushwalking and camping which are provided for in the Millstream Chichester National Park.
- Visitation to the Millstream Chichester National Park has declined since 1999, while visitation to the Mungaroona Range Nature Reserve has remained very low.
- Most visitors do not live locally, are from interstate and visit with family and friends.
- Improved access is likely to see visitation to the Millstream Chichester National Park increase over the life of the plan, particularly day-use visitors.
- Appropriate recreation developments and siting in the Millstream Chichester National Park will be determined using a system of visitor management settings with categories ranging from Wilderness to Highly Modified.
- The criteria for these categories are based on access, site modification, social interaction, probable recreation experiences, degree of self-reliance and style of visitor management.

The objective is to provide visitors with a range of sustainable visitor opportunities to facilitate their enjoyment, understanding and appreciation of the natural, cultural and recreation values of the area.

This will be achieved by:

1. ensuring existing and future recreation and tourism developments and visitor activities are consistent with Department policies, visitor management setting and recreation site hierarchy as shown on Map 9 / Appendix 6;
2. referring any future recreational developments or non-conforming use that will be inconsistent with

the visitor management settings to the Conservation Commission for consultation;
3. assessing and minimising the environmental, visual, cultural and social impacts of recreation and tourism developments and visitor activities and ensuring these are consistent with visitor management settings for the area;
4. ensuring recreation and tourism developments and visitor activities are designed and constructed to minimise environmental, cultural and social impacts;
5. increasing the range of opportunities within the Millstream Chichester National Park in response to increased visitation and visitors associated with the construction of the Karratha-Tom Price Road;
6. in conjunction with the Millstream Park Council, developing a range of opportunities for Indigenous people to be involved in the provision of visitor services in the planning area;
7. liaising with Tourism Western Australia, Regional Tourism Associations and the Karratha, Roebourne and Tom Price Visitors Centres, regarding marketing and the provision and exchange of information;
8. in consultation with the community and stakeholders, preparing a Millstream visitor services plan for the planning area;
9. recording visitor numbers and monitoring visitor satisfaction across a range of activities and sites in the planning area;
10. undertaking social research to assist in recreation planning and development including projects nominated through the Department's Nature Based Tourism Research Reference Group (see Section 42 – *Research and Monitoring*); and
11. using the data collected from visitor numbers and satisfaction surveys and social research, to improve management and minimise environmental, social and economic impacts across a range of sites in the planning area.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
25.1 Visitor satisfaction levels.	25.1 Visitor satisfaction levels are maintained or increased from 2011 levels over the life of the plan.	Every five years
25.2 The perceived level of environmental degradation at high-use sites from visitor impacts as determined by visitor surveys.	25.2 The perceived level of environmental degradation at high-use sites from visitor impacts does not increase over the life of the plan.	Every five years.
25.3 The range of visitor management settings and opportunities (i.e. from wilderness to highly modified).	25.3 Maintain visitor management settings over the life of the plan.	Every five years

26. VISITOR ACCESS

Lands and waters managed by the Department are generally open to public access, although in reality the public uses only a very small proportion of available land for recreation, generally close to features of interest. Access is generally determined by roads, waterways, pathways or airstrips. Given that the planning area contains a variety of scenic attractions, the demand for access to the planning area is predominantly destination-based, and comes from a variety of sources, including:

- visitors who require good quality access to their favourite area;
- neighbours and local landholders wanting access to their property;
- utilities that require access to maintain infrastructure;
- different recreational visitors wanting different types of access;
- managers who require access for management purposes;
- road and rail access for mining and resource development companies.

Fully satisfying the demand for access within the planning area could also compromise the qualities of naturalness and remoteness that are highly valued by many visitors and the community. The type of access provided affects the level and type of use of an area. Therefore, access needs to be carefully managed in consultation with visitors to the planning area and according to the proposed visitor management settings.

There are a number of different types of access by visitors to and through the planning area:

- vehicular access (sealed, unsealed, 2WD and 4WD); and
- flying (for management and recreation).

Vehicular Access

The planning area is reasonably accessible for two-wheel drive and four-wheel drive vehicles, with a range of vehicle roads and tracks covering most of the main attractions of the planning area. The level and intensity of use of an area is influenced by the type of road access available. All public roads open to vehicles within the planning area are shown on Map 11 and in Appendix 7. All motor vehicles accessing the planning area need to be licensed under the *Road Traffic Act 1974*. Roads to most of the attractions within the Millstream Chichester National Park are predominantly unsealed (formed gravel) roads. During the wet season, many of the main access routes into the planning area can be closed to both four-wheel and two-wheel drives. Hence, the level and intensity of use of recreation sites within the planning area is directly influenced by the type of road access available during different weather conditions.

There are three types of public roads within the planning area: dedicated public roads, private roads and roads managed by the Department. Dedicated public roads are those that are managed either by local government or Main Roads WA. Currently, the main access to Millstream Chichester National Park is via the Millstream-Yarraloola Road to the west, and the Roebourne-Wittenoom Road in the north. Both are formed gravel roads maintained by the Shire of Ashburton and the Shire of Roebourne. The access road into Crossing Pool, Dawson Creek Road, is maintained by the Shire of Ashburton. The proposed sealed Karratha-Tom Price Road will become the main access route into the park (see below). Private service roads for the Water Corporation's Millstream supply pipelines and iron ore industry railways pass through the park. A permit is required to use private roads. Other roads and tracks in the planning area are CALM Act public roads or management access roads.

Two-wheel Drive Vehicles

Primary access into the Millstream Homestead precinct is by two-wheel drive vehicle primarily via Deep Reach Pool access road (*Nhangghangunha*) off the Millstream-Yarraloola Road. Snappy Gum Drive and Dawson Creek Road are two-wheel drive scenic routes and completes the road network surrounding the Homestead precinct. Spur roads are provided into recreation sites. The Python Pool area is accessed from the Roebourne-Wittenoom Road.

Currently, much of the two-wheel drive access into and within the Millstream Chichester National Park is on unsealed formed roads. Following periods of heavy rains, particularly during the wet season, many of these have to be closed to all traffic (both two-wheel drive and four-wheel drive vehicles). Consequently, although these roads are accessible for two-wheel drives during dry periods, they are not all weather-access roads.

Improved road links between coastal and inland areas in the Pilbara are part of Main Roads WA strategic directions for regional roads (Main Roads WA 1996). An important arterial road network linking Karratha and Tom Price is currently under construction. Stage Two of the sealed road (about 100 kilometres from Karratha) was opened in August 2008 and passes through the Millstream Chichester National Park, following a similar alignment to the Pilbara Iron access road and the Roebourne-Wittenoom Road south of the Pilbara Iron access road intersection (see Map 11). A timeline for the completion of stage 3 and 4 south to Tom Price is not yet known, but is likely to occur within the life of the plan. This sealed road will greatly improve access to the park and hence, is likely to lead to significantly higher visitor numbers.

At a regional level, this road will provide a link between the Millstream Chichester National Park and a number of other parks and reserves in the Pilbara, including Ningaloo Marine Park, Cape Range and Karijini National Parks, Burrup Peninsula Conservation Reserve, the Dampier Archipelago Island Nature Reserves and the communities of Roebourne, Point Sampson and Cossack. Linking these towns and reserves has provided an opportunity to develop a cultural and scenic drive trail or "Warlu Way" with associated individual marketing potential for each unique location (see Section 39 – *Community Education and Interpretation*).

Four-wheel Drive Vehicles

Many four-wheel drivers are attracted to the isolation, peaceful bush settings, scenic driving opportunities and sense of freedom associated with travelling on tracks that, by virtue of the more difficult access, are less visited and offer a different and more challenging experience. Typically these tracks include scenic viewpoints, rugged

landscapes and picturesque settings. The planning area has many of these qualities. Currently 4WD access is provided on the track to the George River, east of Python Pool.

In 2007 there were 260 825 new four-wheel drives sold in Australia (not including luxury vehicles), an increase of 45 per cent over the last 5 years (Federal Chamber of Automotive Industry figures). The WA 4WD Association states that there are almost 200 000 four-wheel drives registered in Western Australia alone. Four-wheel drive ownership in Western Australia may continue to increase over the life of this management plan; however recent high fuel prices have been impacting on the sale and use of large cars such as four-wheel drives with the long-term impact of fuel prices yet to be seen.

Currently, there is some demand for four-wheel drive access into the Millstream Chichester National Park. The demand for this activity is forecast to increase over the life of this plan. Hence, experiences that challenge the driver such as access into the Chichester Ranges are likely to be demanded by visitors.

There are a number of issues associated with the provision of more opportunities for four wheel drive users including:

- potential conflict between four wheel drive users, other vehicles and providing opportunities for other users (walkers). This conflict can compromise public safety and the Department's duty-of-care;
- many of the landforms and vegetation within the planning area are highly sensitive to the impacts of four-wheel drive vehicles, therefore increasing the risk of degradation of natural values; and
- the potential to compromise the qualities of remoteness that are highly valued by visitors and the community (see Section 25 – *Visitor Opportunities – Visitor Management Settings*).

The CALM Regulations allow the Department to specify that, in some conservation estate, access is by 'lawful authority' only. This can be done by way of registration and/or permit, and visitors wishing to access such areas by vehicle need to inform the Department. A fee is attached to the issue of permits to aid cost recovery.

The current usage of the George River area by four-wheel drive users is unknown, so implementing a system to monitor visitors in the area will provide some valuable information about visitor numbers to the area. A system to monitor track condition will also be required. An audit of the current condition of the track to the George River and level of visitor impact should be undertaken to obtain a benchmark of its current condition. If visitation is found to be causing significant impacts, a permit system with a limited number of permits for individuals and tour operators may be required in the life of the plan. A permit system would also enable (a) environmental conditions to be monitored and (b) by limiting the number of permits issued, the maintenance of a remote experience for visitors. In the meantime, a booking system for use of the George River camping area will be implemented as a means of monitoring visitor numbers in the area.

Some issues which will require consideration in the implementation of a permit system include:

- where and how permits will be made available (e.g. Millstream Visitor Centre, Karratha, Roebourne and Tom Price Visitor Centres, the Department's office in Karratha, via phone/fax or on-line booking system);
- what fee should be attached to the permit (with all funds directed back into the management of the area);
- whether the permit system should differentiate between day visitors and campers and the level of access for each;
- the possibility of seasonal (e.g. during the hot summer months) or temporary closures (e.g. during flooding, cattle mustering);
- whether the numbers of vehicles would be limited; and
- whether a combined access/camping fees could be charged.

Other access tracks for four-wheel drives and two-wheel drives may be developed as demand increases and after detailed planning, review of the visitor management setting implications and consultation with the Park Council, the public and the Conservation Commission.

Currently, there is no vehicle access (either for two-wheel drives or four-wheel drives) into the Mungaroona Range Nature Reserve, due to the absence of roads or tracks into the area.

Flying

There is a gravel airstrip located on a water reserve to the south of the Millstream Chichester National Park, known as Airstrip Block, which provides access to the park via aircraft. The Department currently maintains this

airstrip to a standard suitable for the Royal Flying Doctor Service (RFDS). The RFDS carries out regular surveys of the strip to ensure that the appropriate standard is maintained. Aircraft use this airstrip to land close to the planning area. It is also used for activities known as "stop and go" by trainee pilots and by commercial mustering companies using helicopters.

In the consideration of a formal section 16 CALM Act management agreement between DoW and the Department for this area, issues such as guidelines for the use, management, maintenance of the strip (see Section 9 – *Existing and Proposed Tenure*) and the following are likely to be examined:

- responsibilities for maintenance of the airstrip;
- the potential application of landing fees for the airstrip;
- with the exception of the RFDS, users being required to gain permission from the Department to land on the airstrip; and
- the use of this airstrip for purposes other than management or emergency (e.g. commercial fly/drive operations).

Access for Visitors with Disabilities

The Australian Bureau of Statistics estimates that 18 per cent of the population has a disability. Based on these figures, it is likely that over a million visits per year are made to the public conservation estate by people with some form of disability. A disability can be defined as a condition which is attributable to an intellectual, psychiatric, cognitive, neurological, sensory or physical impairment. Catering for visits by people with disabilities will also have subsidiary benefits to the aged, parents with young children and the carers of people with disabilities.

Three of the outcomes proposed in the Department's *Disability Access and Inclusion Plan 2007-2012*, (DEC 2007b) are that people with disabilities:

- have the same opportunities as other people to access the services of, and any events organised, by the Department;
- have the same opportunities as other people to access the buildings and other facilities of the Department; and
- receive information from the Department in a format that will enable them to access the information as readily as the general population.

Strategies identified to help deliver these outcomes include:

- ensuring that, wherever practicable and appropriate, all new recreation facilities are accessible to people with disabilities;
- ensuring Department-managed recreation areas with universal access are maintained to original standard;
- continuing to upgrade access to Department-managed recreation areas, with priorities based on visitor numbers, costs and ease of modification;
- continuing to improve access by ensuring practice and appropriate standards are developed for recreation facilities on Department-managed estates; and
- ensuring information is clear, visible and complies with the required standards for people with disabilities.

Currently the Millstream Homestead Visitor Centre is wheelchair accessible. Existing and proposed facilities within the planning area need to be reviewed over the life of the plan to determine the possibility of encouraging greater access for disabled visitors. Sites with high priority to provide universal accessibility include the Milyana Campsite, Wahunnha (Cliff Lookout) and the Homestead Walk around Chinderwarriner Pool (*Jirndawarrunha*). Wherever possible, upgrades to existing recreation sites and the development of new ones should consider universal accessibility, without changing the experiences available for all visitors.

Management Access

There is often a requirement for some access within natural areas to be closed to the public for management purposes. They may be used for controlling feral animals, water monitoring, access for maintenance, and for weed control. While further assessment is required, management access is not likely to dramatically change from that existing at present. Roads that are designated as management access will be signposted accordingly.

The roads shown on Map 11 and in Appendix 7 are those that will be open to the public for the life of the plan. All others will be closed or become access for 'management vehicles only'.

26 – Visitor Access

Key Points

- There is a range of access to and within the planning area including vehicle and flying.
- The main access roads into the Millstream Chichester National Park are currently the Millstream-Yarraloola Road from the south-west and the Roebourne-Wittenoom Road from the north.
- Currently all roads into the park are gravel, but the completion of a sealed road linking Karratha and Tom Price and passing through the Millstream Chichester National Park is proposed in the life of the plan and provides the potential for a cultural and scenic drive trial, the Warlu Way, linking the park with other national parks, reserves and towns in the region. This road has been constructed as far as the Park.
- There is four wheel drive access into the George River in the Millstream Chichester National Park. Depending on the amount of visitation to the area and the resulting impacts, a permit system for access and camping in the area will be implemented.
- There is an airstrip adjacent to the Millstream Chichester National Park on a water reserve and current management arrangements are informal.

The objective is to provide and maintain access which is consistent with the maintenance of natural, cultural and recreation values and with the diverse range of visitor needs.

This will be achieved by:

1. providing access as shown in Map 11 and in Appendix 7, consistent with the criteria for the appropriate visitor management setting and in consultation with the Millstream Park Council, visitors and relevant stakeholders;
2. liaising with Main Roads WA and local government to ensure the appropriate management of regional roads and road development to and through the Millstream Chichester National Park;
3. referring regional road development proposals to the Millstream Park Council for agreement;
4. jointly managing roads with the Shire of Ashburton and negotiating formal arrangements governing future funding and management responsibility;
5. in conjunction with Tourism Western Australia and Australia's North West Tourism, promoting the "Warlu Way" as a cultural and scenic drive trail within the region;
6. progressively upgrading roads along existing alignments;
7. prohibiting vehicles driving off dedicated roads and tracks except by authorised persons in exceptional circumstances or subject to approval of the Regional Manager;
8. ensuring 'management vehicle only' tracks are effectively closed to the public and signposted accordingly;
9. providing information to visitors on appropriate different types and locations of safe and appropriate access; four-wheel drive techniques, such as the Department's 'Caring Code for the Bush' and codes of ethics supported by organisations such as the Western Australian Four Wheel Drive Association, Tread Lightly Australia and Leave No Trace;
10. implementing a monitoring system to determine visitor numbers using the four wheel drive access into the George River area and environmental conditions of the track. Depending on the outcomes of this, implementing a permit system, limiting the number of vehicles accessing the area and ensuring environmental conditions remain stable;
11. considering formalising the management of the airstrip on Airstrip Block through a section 16 CALM Act agreement with DoW;
12. considering allowing the use of the airstrip on Airstrip Block by commercial tour operators, subject to appropriate licence conditions;
13. upgrading sites including Milyana Campsite, Cliff Lookout and the Homestead Walk trail around Chinderwarriner Pool (*Jirndawarrunha*), so that they are universally accessible; and
14. consistent with the Department's Disability Access and Inclusion Plan (DEC 2007), improving facilities and services for disabled visitors by:
    - considering disabled visitors in the design of new facilities;
    - ensuring information is accessible, clear, visible and complies with the required standards; and
    - encouraging tour operators who transport visitors to and within the park to provide universal access.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
26.1 The satisfaction that visitors express with their visit in relation to the use and condition of access to and within the planning area.	26.1 Visitors continue to be satisfied with access to and within the planning area.	Every five years.
26.2 Changes in the condition of the George River track.	26.2 Track condition is maintained or improved from 2011 levels over the life of the plan.	Annually

27. VISITOR ACTIVITIES

27.1 Bushwalking

Bushwalking is an activity that can be enjoyed by people of varying ages, interests and levels of physical fitness and mobility. In its various forms, bushwalking can encompass everything from a short, leisurely stroll to a major trek lasting days or even weeks. In comparison with motorised or other assisted types of access, bushwalking enables visitors to experience the natural environment at close quarters.

There are six categories of walking trails recognised by Standards Australia, (2001) (Appendix 8). Class 6 refers to trails where there is no modification to the natural environment and there are opportunities for highly experienced walkers to explore remote and challenging natural areas without reliance on managed tracks. The remaining classes refer to gradually increasing levels of development to Class 1, which are generally broad, hard surfaced constructed tracks suitable for wheelchair use, and where there are opportunities for large numbers of visitors to undertake walks with a high level of interpretation and facilities, in a low-risk environment.

The variety of landscapes and unique wetlands in the Millstream Chichester National Park provides great opportunities to explore by foot. There are seven existing walks within the park, in both the Millstream and the Python Pool precincts. These are shown in Table 5 and range in length from 750 m to 8 kilometres and vary in the degree of difficulty from easy short walks to longer trails, requiring higher levels of fitness and experience.

The proposed trail network in the Millstream Chichester National Park will provide an excellent opportunity to interpret the significance of the area for Indigenous people, aspects of their rich cultural heritage and the natural values of the area. The Homestead walk will be upgraded to incorporate aspects of Yindjibarndi heritage, to complement the information already provided in the Murlunmunyjurna Trail. Other proposed walk trails are outlined in Table 5.

An increasing number of visitors to the Millstream Chichester National Park are looking for more remote 'off-track' experiences or walking routes. The Python Pool area and the Chichester Ranges provide opportunities for long-range walking and cross-country exploration. Minimum definition routes are also proposed within the natural visitor management setting. These will be developed in the longer term with minimal track infrastructure. Bushwalkers will be encouraged to be self-reliant and contact with other walkers is likely to be minimal. Several factors create ideal conditions for this type of recreation, including:

- open terrain allowing walkers to see exactly where they want to go and allowing them to get there freely;
- a shin-high maze of spinifex and open ground effectively creating a large number of choices of paths and ensuring negligible impact from walkers;
- clear weather in visitor seasons allowing reliable navigation by sight, and many good navigational landmarks; and
- vast, spectacular expanses of wild, undisturbed country.

In these remote areas, walkers will be permitted to camp, although no camping facilities will be provided and walkers will be encouraged to carry all their camping equipment (see Section 28 – *Visitor Accommodation*).

No walk trails and associated infrastructure are currently provided in the Mungaroona Range Nature Reserve. Walking is one of the few forms of access permitted in the reserve, due to its considerable isolation, intact ecological systems, status as a nature reserve and proposal for gazettal as a wilderness area (where mechanised

access is not permitted). However, the reserve boundary is a considerable distance from nearby roads, tracks and neighbouring homesteads which makes walking into the area difficult. Hence, demand for walking opportunities in the reserve is likely to be limited. No walk trails or infrastructure will be provided in the reserve over the life of the plan.

Table 5: Existing and Proposed Walk Trails in the Millstream Chichester National Park

Walk	Length (One Way)		Indicative Class 1-6	Comments
	M/ kilometres	Time		
Existing				
Millstream Homestead Precinct				
Homestead Walk Trail – Chinderwarriner Pool (*Jirndawarrunha*)	750m	40 mins	1	Loop trail around Chinderwarriner Pool (*Jirndawurrunha*) to be extended. Will interpret Yindjibarndi culture.
Murlunmunyjurna Trail	6.8 kilometres	4 hrs	4	Realignment required providing link with proposed Milyana Campground and Wahunnha – Strong as Stone Walk. Development of trail head required.
Python Pool Precinct				
Python Pool Access	100m	5 mins	3	
McKenzie Spring	4.5 kilometres	3 hrs	4	
Mt Herbert	600m	30 mins	4	
Chichester Range Camel Trail	8 kilometres	5 hrs	5	To be extended to provide a loop trail between Python Pool, McKenzie Spring, Mt Herbert and return to Python Pool.
Cameleers Trail	4 kilometres	2.5 hrs	5	
Proposed				
Millstream Homestead Precinct				
Wahunnha – Strong as Stone Walk (Cliff Lookout)*			2	Loop trail around Cliff Lookout to interpret Yindjibarndi dreaming stories. Link with Deep Reach Pool (*Nhangghangunha*), Murlunmunyjurna trail and Millstream Homestead.
Warlu Cultural Boardwalk, Deep Reach Pool (*Nhangghangunha*)*			1	Trail and boardwalk linking car park to Deep Reach Pool (*Nhangghangunha*).
Trail to link Stargazer's Camp with Deep Reach Pool (*Nhangghangunha*)*			2	
River Walk Trail, Palm Pool (*Thaawuthungganha*) Camping Area*			3	
Hills Walk Trail, Palm Pool (*Thaawuthungganha*) Camping Area*			3	

Walk	Length (One Way)		Indicative Class 1-6	Comments
	M/ kilometres	Time		
Fortescue Valley Walk*			6	Remote walk along Fortescue Valley, west out of the Millstream Chichester National Park to the river mouth. Some use of this currently occurs. Would require collaboration with other stakeholders such as Tourism WA, local government and pastoralists.
Python Pool Precinct				
Chichester Ranges*			6	Opportunities for remote walking. No infrastructure to be provided.

*Length yet to be determined

Further walks may be developed as the need arises, as long as they fit within the visitor management setting of the area, provide an increase in the range of natural values that can be appreciated and the values of the Millstream Chichester National Park are not unduly compromised.

The Millstream Chichester National Park offers a remote walking experience. Rugged terrain and arid environments of the park can make bushwalking hazardous for those who are inexperienced or unprepared. There can be safety risks associated with long distance hikes including the threat of wildfire, or becoming lost or injured. Such problems can largely be overcome through the provision of a self-registration system (where walkers heading to remote locations will be encouraged to register with family or friends), effective signs and visitor information programs designed to ensure walkers are adequately informed about and equipped to handle the conditions they will encounter (see Section 30 – *Visitor Safety*). The Department's 'Caring Code for the Bush', outlined in Department *Policy Statement No. 62 – Identification and Management of Wilderness and Surrounding Area* (CALM 2004), offers visitors a number of pre-trip safety guidelines, as well as guidelines during the trip, including rubbish disposal, toilet waste disposal and keeping to existing tracks. The alignment of walk trails in the park will avoid any areas not suitable for walkers.

27.1 – Visitor Activities – Bushwalking

Key Points

- Millstream Chichester National Park provides excellent opportunities for bushwalking.
- More developed walk trails be developed around the Millstream Homestead and Python Pool precinct.
- Remote walking opportunities are available in less accessible parts of the park such as the Chichester Ranges.

The objective is to provide a range of bushwalking opportunities appropriate to visitor management settings that do not significantly impact on natural, cultural and other key values.

This will be achieved by:

1. developing bushwalking tracks in accordance with Department policies;
2. providing a range of bushwalking opportunities (Table 5) consistent with the criteria for each class of trail and the appropriate visitor management setting. Referring all proposals for new walks to the Millstream Park Council;
3. designing, constructing and maintaining walk tracks according to established planning procedures, design class standards and site environmental capability. Signposting walk trails to indicate their degree of difficulty according to the standards outlined in Appendix 8;
4. monitoring the impacts of bushwalking for environmental degradation and visitor safety reasons and, in liaison with users and if the activity is environmentally unacceptable, issuing permits and modifying or restricting access (temporarily or permanently);
5. providing information to visitors about bushwalking opportunities that provides:
   - a walk that best suites the needs and abilities of visitors;
   - the degree of difficulty;
   - safety guidelines including party size and registration;

- camping and campfire policy; and
- the code of conduct; and

6. consulting with visitors and relevant stakeholders about bushwalking opportunities.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
27.1 The satisfaction that visitors express with their visit in relation to the use of walk trails.	27.1 Visitors continue to be satisfied with walk trails.	Every five years.

27.2 Cycling

Cycling, in particular mountain biking, has dramatically increased in popularity in recent years, both in Australia and internationally. In 1999, more than 90 per cent of all bikes sold in WA were mountain bikes, due to the increase in mountain biking both as a sport and a recreational activity. Their popularity may also be because they are robust, compact, and comfortable and can go off-road if needed. Across Australia, it is predicted that interest in mountain biking will increase by 10 per cent per year.

The Department is developing draft Mountain Bike Management Guidelines that includes a classification system for user groups and cycling styles, trail types and trail difficulty, based on the International Mountain Bicycling Association standards. Mountain biking styles that utilise the natural environment to enhance trail characteristics are (i) touring, (ii) cross-country, (iii) downhill, and (iv) free riding. Trail types are:

- Type 1: sealed dual-use path for smooth, all weather use;
- Type 2: surfaced dual-use or single track, such as converted roads and rail formations;
- Type 3: wide unsurfaced single track;
- Type 4: narrow unsurfaced single track; and
- Type 5: low-impact or lightly-used nature trail.

The International Mountain Bicycling Association's trail classification system classifies trails relative to the trail grade, surface type and width, technical trail features and trail obstacles to allow riders to match their riding ability with the appropriate trail, manage risks and minimise injuries, improve the recreation experience for a variety of visitors and to plan trail systems.

Cycling is a popular activity and interest and demand for facilities associated with cycling in the Millstream Chichester National Park is increasing. Cycling can be undertaken within the park for recreation on all public roads and tracks (unless specifically prohibited), although there are currently no specific cycling opportunities provided. Riding of bicycles off public roads or designated tracks will not be permitted. Provision of cycling opportunities within the Millstream Homestead and Python Pool Precincts will be considered if demand for these facilities increases and there is conflict between cyclists and other users. Consideration will also be given to the development of a specific mountain bike trail within the Millstream Chichester National Park.

27.2 – Visitor Activities – Cycling

Key Points

- Cycling occurs in the Millstream Chichester National Park, although no specific cycle trails are provided.
- Trail types on Department-managed estate range from type 1, multi-use paths to type 4, narrow single tracks or trails.

The objective is to provide a range of cycling opportunities appropriate to visitor management settings that do not significantly impact on natural, cultural and other key values.

This will be achieved by:

1. continuing to facilitate cycling on public roads in the park;
2. considering the development of designated cycle tracks (either sole or multiple use) should conflict develop between cyclists and other users within the park;

3. designing, constructing and maintaining cycle tracks according to established planning procedures, design class standards and site environmental capability;
4. monitoring the impacts of cycling for environmental degradation and visitor safety reasons and, in liaison with users and if the activity is environmentally unacceptable, issuing permits and modifying or restricting access (temporarily or permanently);
5. restricting cycling activity on tracks used by other track visitors, except where they are designated dual-use paths;
6. consulting with visitors and relevant stakeholders about the development of cycling opportunities; and
7. providing information to visitors about cycling opportunities that provides:
   - a cycle path that best suites the needs and abilities of visitors;
   - the degree of difficulty;
   - safety guidelines including party size and registration;
   - camping and campfire policy;
   - the code of conduct; and
   - the impacts of cycling on the environment.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

27.3 Day Use

A 'day-use' area is any recreation site that is used specifically for day visits. These sites usually provide opportunities for picnicking and barbequing, but can often have other facilities such as lookouts, boat launching facilities and interpretation, and can also be the central focus for other nature-based leisure activities such as scenic driving and bushwalking. Many camping areas also have a day-use function. This can occasionally lead to conflicts between visitors (e.g. day visitors driving through camping areas) unless adequate provision is made for the different visitor types. Day-use sites range from primitive sites such as small clearings with little or no facilities to well developed sites with many facilities.

Currently, several day use sites are provided in the Millstream Chichester National Park. In the Millstream Homestead precinct, the primary visitor orientation and information centre is the Homestead Visitor Centre. This established complex will remain the focus for park visitors, and continue to act as the dissemination point for park information. Current and proposed day use sites are shown in Table 6 and in Map 12.

Currently, lookout facilities are provided at Cliff Lookout, which provide extensive views over Crossing Pool (*Murlunmunjurna*) and the Hamersley Ranges. An expansion of the facilities is proposed, including a walk trail interpreting Yindjibarndi dreaming stories and increased car parking capacity.

Two new lookouts are proposed as additional features along Snappy Gum Drive. A lookout with interpretive information will be considered as a feature stop point on the popular scenic drive. Another lookout and an associated car park are proposed to take advantage of the spectacular views from Snappy Gum Drive.

New day-use facilities are to be considered at Palm Pool (*Thaawuthungganha*) (Table 6 and Map 12). Currently the banks of the pool are used informally for day-use and swimming occurs to the west of the concrete crossing over the pool (see Section 27 – *Visitor Activities – Swimming*). Day-use facilities will be developed away from the concrete crossing and will include facilities for picnicking, non-powered boat launching and swimming.

Existing day-use facilities in the Python Pool precinct require major upgrading. There are functional, maintenance and aesthetic problems associated with the site at Python Pool and relocation or redesign of the parking facilities will be required as an important part of the upgrade, together with new camping facilities at nearby Snake Creek (see Section 28 – *Visitor Accommodation*). Day use facilities at Python Pool and Mt Herbert lookout will be reviewed; car park and day-use areas may be relocated to more appropriate locations. In addition, increased visitation to the site is likely with the construction of the Karratha-Tom Price Road (see Section 26 – *Visitor Access*). Redevelopment will be required to ensure that the site has increased capacity for visitors and to limit the extent of visitor impacts on the area. Facilities required include new signage, toilets, tables and shelters. The site will remain day use only, and the Camel Trail will continue to begin and terminate at Python Pool.

Table 6: Existing and Proposed Day-Use Areas in the Millstream Chichester National Park

Day Use Site	Main Activities	Management Setting	Comments
Existing			
Millstream Homestead Precinct			
Millstream Homestead Visitor Centre	Picnicking, information, bushwalking	Highly Modified	Redevelopment of site required to cater for predicted increased visitor numbers.
Deep Reach Pool (*Nhangghangunha*)	Picnicking, bushwalking, interpretation.	Highly Modified	Redevelopment of site required.
Crossing Pool (*Murlunmunjurna*)	Camping, picnicking, boating, bushwalking.	Highly Modified	Redevelopment of site required to move carparking away from pool edge.
Wahunnha (Cliff Lookout)	Lookout, picnicking, interpretation.	Highly Modified	Redevelopment of site required.
Snappy Gum Drive Lookout	Lookout	Highly Modified	
Main Entry Station	Entry Station	Highly Modified	Retain
Snappy Gun Drive Entry Station	Entry Station	Highly Modified	Retain
Python Pool Precinct			
Mount Herbert	Lookout, bushwalking	Natural	Redevelopment of site required.
Python Pool	Bushwalking, picnicking.	Recreation	Redevelopment of site required.
Panorama Lookout	Lookout	Recreation	Redevelopment of site required.
Proposed			
Dawson's Creek area	Picnicking, walking	Highly Modified	
Palm Pool (*Thaawuthungganha*)	Camping, picnicking, boating, bushwalking.	Recreation	Existing informal use may be formalised if demand increases.
Additional lookouts on Snappy Gum Drive	Lookout	Recreation	
Karratha-Tom Price Road	Lookouts, stopping points and entry stations.	Highly Modified	

Stopping points and lookouts at significant natural features and park entry stations may be required along the proposed Karratha-Tom Price Road, which will traverse the Millstream Chichester National Park. These sites are likely to occur mainly within the road reserve, but some may be located within the park to enable the maximum appreciation of the park's values by the visitor.

Development of several sites is proposed in this plan but, for each proposal, a site development plan will be required before any works commence. Consultation with the Yindjibarndi and Ngarluma community will occur through the Park Council.

Other day-use sites within the Millstream Chichester National Park may be developed as demand increases and after detailed planning, review of the visitor management setting implications and consultation with the Park Council, the public and the Conservation Commission.

The major management issues associated with day-use sites are litter, and the provision and servicing of toilets. Rubbish bins are provided at some day-use sites within the Millstream Chichester National Park and are emptied as necessary. However, this service requires the removal of the rubbish to the nearest town and is expensive. Several options include (i) remove all rubbish bins from the planning area and request that visitors take their own rubbish home with them (this has proven a very cost-effective strategy in most cases, and has significantly reduced management costs), (ii) establish one or two collection points where visitors can place rubbish directly

onto a trailer for removal, and (iii) continue with the current system of bins at some sites. The first option is preferred and visitors will be encouraged to take their rubbish home.

Toilet facilities are provided at a number of day-use sites and are generally sealed vault, pit style. There are a number of safety and environmental issues associated with these toilets and the disposal of waste material. Therefore, composting or similar environmentally-friendly options will be investigated, particularly at sites located above the Millstream aquifer, where Priority 1 Drinking Water Source Areas apply (see Section 37 – *Water Extraction*).

Currently, gas barbeques are provided at several of the day use sites and camping areas in the Millstream Chichester National Park. In addition, a communal cooking area with gas barbeques will be investigated for the major day-use area within the park. No wood campfires will be permitted within the park and visitors will be encouraged to use the gas barbeques provided or bring their own gas barbeques or fuel stoves in areas where these are not provided (see Section 28 – *Visitor Accommodation – Campfires*).

27.3 – Visitor Activities – Day-Use

Key Points

- A 'day-use' area is any recreation site used specifically for day visits and includes picnic and barbecue sites, lookouts, interpretive stops, fishing spots, short walks and nature viewing sites. They can provide a focus for activities such as bushwalking or scenic driving.
- Current day use areas in the Millstream Chichester National Park are around the Millstream Homestead precinct and the Visitor Centre, Crossing Pool (*Murlunmunjurna*), Deep Reach Pool (*Nhangghangunha),*Cliff Lookout, and at Python Pool.

The objective is to provide day-use facilities appropriate to the environment and desired visitor management setting that encourage visitor enjoyment and understanding of the values of the planning area.

This will be achieved by:

1. providing a range of day-use opportunities consistent with the appropriate visitor management settings and as resources permit according to Table 6 and Map 12. Ensuring site development plans are prepared for each proposal before any works commence;
2. designing, constructing and maintaining day use sites in accordance with Departmental policy, Drinking Water Protection Area guidelines, established planning procedures, design standards and site environmental capability;
3. referring all proposed developments for day-use facilities to the Millstream Park Council;
4. monitoring the impacts of day use activities for environmental degradation and visitor safety reasons and, in liaison with users and if the activity is environmentally unacceptable, issuing permits and modifying or restricting access (temporarily or permanently);
5. prioritising projects in accordance with the following criteria:
   - visitor risk;
   - environmental and cultural impacts;
   - social benefit;
   - equity;
   - public demand; and
   - potential economic benefit.
6. where practicable, designing and constructing picnic and barbecue areas and associated facilities to a standard suitable for use by everyone in the community, including people with disabilities;
7. providing information to visitors about day-use opportunities;
8. removing litter bins from recreation sites within the Millstream Chichester National Park and encouraging visitors to take their litter home;
9. providing toilet facilities where appropriate with a preference for environmentally sensitive systems where practical: and
10. consulting with visitors and relevant stakeholders about the development of day-use opportunities.

Key Performance Indicators (see also Appendix 1):		
Performance Measure	**Target**	**Reporting Requirements**
27.2 Visitor satisfaction over the life of the plan as a result of day use activities in designated areas.	27.2 No decrease in visitor satisfaction over the life of the plan as a result of day-use activities in designated areas.	Every five years.

27.4 Non-commercial, Education and Not-for-profit Activities

Non-commercial, educational and not-for-profit groups have the potential to offer experiences and services to visitors that would not otherwise be available. They may also be able to provide access to visitors with special needs (for example, visitors with physical disabilities), deliver interpretation and education messages that foster appreciation and understanding of the planning area, or assist with other operations.

Groups can range from well-organised multi-national organisations with trained staff and codes of practice to small school groups with varying levels of preparation and expertise. The level of impact on the environment and level of management input also varies. The Millstream Chichester National Park has only had limited use by non-commercial, education and not-for profit groups in the past. Local schools use the park for camps, educational activities and excursions. The Western Australian Rogaining Association has held rogaining events in the park. The park has also been used for geocaching. Geocaching is a new sport involving the use of a GPS where individuals find containers hidden by other players. Caches are established all over the world and location coordinates are shared on the internet. With improved access to the park associated with the construction of the Karratha-Tom Price Road, the demand for the use of the park by these types of groups (particularly school groups) is likely to increase.

Areas within the Millstream Chichester National Park that offer the best conditions for such activities generally coincide with areas favoured by other visitor groups, and this can lead to competition or conflict between groups wanting to use the same area. For this reason, the Department requires all organised non-commercial, educational and not-for-profit groups to gain permission from the Pilbara Regional office in Karratha prior to undertaking their activities, to ensure that their requests can be met. Guidelines and forms have been prepared for groups seeking the Department's permission for such activities.

Group camping areas are proposed as part of the development of camping facilities, which will be made available to non-commercial, educational and not-for-profit groups. The Department is currently in the process of developing a State-wide booking system for groups to enable them to book ahead and guarantee a camping area.

27.4 – Visitor Activities – Non-commercial, Education and Not-for-profit Activities

Key Points

- Currently there is limited use of the Millstream Chichester National Park by non-commercial, education and not-for-profit groups.
- These groups have the opportunity to provide visitors with experiences that would not be available otherwise.
- Groups such as these create a need for more formal camping areas, as well as the need to monitor the impacts on other visitors and the environment.

The objective is to ensure that non-commercial, education and not-for-profit activities are compatible with other management objectives that extend the range of services and recreational experiences available in the planning area.

This will be achieved by:

1. providing a range of opportunities for non-commercial, education not for profit activities while ensuring they are consistent with the appropriate visitor management settings, pose no adverse impacts on the environment or unreasonably interfere with public use;
2. assessing non-commercial, education not for profit activities on a case-by-case basis and permitting them where they are consistent with Department policies;
3. ensuring that all non-commercial, educational and not-for-profit groups contact the Department for approval to conduct activities in the Millstream Chichester National Park and that activities are

undertaken subject to conditions stipulated by the Department;
4. promoting the use of the Departmental booking and entry permit system for non-commercial, educational and not-for-profit groups to avoid overuse and conflict between visitors and ensuring groups comply with the guidelines and codes of practice associated with these permits;
5. providing information to non-commercial, education and not-for-profit groups about suitable projects and activities that can be undertaken and codes of practice for the use of the planning area by these groups;
6. allowing the use of management access tracks for vehicle use by non-commercial, educational and not-for-profit groups strictly in emergency situations only, or where assisting the Department with management activities;
7. investigating partnerships between the Department and non-commercial, educational and not-for-profit groups that provide opportunities for the delivery of education and interpretation programs for visitors to the Millstream Chichester National Park; and
8. exploring opportunities for non-commercial, educational and not-for-profit groups to contribute to management by organising or participating in service projects such as rehabilitation, weed control or other activities.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

27.5 Recreational Boating

Boating is a popular activity on and adjacent to many conservation reserves including the Millstream Chichester National Park. The use of boats is a popular way of exploring the Millstream Pools. Currently, non-powered boats (row boats, canoes, rafts and wind surfers) are permitted on Deep Reach Pool (*Nhangghangunha*). However, boating at Deep Reach Pool (*Nhangghangunha*) is considered inappropriate by the Traditional Owners due to the cultural significance of the area to Yindjibarndi people (see Section 23 – *Indigenous and Non-Indigenous Heritage*). Consequently, all forms of boating will not be permitted from the Deep Reach (*Nhangghangunha*) day-use site or the camping area (which is to be closed). At Crossing Pool (*Murlunmunjurna*), continued erosion during flood events has created steep banks, above the water mark, which can be very slippery and can pose a risk to visitors, particularly to children. Appropriate boat launching facilities will be required to ensure that boats can be launched safely into the pool. Also signage will be installed at this site advising visitors of the risks associated with boating in the pool.

The provision of facilities for launching non-powered boats at other sites within the Millstream precinct will be considered. There is the potential to develop canoe and other boat launching facilities at the proposed new camping and day-use facilities to be developed at Palm Pool (*Thaawuthungganha*). There is also the opportunity to develop canoe hire facilities here and a canoe trail with appropriate access and launching facilities. A commercial operation such as this would be a worthwhile opportunity for the Traditional Owners to be involved in.

No powered boats will be permitted in the pools within the Millstream Chichester National Park, except for management (including emergency) purposes.

Operational safety for boating activities is provided by the Department of Transport under the *Shipping and Pilotage Act 1967* and the *Navigable Water Regulations* and the *Shipping and Pilotage (Mooring Control Areas) Regulations* made under that Act. The CALM Act enables the Department to determine where boating may occur on waters managed by the Department, although the *Navigable Waters Regulations* and *Shipping and Pilotage (Mooring and Control Areas) Regulations* still apply.

Other boating opportunities may be developed as demand increases and after detailed planning, review of the management setting implications and public consultation.

27.5 – Visitor Activities – Recreational Boating

Key Points
- Non-powered boating such as the use of row-boats, canoes, rafts and wind surfers currently occurs at Deep Reach Pool (*Nhangghangunha*) and Crossing Pool (*Murlunmunjurna*).
- Boating on Deep Reach Pool (*Nhangghangunha*) is not considered appropriated by the Traditional Owners because of its important cultural significance.

The objective is to provide a range of boating opportunities appropriate to visitor management settings that do not significantly impact on natural, cultural and other key values.

This will be achieved by:

1. providing for non –powered recreational boating in accordance with relevant Department policies and other legislation;
2. designing and constructing boat launching and mooring areas to address site capability and minimise environmental impacts and conflict with other visitors;
3. undertaking risk assessment to identify and manage hazards associated with recreational boating;
4. closing the Deep Reach Pool (*Nhangghangunha*) camping and day-use areas to all boating activities;
5. continuing to prohibit motorised boating on all pools in the Millstream Chichester National Park;
6. ensuring the effects of non-powered boating activities do not impact on the environment and modify their management if necessary;
7. providing information to visitors about recreational boating opportunities that provides:
   - locations where boating is permitted;
   - safety guidelines;
   - location of designated camping areas for boat users; and
   - a code of conduct for boat users;
8. consulting with visitors and relevant stakeholders about recreational boating opportunities; and
9. encouraging the development of a commercial canoe hire operation and a canoe trail at Palm Pool (*Thaawuthungganha*).

Key Performance Indicators:

There are no Key Performance Indicators for this section.

27.6 Recreational Fishing

Recreational fishing is managed by the Department of Fisheries throughout the State in accordance with the *Fish Resources Management Act 1994*. Recreational fishing is generally controlled through orders and regulations made under the fisheries legislation in respect to size and bag limits, gear controls, closed seasons and licensing. These controls vary around the State and are amended from time to time. Fishing is permitted in State forests, national parks, nature reserves and other parts of the terrestrial conservation estate in accordance with the Fish Resources Management Act, any CALM Act management plan and the CALM Regulations. Access to fishing sites is managed by the Department to prevent or manage environmental degradation of riverbanks and foreshores.

Freshwater fishing is a popular activity on the pools of the Fortescue River (*Yarnda Nyirranha*) within the Millstream Chichester National Park. Fish species sought are the variety of catfish found in the Fortescue River (*Yarnda Nyirranha*), including *Arius bilinneatus*, the blue catfish (*Arius graeffei*) and *Neosilurus hyrtlii*. Fishing will be permitted at all pools in the planning area, with the exception of the part of Deep Reach Pool (*Nhangghangunha)* adjacent to the existing camping area which will be closed to all public access.

27.6 – Visitor Activities – Recreational Fishing

Key Points

- The *Fish Resources Management Act 1994* has application to recreational fishing on lands and waters managed by the Department.
- Recreation fishing currently occurs in the pools of the Fortescue River (*Yarnda Nyirranha*) in the Millstream Chichester National Park.

The objective is to provide for fishing consistent with the *Fish Resources Management Act 1994* and the CALM Act, unless this leads to degradation of natural or cultural values or unacceptable levels of conflict between visitors.

This will be achieved by:

1. providing for recreational fishing within the Fortescue River (*Yarnda Nyirranha*) in the Millstream

Chichester National Park, in accordance with Departmental policies and other relevant legislation, with the exception of the part of Deep Reach Pool (*Nhangghangunha)* adjacent to the existing camping area which will be closed to public access (see Section 28 – *Visitor Accommodation*);
2. designing and constructing access for fishing areas to address site capability and minimise environmental impacts and conflict with other visitors;
3. undertaking risk assessment to identify and manage hazards associated with recreational fishing;
4. monitoring sites where recreational fishing occurs for environmental degradation and visitor safety reasons, and, in liaison with users and if the activity is environmentally or socially unacceptable, issuing permits and modifying or restricting access (temporarily or permanently);
5. providing information to visitors about recreational fishing opportunities that provides:
   - the location of safe sites suitable for fishing;
   - safety guidelines;
   - location of designated camping areas for recreational fishers; and
   - the code of conduct;
6. consulting with visitors and relevant stakeholders about recreational fishing opportunities;
7. liaising with the Department of Fisheries and ensuring ranger presence to apply the provisions of the Fish Resources Management Act to regulate fishing restrictions and to prohibit fishing at the Deep Reach Pool (*Nhangghangunha)* camping area; and
8. providing information to visitors about fishing, particularly on the methods of reducing environmental impacts and on safe access to pools on the Fortescue River (*Yarnda Nyirranha*).

Key Performance Indicators:
There are no Key Performance Indicators for this section.

27.7 Swimming

Swimming is popular in the Millstream Chichester National Park, as an escape from the Pilbara heat.

Swimming currently occurs at Deep Reach Pool (*Nhangghangunha),* and Crossing Pool (*Murlunmunjurna*). However, due to its strong cultural significance and the strongly-felt presence of the Warlu in the area, the Deep Reach Pool (*Nhangghangunha)* camping area will be closed and visitors will be encouraged not to swim in this area (see Section 23 – *Indigenous and Non-Indigenous Heritage*). Chinderwarriner Pool (*Jirndawarrunha*) also has important cultural significance for the Yindjibarndi people and swimming will not be encouraged.

At Crossing Pool (*Murlunmunjurna*), continued erosion during flood events has created steep banks, above the water mark, which can be very slippery and can pose a risk to visitors, particularly to children. Signage will be installed at this site advising visitors of the risks associated with swimming in the pool and appropriate access points will be investigated.

On occasion, swimming also occurs in Python Pool. During dryer months, water levels in this pool drop and the water stagnates, creating suitable conditions for the development of *Amoebic meningitis* and swimming at these times is not recommended. Hence, signage will be installed and information distributed to visitors to advise that swimming in this area is at their own risk.

Palm Pool (*Thaawuthungganha*) is a popular spot for swimming, which occurs to the west of the concrete crossing and pipeline over the Fortescue River (*Yarnda Nyirranha*). However, safety concerns associated with swimmers in close proximity to vehicles crossing the river suggest that an alternative to the current roadway is required. As an alternative, opportunities will be investigated away from the concrete crossing. This area is not as culturally significant for the Yindjibarndi people and the impact of flooding in the pool is not as severe as in other pools.

With the closure of Deep Reach Pool (*Nhangghangunha)* camping area, alternative opportunities for swimming will be investigated in the Millstream Homestead precinct in the Millstream delta. Natural spring baths will be investigated allowing visitors to relax and cool off in a series of sitting or bathing pools, associated with the Milyana camp ground and the Millstream Homestead.

Other opportunities for swimming may be developed as demand increases and after detailed planning, review of the visitor management setting implications and consultation with the Park Council, the public and the Conservation Commission.

27.7 – Visitor Activities – Swimming

Key Points

- Swimming currently occurs at Deep Reach Pool (*Nhangghangunha)*, Crossing Pool (*Murlunmunjurna*) and Python Pool.

The objective is to allow for swimming in the planning area, except where there is a threat to the natural and cultural values or a risk to public health or visitor safety.

This will be achieved by:

1. developing swimming in accordance with Departmental policies;
2. encouraging visitors not to swim in the Chinderwarriner Pool (*Jirndawarrunha*) or in Deep Reach Pool (*Nhangghangunha)* adjacent to the existing camping area (which will be closed to the public);
3. providing a range of opportunities for swimming consistent with appropriate visitor management settings and as resources permit;
4. undertaking risk assessment to identify and manage hazards associated with water based activities;
5. maintaining access for water based activities tracks according to the established standards;
6. controlling water based activities including the issuing of permits, re-alignment or closure of tracks (temporarily or permanently) for reasons of visitor safety, protection of threatened species, rehabilitation or impacts from fire;
7. providing information to visitors about water based opportunities that provides:
   - the location of safe sites suitable for water based activities;
   - safety guidelines including hazards; and
   - the code of conduct;
8. consulting with visitors and relevant stakeholders about water-based opportunities
9. investigating the development of sitting or bathing pools in the Millstream delta area, in the vicinity of the Milyana camping area in the Millstream homestead precinct; and
10. providing a range of information to visitors about any hazards associated with swimming in the Millstream Chichester National Park (e.g. steep and slippery banks, underwater hazards and the risk of *Amoebic meningitis* in freshwater areas).

Key Performance Indicators:

There are no Key Performance Indicators for this section.

28. VISITOR ACCOMMODATION

Built Accommodation

Currently, no built accommodation is provided for visitors in the Millstream Chichester National Park. A transportable building within the Millstream Ranger's residence/accommodation precinct provides accommodation for Park Council members while spending time on country and during Park Council meetings, for volunteers and visiting Department staff. However, these are frequently at capacity. This precinct also contains the Department of Corrective Services work camp, which comprises several transportable buildings used to accommodate low security Indigenous prisoners who are used as a workforce in the park (see Section 40 – *Community Involvement and Volunteers*). This work camp will also require expansion and upgrade throughout the life of the plan and relocation away from the Millstream Homestead precinct, together with residential accommodation for rangers, other accommodation for volunteers, Departmental staff, the Department of Corrective Service's work camp and Departmental workshop facilities. Accommodation for Park Council members and the Ranger's office will remain adjacent to the Millstream Homestead Visitor Centre and will be upgraded and redeveloped.

In recent years, particularly in Western Australia's North West, demand has increased for high quality built accommodation with an ecotourism focus. Currently there is no high quality built accommodation provided in the Millstream Chichester National Park. The park is being considered as part of a wider State Government initiative and coordinated by Tourism Western Australia known as Landbank. This process involves environmental, social and economic studies of areas that could contribute to increasing the number and variety of accommodation in Western Australia, in proximity to iconic locations and landmarks, to meet future tourism needs. Part of the Landbank project involves examining the potential for low impact, nature-based

accommodation across conservation estate that will expand the range of visitor experiences. Landbank developments in remotes area such as the planning area will also provide opportunities for Aboriginal tourism.

Where Landbank proposals are on conservation estate and is in partnership with the Department, they are called Naturebank. There is great potential in the Millstream Chichester National Park to improve visitor facilities and infrastructure, including the development of low-impact nature based accommodation, allowing visitors a greater appreciation of the natural values of the area. Within the park, several sites have been assessed for the suitability of Landbank developments. However, more environmental and feasibility analysis and consultation with stakeholders and the community is required. The Millstream Park Council will play a major role in these investigations and any facilities which may be established. Any developments are likely to have a high degree of Aboriginal interpretation and cultural experiences, representing commercial opportunities for Indigenous communities in the area.

There is also the opportunity within the Millstream Chichester National Park to develop the Maya Campground. As with the Landbank proposals, this would incorporate the development of safari-tent style accommodation, built in a style to resemble traditional Indigenous "maya" huts. The facility would provide accommodation and cultural and environmental education for school and university students, the Indigenous and other community groups, mining industry staff and for particular events. A specific location for the Maya Campground has yet to be determined and further assessment and consultation is required for this development.

Camping

Camping is a common and popular activity allowing visitors to relax and develop an awareness and understanding of the natural environment. The demand for camping within natural areas often varies from the individual seeking solitude, inspiration or self-reliant recreation to large semi-organised groups. Often camping is associated with nearby recreational activities or scenic attractions. Camping, under the Department's *Policy Statement No. 18 – Recreation, Tourism and Visitor Services* (DEC 2006), broadly falls into two classes:

- designated site camping, where areas are set aside for the purpose of camping, often with the provision of facilities and usually accessible by vehicle; and
- remote camping, where there is no specified area set aside for camping and where facilities are generally not supplied.

Within 'designated site camping', there may be a spectrum of camping opportunities available, such as vehicle-based camping or backpacking, based on the level of development of facilities such as toilets, access, water supply, tables and visitor information.

Vehicle-Based Camping

In the Millstream Chichester National Park, shady bush-style camping areas with pit toilets are currently provided at Deep Reach Pool (*Nhangghangunha*), Crossing Pool (*Murlunmunjurna*) and Stargazer's Camp in the Millstream Homestead precinct and Snake Creek in the Python Pool precinct. However, the site at Deep Reach Pool (*Nhangghangunha*) is not suitable in the long term for camping because it is inappropriate due to the cultural significance of the area to Yindjibarndi people (see Section 23 – *Indigenous and Non-Indigenous Heritage*). The Deep Reach Pool (*Nhangghangunha*) camping area will be closed to camping and the adjoining day-use site (which is less culturally-sensitive) will remain open. Stargazer's Camp and Crossing Pool (*Murlunmunjurna*) will remain open to camping. Stargazer's Camp requires expansion and redevelopment and the Crossing Pool (*Murlunmunjurna*) camping area requires redevelopment with the camping and car parking area moved well away from the pool edge.

Camping sites will be provided near the Millstream Homestead in the vicinity of the Millstream delta (Milyana Campground) and opportunities at Palm Pool (*Thaawuthungganha*) are being investigated to accommodate campers in the park (see Map 12 and Table 7). These sites are more culturally appropriate, are not subject to seasonal inundation and are more able to cater for larger visitor numbers likely as a result of improved access to the park. The final location, layout and size of the camping areas will be determined in conjunction with Millstream Park Council through specific site development plans. It is likely they will cater for a range of visitors, by providing sites for individuals and groups. Development of these new camping areas will also provide an opportunity to accommodate educational groups.

The Snake Creek campsite in the Python Pool precinct has proven to be an unsatisfactory camp ground due to rocky soils and lack of shade. A new camp ground in a more appropriate location is needed, in addition to the

redevelopment of the whole precinct to provide for an expanded capacity on level stable ground with shade trees and natural amenity attractions. A site a few kilometres downstream is being investigated, but other opportunities may also be available in the immediate area. Use of this site is likely to increase over the life of the plan with the completion of the Karratha-Tom Price Road. There may be a requirement for a mobile ranger to be allocated to the Python Pool area to assist with the development and management of recreation facilities. Considerably more site planning is required in the Python Pool area. More detailed consultation with the Millstream Park Council will be required prior to development.

Table 7: Existing and Proposed Camping Areas in the Millstream Chichester National Park

Camping Areas	Access	Management Setting	Comments
Millstream Homestead Precinct			
Changes to Existing Sites			
Deep Reach Pool (*Nhangghangunha)*	2WD	Highly Modified	Will be closed for camping. The adjacent day-use area will remain open.
Crossing Pool (*Murlunmunjurna*)	2WD	Highly Modified	Relocate camping area and car-parking away from pool edge and improve access to the pool.
Stargazer's Camp	2WD	Highly Modified	Requires expansion and redevelopment to cater for individuals and groups.
Milyana Campground	2WD	Highly Modified	To be expanded to cater for a range of visitors including individuals and groups.
Proposed New Sites			
Palm Pool (*Thaawuthungganha*)	Access to be determined.	Recreation	Will cater for a range of visitors including individuals and groups.
Python Pool Precinct			
Changes to Existing Sites			
Snake Creek	2WD	Recreation	Relocate and upgrade facilities.
George River	4WD	Natural	Remote camping only. No facilities to be provided.

Under the CALM Regulations, campers are limited to a maximum stay of 28 days. In a visitor survey carried out in 2001 in the Millstream Chichester National Park, 42 per cent of visitors stayed one night and only 9 per cent stay more than two nights. Most visitors also favoured the retention of low key facilities and the naturalness and remoteness of the park were important reasons for visiting the area. Hence, the development of future camping areas in the park will need to retain the 'feel of the area'.

Fundamental to the success of the proposals to better manage camping is the introduction of a booking system. The Department is currently developing such a system for a number of parks as a trial, with a view to introducing it State-wide. This will allow visitors (both individuals and groups) to visit the Millstream Chichester National Park with the surety of obtaining a site during busy periods (in particular school holidays). It is proposed that the system will allow for on-line booking.

Remote Camping

Camping will also be permitted within the proposed wilderness area over all of the Mungaroona Range Nature Reserve (see Section 13 – *Wilderness*). This reserve will be designated for camping under the CALM Regulations, although no facilities will be provided and there will be no specific areas will be set aside for camping. Access will be on foot only to enable visitors to better appreciate the wilderness values of the area. Although vested as a nature reserve, permitting camping associated with walk-in access only and for the appreciation of the reserve's natural and wilderness values is consistent with its purpose. For safety reasons, campers and bushwalkers will be required to register their intent to camp in wilderness areas with friends and family.

The Millstream Chichester National Park also provides some excellent opportunities for remote camping. Remote camping can be designated under regulations 6 and 66 of the CALM Regulations. Camping by

bushwalkers occurs in remote parts of the Chichester Ranges and this will continue to be permitted. Access to the George River in the Chichester Ranges, east of the Python Pool precinct will be via a booking system for four-wheel drives (see Section 26 – *Visitor Access*). Remote camping will be permitted in the George River area. Should visitation to this area increase or the natural or cultural values of the area become affected, a permit system will be developed for access to the area, possibly in combination with a camping permit.

Other opportunities for built accommodation and camping may be developed as demand increases and after detailed planning, review of the visitor management setting implications and consultation with the Park Council, the public and the Conservation Commission.

28 – Visitor Accommodation – Built Accommodation and Camping

Key Points

- No built accommodation for visitors is currently provided in the planning area.
- An upgrade and relocation of the Millstream Ranger's residence/accommodation precinct is required.
- In the Millstream Chichester National Park, camping currently occurs at Crossing Pool (*Murlunmunjurna*), in the vicinity of the Millstream Homestead (Milyana Campground) and at Stargazer's Camp in the Millstream Homestead precinct.
- Camping in the Python Pool precinct occurs at the Snake Creek camping area and requires redevelopment.
- Remote camping occurs in the George River area and in the Chichester Ranges in the Millstream Chichester National Park.

The objective is to provide a range of quality built accommodation and camping opportunities in designated areas in the planning area.

This will be achieved by:

1. developing built accommodation and camping areas in accordance with Departmental policies;
2. providing a range of built accommodation and camping opportunities for individuals and groups consistent with appropriate visitor management settings and as resources permit (see Table 7 and Map 12). Ensuring site development plans are prepared for each proposal before any works commence;
3. designing, constructing and maintaining built accommodation and camping sites according to established planning procedures, design standards and site environmental capability;
4. monitoring the impacts of day use activities for environmental degradation and visitor safety reasons and, in liaison with users and if the activity is environmentally unacceptable, issuing permits and modifying or restricting access (temporarily or permanently);
5. upgrading built accommodation for Park Council members, the Department of Corrective Services work camp, volunteers and Department staff at a suitable site within the Millstream Chichester National Park;
6. not permitting camping at Deep Reach Pool (*Nhangghangunha)*;
7. providing built safari-tent style accommodation within the Millstream Chichester National Park. Ensuring site development plans are prepared for each proposal before any works commence;
8. gazetting areas designated for the purposes of camping under regulation 6 of the CALM Regulations within the Millstream Chichester National Park and permitting remote camping by way of lawful authority under the CALM Regulations;
9. considering the introduction of a booking system for camping within the Millstream Chichester National Park;
10. developing and implementing a registration system for bushwalkers and campers intending to camp in wilderness areas or remote parts of the Millstream Chichester National Park;
11. depending on the level of visitation and visitor impacts, developing and implementing a booking and permit system for access to remote camping in the George River area;
12. allowing generators only in designated areas, specifying generator curfew times, and allowing a maximum capacity of 5Kva;
13. charging fees for camping at designated camping sites;
14. providing information to visitors about built accommodation and camping opportunities that provides:
    - location of built accommodation and designated campsites and facilities available;
    - fees;
    - safety guidelines including party size and registration;
    - campfire policy; and
    - code of conduct.

15. encouraging the establishment of further camping areas on private property outside the planning area; and
16. consulting with visitors and relevant stakeholders about the development of built accommodation and camping opportunities.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
28.1 Visitor satisfaction levels in relation to camping within the planning area according to visitor surveys.	28.1 No decrease in the visitor satisfaction levels over the life of the plan.	Every five years
28.2 Perceived levels of environmental degradation at high-use sites (e.g. erosion, littering, vandalism) according to visitor surveys.	28.2 No increase in perceived levels of degradation at high-use sites (e.g. erosion, littering, and vandalism) according to visitor surveys.	Every five years

28.1 Campfires

Campfires provide a focal point for social interaction, and are a traditional and valued part of many visitors' park experiences and can provide warmth and comfort to campers. However, the collection of firewood can have detrimental effects on the natural environment, including the loss of vegetation cover and a reduction of habitat integrity. In particular, in the Pilbara, there are only very limited supplies of wood suitable for campfires. The area around campfires can suffer vegetation loss and compaction, the accumulation of ash and the failure of groundcover to regenerate where there have been continuous campfires. In addition, campfire escapes can lead to wildfires. Sites impacted by campfires and firewood collection can take many years to regenerate. Therefore, camp fires will not be permitted within the Millstream Chichester National Park, except for approved cultural, community education and interpretation purposes, where camp fires can be used in a more controlled situation.

Gas barbeques are currently provided in the Deep Reach Pool (*Nhangghangunha*), Crossing Pool (*Murlunmunjurna*) camping areas and at day use sites at Deep Reach Pool (*Nhangghangunha*) and Crossing Pool (*Murlunmunjurna*) and the Millstream Homestead. The provision of gas barbeques and communal cooking facilities will be considered at all designated camping areas and major day-use sites.

Within the Mungaroona Range Nature Reserve, in remote parts of the Millstream Chichester National Park and in wilderness areas, campfires will not be permitted and the use of portable gas barbeques or fuel stoves by bushwalkers using the reserve will be encouraged.

28.1 – Visitor Accommodation – Campfires

Key Points

- Campfires can have significant impacts on natural values within the vicinity of campsites and escapes from campfires can cause wildfires.
- Within wilderness areas and remote parts of the planning area, visitors should only use portable fuel stoves.

The objective is to reduce the impact of campfires on the environment of the planning area.

This will be achieved by:

1. installing communal cooking areas in day-use and campsites, where this is cost effective and practical;
2. not permitting campfires in the Millstream Chichester National Park except for cultural, community education and interpretation purposes;
3. encouraging the use of portable fuel stoves and providing fuel, such as gas or electric barbeques, to designated overnight sites and selected day-use sites, for cooking purposes where this is cost effective and practical; and
4. including information on the environmental impacts of firewood collection and campfires in interpretive media and information.

Key Performance Indicators (see also Appendix 1):		
Performance Measure	**Target**	**Reporting Requirements**
28.3 Number of wildfires caused by escapes from campfires.	28.3 No incidence of wildfires caused by escapes from campfires.	Annually

29. COMMERCIAL OPERATIONS

Commercial concessions can help meet the rising demand for high quality recreation and tourism opportunities, facilities and services, whilst ensuring that financial contributions from tourism help the Department meet the costs of managing the natural resource. A commercial concession is a "right granted by way of a lease, licence or permit for occupation or use under appropriate conditions, of an area of land or water managed by the Department for the purposes of the provision of appropriate facilities and services for visitors' use and enjoyment" (CONCOM 1985). This definition is applied worldwide and is appropriate for use on lands and waters managed by the Department. Commercial concessions must be consistent with the purpose of the reserve, the protection of its values and with the objectives of this management plan. The Department's *Policy Statement No. 18 – Recreation, Tourism and Visitor Services* (DEC 2006) outlines conditions for commercial concessions.

Leases

Leases are formal agreements issued when the activity involves significant infrastructure and/or retailing and requires the exclusive use of the land. A lease allows a lessee to occupy a particular area of land and hence provides security to protect significant investments. Leases may be up to 21 years with an option of a further lease up to 21 years, with the length of commercial leases (for tourism and recreation purposes) usually being proportional to the level of investment and the return on that investment.

Leases in national parks and conservation parks are granted under section 100 of the CALM Act. Leases are usually issued or renewed on a case-by-case basis. If the operation has a commercial benefit (such as a caravan park), then a formal public 'Expression of Interest' process is initiated.

Apart from tourism and recreation purposes, other common lease uses include the provision of utilities. This is the case in the Millstream Chichester National Park, where two leases are held by Pilbara Iron Pty. Ltd. for the provision of a power line through the planning area and a repeater station. The former is a 10 year lease due to expire in 2014, whereas the latter is in the process of being renewed at the time of writing). A third lease is held by Telstra for a microwave tower and is due to expire in 2013.

Given the strong growth in nature-based tourism it is likely that demand for tourism facilities in or near the park will increase in the future. These may be provided by way of leases. Proposals which encourage visitors' appreciation of the area and reflect the natural values of the park will be considered on their merits. In other national parks in Western Australia these can include leases for the provision of accommodation, cafes, shops, booking offices and the like (although not all these facilities will be provided in the Millstream Chichester National Park). Public 'Expressions of Interest' for accommodation must meet sustainability goals for:

- the protection of the natural environment (e.g. maintenance of natural ecology, erosion, extent of soil loss, compaction and vegetation damage, volume of water used, amount of solid waste produced on site, amount of non-renewable energy consumed on site, reduced vehicle use for visitor trips, light spill and noise levels);
- the built environment (e.g. site design and layout, style and character, design form and function, waste water volume, quality and disposal methods, methods of energy production, fuel and chemical storage, handling and chemical spill procedures, toilet facility standards and operation and waste storage and disposal methods);
- the social environment (e.g. level of Indigenous ownership and employment, culturally sensitive behaviour, provision of interpretive materials, safety equipment and procedures, visitor feedback, content of marketing material, expenditure from local businesses and membership of local associations); and
- the business environment (e.g. market demand study, cash flows and profit and loss forecasts, financial capacity, details of commercial activities to be conducted and relevant tourism accreditation).

Similar goals would be required in any public 'Expression of Interest' for the establishment of tourism facilities in the Millstream Chichester National Park.

Licences

Licences allow tourist operators to enter and use lands and waters managed by the Department. Activities carried out under a licence are generally itinerant and do not require substantial infrastructure. All private tour operators conducting commercial tourist activities on conservation reserves and State forest are required to obtain a licence in accordance with section 101of the CALM Act and Part 7 of the CALM Regulations. Licensing enables the Department to monitor and regulate access and use of lands and waters under its control, and ensure that the natural values of these areas are maintained. By protecting these values, tour operators will be able to continue to visit areas maintained to the satisfaction of visitors. Collection of data can be made a condition of licensing.

Two types of licences are issued, depending on the nature of the activity, the security of the resource, and the risk to the participants. Restricted 'E Class' licences are issued where there is safety, environmental or management concerns, and hence the number of licences needs to be restricted. Generally 'E Class' licences are issued following a formal publicly advertised and competitive process. 'T Class' licences are issued where environmental and visitor management objectives can be achieved through the implementation of licence conditions, and most commonly apply to low-impact vehicle-based operations. 'T class' licences can be issued for one, three or five-year periods based on the level of accreditation with recognised accreditation programs.

Conditions apply to all licences to minimise the impacts of activities, or to aid in management of the value being appreciated by the public. The Department considers the following factors before issuing licences:

- infrastructure requirements of tour operations (e.g. adequate toilet facilities, access and parking for large vehicles);
- potential impacts to water quality;
- visitor safety;
- competence of group leaders;
- the potential damage to sensitive areas and wildlife; and
- the appropriateness of retail concessions in particular natural environments.

Guidance for the general conditions for tour operators in national parks and conservation parks is provided in the Department's Tour Operator Handbooks.

As of September 2008, there were 126 T-class commercial tour operators licensed to operate within the Millstream Chichester National Park, although not all licensed operators actually use the planning area. Most operators run vehicle-based tours, stopping at developed recreation sites. For commercial tour operators who use the George River, tour vehicles would be included in any limitations on vehicle numbers accessing the track if a permit system is implemented (see Section 26 – *Visitor Access*). Opportunities for tour operators within the park include the provision of guided walks, camping and nature study tours. Improvements in licensing, technology and the relationship with tour operators may provide more information about areas used, numbers of tourists visiting with tour operators, frequency/season of use and other vital information that can assist the Department and tourism organisations better cater and manage for tourism.

Outdoors WA is the main industry body for outdoor recreation in Western Australia and is currently in the process of developing Adventure Activity Standards. These are being developed for a range of adventure activities, including bushwalking, canoeing/kayaking, mountain biking and four-wheel driving, which all occur in the Millstream Chichester National Park. In consultation with a variety of stakeholders, Outdoors WA aims to develop a set of minimum standards and voluntary guidelines for organisations conducting outdoor adventure activities programs. These may have implications for tour operators conducting these types of activities in the Millstream Chichester National Park.

The participation of Indigenous Traditional Owners in promoting aspects of culture and lifestyle is of enormous interest to visitors. This provides an excellent opportunity for the Traditional Owners to develop economic enterprises. Guided walks, activities, vehicle-based tours, camping and nature study tours, including reference to Yindjibarndi and Ngarluma language, stories and songs, are just some examples of activities which can be run by the Indigenous community in partnership with the Department. Interpretation of the Millstream Chichester area from the Indigenous perspective must take place in a manner agreed by the Millstream Park Council.

The participation of the Ngarluma and Yindjibarndi community in commercial activities in the planning area will be encouraged through cooperation with organisations such as Juluwarlu Aboriginal Corporation. Juluwarlu records, catalogues, archives, preserves, re-produces, exhibits and broadcasts the culture and history of the

Yindjibarndi people and one of their aims is to provide the resources to drive and nurture cultural and economic futures. Collaboration with groups such as these will assist in raising the profile of the park and developing commercial opportunities for Ngarluma and Yindjibarndi people.

29 – Commercial Operations

Key Points

- The Department enters into commercial arrangements to help meet the rising demand for high quality recreation and tourism services, while at the same time ensuring that the financial contributions from tourism assist in meeting the costs of managing the natural environment.
- A commercial concession is a right granted by way of a lease, licence or permit for occupation or use, under appropriate conditions, of an area of land or water managed by the Department. A lease allows for occupation of an area and enables significant development to occur, whereas licences allow operators to enter and use lands and waters. Three leases exist within the planning area.
- Opportunities for tour operators include vehicle-based tours, guided walks, provision of and/or management of accommodation, camping and nature study tours.
- Demand is increasing for Traditional Owners to present activities such as guided walks, vehicle-based tours and camping to visitors, interpreting Indigenous culture and there are increasing opportunities for the development of commercial enterprises.

The objectives are:

1. **to encourage and promote Indigenous ownership of, and participation in commercial enterprises involving Indigenous cultural heritage, and to ensure that the use of Indigenous cultural material by commercial tour operators is appropriate; and**
2. **to ensure that commercial tourism activities are compatible with other management objectives and to extend the range of services and recreational opportunities available in the planning area through the involvement of private enterprise and the Traditional Owners.**

This will be achieved by:

1. giving due consideration to the interests and aspirations of the Traditional Owners in the development of Indigenous commercial operations, and encouraging appropriate Indigenous commercial initiatives;
2. involving the Millstream Park Council in the development of interpretive material used by commercial tour operators;
3. developing a policy, in conjunction with the Millstream Park Council to promote the Traditional Owners' participation in commercial activities within the Millstream Chichester National Park;
4. collaborating with organisations such as Juluwarlu Aboriginal Corporation and the Ngarluma-Yindjibarndi Foundation to promote the involvement of the Traditional Owners in commercial operations in the planning area;
5. ensuring all commercial operations operate under a lease, licence or permit agreement with appropriate conditions that:
   - ensure the operation is consistent with other management objectives within the planning area;
   - facilitate park management; and
   - provide a service or facility to visitors that the Department would not otherwise be able to provide.
6. encouraging Tour Operators that operate in the planning area to acquire quality assurance through industry accreditation, qualification programs and to comply with any guidelines developed relating to their activities (e.g. Outdoors WA Adventure Activity Standards). This will be facilitated, in part, by ensuring that operators have their Tour Operator Handbooks when in the planning area;
7. evaluating proposals for licences and commercial tourism leases according to Departmental policy and permit their establishment where appropriate;
8. including goals for natural environment, built environment, social environment and business environment in any public competitive allocation process for the provision of tourism facilities by way of a lease;
9. ensuring better cost recovery associated with leases for utilities and services;
10. not providing concessions within the planning area if adequate facilities or services exist, or they can be developed, outside the planning area that meet visitor needs;
11. providing resources and training for the tourism industry in interpreting the Department's role and the planning area's natural and cultural values;
12. monitoring the level and impact of operator use to ensure it is sustainable;

13. working with tourism industry and associations regarding any commercial proposal or activity;
14. encouraging and providing incentives for tour operators to acquire quality assurance through industry accreditation and qualification programs; and
15. consulting with visitors and relevant stakeholders about the development of commercial opportunities.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
29.1 The number of unlicensed commercial operators operating within the planning area.	29.1 The number of unlicensed commercial operators operating in the planning area decreases over the life of the plan.	Annually
29.2 The development of Indigenous commercial opportunities.	29.2 Indigenous commercial opportunities established in the planning area.	Every five years

30. VISITOR SAFETY

In addition to a genuine concern for visitor welfare, the Department has a moral and legal responsibility to consider the personal safety of visitors to the planning area. According to the *Occupiers Liability Act 1985*, the Department is defined as the "person occupying or having control of land or other premises" and needs to show anyone entering conservation lands a "duty of care". This is defined as "such care as in all the circumstance of the case is reasonable to see that the person will not suffer injury or damage by reason of any … danger".

Many national parks and other natural areas that the Department manages are remote from emergency services, hard to access by emergency vehicles or have communication problems. The Department manages the risks presented to visitors by their activities and by the natural, cultural, and developed environments through a visitor risk management program under *Policy Statement No. 53 – Visitor Risk Management* (CALM 1997). The program involves the identification of hazards, assessment of the risks posed by these hazards, implementation of risk mitigation measures and ongoing monitoring. As part of the program, all designated recreation sites are routinely audited to identify visitor risks.

The level of risk is part of the visitor experience and opportunities for risk taking are essential to many people's attraction to the outdoors. Visitor risk is often higher in the more 'natural' sites, although risk reduction is less at these sites and visitors should be advised accordingly. Some visitors to the planning area deliberately seek out activities because they involve risk, not despite them. These activities include rock climbing and abseiling, mountain biking and remote bushwalking. However, visitors are expected to take responsibility for their own safety, and the Department encourages visitors to use appropriate behaviour whilst undertaking recreational activities that involve risk.

The Pilbara is hazardous to unwary visitors unused to high daily temperatures and limited water supplies. Dehydration and heat stroke are possible consequences for visitors who do not protect themselves from the sun and fail to maintain fluid intake. Other risks associated with the planning area can include:

- hypothermia from over-exposure under cold conditions;
- falling injuries associated with climbing and walking;
- increased threat of visitors becoming lost in remote areas distant from access, contact and emergency assistance;
- canoeing and swimming in the pools of the Fortescue River (*Yarnda Nyirranha*), particularly in areas with snags, rocks or steep and slippery banks. Fluctuating water levels can vary the water depth over obstacles such as sunken trees and stumps, and river floods can move obstacles to new locations; and
- vehicles becoming stuck in river and creek crossings during floods.

Many of these risks are overcome through attention to personal safety, appropriate maintenance of facilities by Department staff, and appropriate risk warnings through brochures, promotional material and signage. Risk assessments are regularly carried out on recreation sites, facilities and visitor services to identify potential hazards. This information is used as the basis for preparing and implementing recreation site maintenance programs and the refinement of visitor services. On occasion, these hazards may require considerable works to mitigate risks or even closure of the site.

The Department works closely with local government, the State Emergency Service, the Police, Main Roads WA and the Royal Flying Doctor Service in managing visitor risk within the planning area. In the event of an incident, the coordination of search, rescue or recovery operations is the responsibility of the Western Australian Police Service. However, where these occur on lands and waters managed by the Department, it is often the Department that organises the initial response. Staff in the Millstream Chichester National Park are trained in First Aid and emergency incident management.

30 – Visitor Safety

Key Points

- The Department has a moral and legal responsibility to minimise visitor risk, and under the *Occupiers Liability Act 1985* has a "duty of care" for visitors to the planning area.
- The Department manages the risks presented to visitors by implementation of *Policy Statement No.53 – Visitor Risk Management* (CALM 1997) and the visitor risk program.
- As part of this program, designated recreation sites are routinely audited to identify visitor risks.
- The main hazards for visitors in the Pilbara include high daily temperatures and limited water supplies.
- Staff are trained in First Aid and emergency incident management.

The objective is to maintain visitor experiences in the planning area by minimising risks to public safety wherever possible.

This will be achieved by:

1. developing and implementing an emergency management plan for the planning area;
2. continuing to provide information to enable visitors to consider risks and to highlight potentially hazardous areas and activities, particularly the inundation of seasonally wet areas;
3. highlighting the risks associated with recreation in natural areas and emphasise visitor responsibilities in relation to personal safety;
4. continuing to implement the Department's visitor risk management program in accordance with Department policy that maintains recreation sites to minimise visitor risk;
5. continuing to undertake formal risk assessment of all recreation sites and facilities as part of the visitor risk management program and in addition to that which occurs on a day to day basis;
6. providing information to highlight potentially hazardous areas and activities and to modify visitor behaviour accordingly;
7. maintaining the current level of preparedness in relation to park rescue and medical services. Continue to cooperate with State Emergency Services, Police, Royal Flying Doctor Service and other bodies in order to assist the public in emergency situations;
8. investigating methods for improved emergency communication within the planning area;
9. if required, relocating campground, day-use areas and walk trails away from hazardous areas, and upgrading facilities in the Millstream Chichester National Park, particularly walk tracks and lookouts, in accordance with site development plans;
10. prohibiting activities in areas where they are hazardous to other park users;
11. training all park staff in risk assessment, first aid, occupational safety, basic bushcraft and survival skills, radio communications, search and rescue, fire control and the safe use of firearms. Offer training to other residents of the park; and
12. applying industry standards and utilising appropriate expertise in the safe design and construction of visitor facilities.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
30.1 The number and severity of incidents occurring within the planning area and reported to the Department.	30.1 The number and severity of incidents occurring within the planning area and reported to the Department remains stable or decreases from 2011 levels.	Annually

31. DOMESTIC ANIMALS

Many people when they travel take their pets with them, in particular dogs. This is a significant problem in parks that are remote from settlements, such as the Millstream Chichester National Park as there are usually no kennelling facilities available adjacent to the park .Within the planning area domestic animals are considered undesirable. This is because:

- native animals see domestic animals such as dogs as predators and the lasting scent left by them can easily scare small animals and birds, often causing them to leave their young unprotected;
- domestic animals can increase the spread of weed species and also increase vegetation disturbance (e.g. horses);
- faeces carries diseases which can be harmful to wildlife and people; and
- domestic animals, particularly dogs can interfere with the enjoyment of other park visitors.

Domestic animals are not usually permitted in national parks or conservation reserves. The exception is guide and hearing dogs for visually and hearing impaired visitors and specially trained dogs for search and rescue operations. Visitors will be encouraged to kennel pets in neighbouring towns.

31 – Domestic Animals

Key Points

- Domestic pets can cause significant problems in the planning area.
- Guide dogs and tracker dogs are allowed into the planning area.

The objective is to protect native fauna and visitors to the planning area from the impacts of domestic animals.

This will be achieved by:

1. managing domestic animals in accordance with Department policies and relevant legislation;
2. prohibiting domestic animals within the planning area, except for:
   - guide dogs;
   - animals required for emergency search and rescue purposes; or
   - with the approval of the Regional Manager
3. encouraging visitors to take their domestic animals to areas outside the planning area;
4. promoting the use of kennel facilities in neighbouring towns;
5. providing information explaining Department policy on domestic animals, their impact on natural values and promoting appropriate owner behaviour; and
6. monitoring the effects of domestic animals on natural values and visitors.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

32. VISUAL LANDSCAPE

Landscape management is based on the premise that the visual quality of any landscape is a resource in its own right and can be assessed and managed in much the same way as other values, such as fauna, flora, water and recreation. The role of landscape management is to ensure that all uses and activities are planned and implemented to complement rather than detract from the inherent visual quality of the environments in which they occur.

In the recreation and tourism context, the term ‘visual landscape’ refers to the appearance or visual quality of an area - the segment of the environment that is perceived, interpreted and responded to by people. For many, a landscape’s visual values are the most direct way they will experience an area and therefore, are often the criteria by which land management practices are judged. The ‘visual quality’ refers to either the characteristics (qualities) of a landscape or the degree of excellence in terms of naturalness, distinction and public exposure/perception.

The Department's Visual Landscape Management System considers physical and social information, such as Landscape Character Types, visual quality, viewer sensitivity, and visual exposure, and integrates these components to form Visual Landscape Management Zones.

Landscape Character Types

Every landscape has an identifiable visual character determined by its context of geomorphology, hydrology, soils, vegetation, land-use and cultural heritage values. Most people's understanding and response to their environment is largely visual. According to these features, landscapes in Western Australia have been broadly identified and described as Landscape Character Types (LCT) in order to assess their visual landscape values (CALM 1994).

The planning area encompasses four Landscape Character Types: the Karratha Coastal Plains, Chichester Ranges, the Fortescue Valley and the De Grey Lowlands (see Map 10).

Chichester Ranges

The Chichester Ranges are a narrow range with a gently undulating plain forming a plateau. The vegetation consists of widespread spinifex and mixed grasses on rocky slopes with medium shrubs, scattered trees such as snappy gums and taller shrubs. Vegetation is sparse in many areas. Several rivers flow from the northern side of the Ranges and the Fortescue River (*Yarnda Nyirranha*) drains to the south. Most of the eastern part of the Millstream Chichester National Park and all of the Mungaroona Range Nature Reserve, with the exception of a small part of the far northern end of the reserve is in the Chichester Ranges LCT.

Fortescue Valley

The Fortescue Valley consists of a long broad U-shaped valley with wide, open sandy plains. Vegetation is varied and consists of tall, scattered eucalypts and acacias with thick hummock grasses underneath in the western end of the valley. Low woodlands with mulga groves are in the central valley and savanna and scattered shrubs are common on the eastern plains. The Fortescue River (*Yarnda Nyirranha*) is the dominant feature of this Landscape Character Type and is intermittent until it reaches the Millstream Chichester National Park on the western side of the valley. The south-western part of the Millstream Chichester National Park is in the Fortescue Valley LCT.

Karratha Coastal Plain

The north western part of the Millstream Chichester National Park lies within the Karratha Coastal Plain. This LCT consists of a gently undulating coastal plain. Hence much of the LCT is influenced by the coast, which has less of an impact further inland in the Millstream Chichester National Park. The vegetation is predominantly sparse grassland with shrubs and heath and isolated low trees. Larger rivers including the Fortescue form estuaries and floodplains on the coast.

De Grey Lowlands

This LCT extends along the coast east of Karratha to east of Port Hedland and only a very small portion extends into the northern part of the Millstream Chichester National Park and a small part into the northern section of the Mungaroona Range Nature Reserve. This is low-lying coastal plain, sloping gently northwards towards the sea, with delta and floodplain features and wide and braided sandy riverbeds. In inland areas, there are small stony hills and elongated ridges, with sparse hummock grasslands and low scattered shrubs. Most parts are treeless, with the exception of more wooded watercourses. Rivers are mostly north flowing and seasonally dry and form extensive deltas and floodplains with occasional permanent pools.

Visual Quality

Within many Landscape Character Types in Western Australia, the visual (or scenic) quality has been classified as high, moderate or low. This is typically based on diversity, uniqueness, prominence and naturalism of landform, vegetation and water form within each type (CALM 1994). However, the planning area is an exception and no visual quality measures have been determined for the Chichester Ranges or Fortescue Valley Landscape Character Types.

Public Sensitivity

Public sensitivity is the degree of public exposure to the visual landscape and is based on the assessment of travel routes, distance, duration and level of screen and includes all roads, railways, navigable rivers, walking/cycle trails and sites where visitors gather to view the landscape. Sensitivity levels are classified into 'high', 'medium', 'low' and 'very low', on the basis of visitor volumes and types, and the national, state, regional or local significance of sites or areas.

The planning area has not been assessed for public sensitivity. However, areas with the highest levels of sensitivity are likely to be along the main access routes within the Millstream Chichester National Park, such as the Wittenoom-Roebourne Road, the Hamersley Iron Access Road, the Deep Reach Pool (*Nhangghangunha*) and Crossing Pool (*Murlunmunjurna*) roads and Snappy Gum Drive and in the vicinity of the Millstream and Python Pool precincts where there is a concentration of visitors. In addition, most of these roads are highly scenic, offering excellent views of the surrounding landscape, thus increasing their levels of sensitivity (for example, where the Wittenoom-Roebourne Road ascends the Chichester Ranges in the Python Pool area, there are excellent views of the landscape to the north and the Hamersley Ranges to the south). Due to the remoteness and very low visitation levels of the remainder of the Millstream Chichester National Park and all of the Mungaroona Range Nature Reserve, these areas are likely to be medium or low levels of public sensitivity.

Visual Exposure

Visual exposure is classified by identifying and delineating the seen areas and distance zones from all Level 1, 2 and 3 travel routes and use areas. Visual exposure is classified into foreground (0 – 0.5 kilometres), middle-ground (0.5 – 6.5 kilometres), background (6.5 – 16 kilometres), and un-inventoried areas.

As with public sensitivity, visual exposure has not been assessed in the planning area. However, given the high levels of visibility from many of the access routes within the Millstream Chichester National Park, visual exposure is likely to be in the middle-ground to background for most travel routes and use areas.

Visual Landscape Management Zones

The Visual Landscape Management System overlays and integrates this physical and social information above to derive three visual landscape management zones, which are:

- Zone A – areas of high scenic quality and rare landscape character which have high to moderate public exposure or sensitivity and some areas not assessed with moderate scenic quality but with very high public exposure or sensitivity;
- Zone B – areas of low to moderate scenic quality and high public exposure or sensitivity and areas of high scenic quality or rare landscape character that have low public exposure or sensitivity; and
- Zone C – all remaining areas with few or no elements of particularly high scenic quality and only low to moderate public exposure or sensitivity.

Visual landscape management zones have not been derived for the planning area. However, significant features with high scenic quality in the Chichester Ranges Landscape Character Type are likely to be the deep gorges and pools at the western end, such as those around Python Pool. Likewise significant areas in the Fortescue Valley Landscape Character Type include the Millstream oasis and associated pools and springs, the permanent pools such as Deep Reach Pool (*Nhangghangunha*), Crossing Pool (*Murlunmunjurna*) and Palm Pool (*Thaawuthungganha*) and the unusual flora associated with the wetlands, such as the Millstream palm. These areas and the main access routes associated with them would likely be classified as Zone A, given their high scenic quality, rare landscape character and reasonably high levels of public exposure. The remainder of the Millstream Chichester National Park and all of the Mungaroona Nature Reserve would probably be Zone B, because of the likely high scenic quality or rare landscape character and low public exposure or sensitivity.

Guidelines for Management

Department's *Policy Statement No. 34 – Visual Resource Management of Lands and Waters Managed by CALM* (CALM 1989) provides guidance for visual resource management and should be adhered to in all aspects of land management, particularly the planning and implementation of new facilities, buildings, recreation sites, signs and infrastructure. Areas of high visual quality that are visited (as outlined above) are the areas of greatest visual concern in terms of visual landscape management and are the most sensitive to alterations. Any changes should borrow from the natural established landscape character and not be noticeable to the casual observer.

Guidelines for management in high quality visual landscapes include the following:

- site specific visual landscape factors should be carefully identified and evaluated prior to any management activities;
- roads, recreation sites and walking tracks should focus views onto distinctive features by selecting optimum siting and alignment, for example Cliff Lookout (*Wadunnha*) and Python Pool day uses areas;
- road design and construction should remain subordinate to landscape elements (subject to achievement of minimum safety and road standards) by utilising minimum design standards, limited cuts and fill, minimum clearing widths, undulating edges and sensitive alignment;
- interpretive and explanatory signage should be utilised before and during operations that alter landscape character, such as new recreation site development, and weed control (in particular removal of the date palms in the vicinity of the Millstream Homestead) adjacent to travel routes and walking trails;
- where structures are required they should be sympathetic in design, materials and colour to complement surrounding landscape elements and be carefully sited away from major natural focal points, out of viewer sight-lines and where vegetation or landform screening can be used;
- essential firebreaks should follow natural landform, vegetation, or land use patterns/lines in the landscape, wherever possible;
- prescribed burning should be carried out by employing prescriptions that minimises visible impacts; and
- previously disturbed areas within high visual landscape zones should be given the highest priority for rehabilitation until the desired standard of visual quality is attained.

A number of development activities have occurred in the planning area in the past, which have had an impact on visual landscape quality, in particular the construction of transport (railway lines and roads) and utility corridors (power lines and water pipelines). In the life of this plan, the construction of the Karratha-Tom Price Road is likely to impact upon visual landscape within the planning area. As part of the Consultative Environmental Review process for this project, a visual assessment was made of the proposed road alignment. Some of the likely visual impacts of the project include some visual scarring associated with the road itself and the construction of borrow and base course pits along parts of the alignment until their rehabilitation. A number of recommendations were made to enhance the visual experience of the proposed road. These included:

- the provision of opportunities for long viewing corridors within the Millstream Chichester National Park; and
- the provision of opportunities for views of fragmented rock formations within the Millstream Chichester National Park.

Close liaison will be required with Main Roads Western Australia and associated contractors to ensure that visual impacts of the road construction are kept to a minimum

27 – Landscape

Key Points

- Four landscape character types exist within the Millstream Chichester National Park; the Chichester Ranges, the Fortescue Valley, the Karratha Coastal Plain and the De Grey Lowlands.
- Activities and services which are likely to impact upon visual landscape quality include construction of transport corridors (such as roads) and utility corridors.

The objectives are:

1. **to protect and enhance the visual landscape qualities of the planning area; and**
2. **to plan all uses and management activities to complement the planning area's landscape value.**

This will be achieved by:

1. managing visual landscape values in accordance with Department policy;
2. ensuring visual landscape management is considered prior to any development or management activities within the planning area;
3. determining areas of high scenic quality through the implementation of a scenic quality assessment and, in light of this, not permitting developments or activities with adverse impacts on areas of

outstanding landscape value except where necessary for public safety;

4. providing access and recreational opportunities to areas of high visual landscape quality where this is environmentally sustainable, compatible with other values and in accordance with the proposed visitor management settings;
5. encouraging sensitive management of visual resources along access corridors, tourist destinations, features and areas of high scenic viewing of the planning area;
6. applying the general management guidelines set out in Department policies in assessing any proposed management activities and development of facilities to determine their impact on visual landscape values;
7. liaising with neighbouring landowners and local government to ensure visual landscape management guidelines are considered in any development they may undertake, and provide advice upon request; and
8. seeking environmental offsets from external agencies for activities or developments that could permanently impact on the natural, cultural and landscape values.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

PART F. CARING FOR COUNTRY: MANAGING RESOURCE USE

33. INDIGENOUS CUSTOMARY ACTIVITIES

Traditional use and access is critically important for the Yindjibarndi and Ngarluma people to maintain social, economic and spiritual links to their homeland and to pass this on to their children. The Yindjibarndi and Ngarluma people still have very strong links to their country within the planning area and the teaching of cultural heritage and singing songs in the homeland is needed to enable replenishment of the land to occur. Culture-based activities include hunting, fishing, gathering of native foods and medicines, and activities for ceremonial, law or religious purposes. Religion, ceremony and sustenance are closely connected culture-based activities. Yindjibarndi and Ngarluma people want to continue the culture-based activities of hunting, fishing and gathering of native foods and medicines, as these are extremely important to Indigenous people, particularly with respect to teaching Indigenous cultural activities to their children and grandchildren.

The desire by Yindjibarndi and Ngarluma people to legally engage in customary activities, including hunting, within the planning area, has been expressed through the Millstream Park Council. Traditional use and access by Indigenous people for cultural, educational and law purposes will be promoted by Indigenous Traditional Owners in the planning area and facilitated through the Millstream Park Council. Traditional activities such as hunting and gathering or use or access for ceremonial purposes will be considered by the Park Council. Sites important for ceremonial purposes will be kept confidential in many cases. When appropriate, sites will be allocated for Indigenous cultural purposes.

Legislation in Western Australia under section 23 of the Wildlife Conservation Act allows Indigenous people to be exempt from some of the provisions relating to the taking of certain flora and fauna as long as consent of the occupier of the land has been given. As such, Indigenous people seeking to engage in food gathering in the planning area, including for ceremonial or demonstration purposes (but not for commercial gain), must obtain prior, general consent from the Department.

The CALM Act allows Traditional Owners and those approved by them to undertake such activities for their own purposes subject to agreed conditions and criteria, developed with the Millstream Park Council to ensure:

- the conservation status of target species;
- the ecological function of target species;
- sustainability of resources;
- visitor safety;
- that activities are located away from visitor areas;
- there is minimal risk of interruption or intrusion by visitors;
- the confidentiality of locations or areas of ceremonial significance is maintained
- any firearms in the planning area are registered with the Department's Regional Manager and operated within strict safety procedures; and
- suitable access is provided to areas established.

It will also be important to ensure that these conditions take into account the other management strategies described as part of this management plan and through other Departmental policies. Part of these conditions would also involve the development of a system of monitoring to ensure that the impacts of hunting and gathering on the flora, fauna and ecological communities within the planning area are minimised. The Department will ensure conformity with any future changes to legislation or Government policy relevant to traditional food gathering.

Two possible areas have been identified by the Millstream Park Council and the Department as suitable for Indigenous hunting: Ngurawaana and Fish Pool blocks. Safety is a major consideration in determining areas for hunting. Ngurawaana and Fish Pool blocks are adjacent the Millstream Chichester National Park. Fish Pool block is proposed to be added to the park (see Section 9 – *Existing and Proposed Tenure*). The Ngurawaana block is currently vested as a water reserve and any proposals for hunting in this area would be through a formal Memorandum of Understanding with DoW and the Water Corporation. Other areas within the planning area

may also be considered for Indigenous hunting and gathering over the life of this plan.

33 – Indigenous Customary Activities

Key Points

- Indigenous use of and access to the planning area is important in maintaining cultural links to the land.
- Traditional use and access will be promoted and facilitated through the Millstream Park Council.
- Guidelines and a monitoring system will be developed to ensure that use is sustainable.
- Important cultural based activities include hunting, fishing, gathering of native foods and medicines and activities for law and ceremonial purposes.

The objectives are:

1. **to provide the Traditional Owners with an opportunity to maintain their social, economic and cultural practices in harmony with the conservation and management of the natural and cultural values in the planning area; and**
2. **to encourage Traditional Owners to continue to practice cultural activities.**

This will be achieved by:

1. providing opportunities for Traditional Owners of the area or others approved by them to take sufficient food for themselves and their family, with the approval of the Millstream Park Council, the Director General and according to Section 23 of the Wildlife Conservation Act and any associated conditions;
2. ensuring that management of food gathering activities conforms to any legislative changes during the life of this plan;
3. the Park Council developing guidelines pertaining to hunting, gathering and ceremonial activities;
4. developing a system of monitoring the planning area's natural and cultural resources in consultation with the Park Council and implemented by the Department and the Traditional Owners; and
5. enabling Indigenous hunting to continue, subject to a code of conduct and the criteria listed above, in Fish Pool block, considering Indigenous hunting in other parts of the planning area and promoting its adoption in Ngurawaana block.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

34. MINERAL AND PETROLEUM EXPLORATION AND DEVELOPMENT

Mineral extraction, processing and manufacturing is the largest industry in the Pilbara region. In 2004/05 the mining and petroleum industries contributed $20.6 billion to the Region's economy, representing 62 per cent of the State's total. The production of iron ore contributed $8 billion to the Region's economy and petroleum (oil and gas) contributed nearly $12 billion. Other minerals extracted in the region include salt, silver, gold, manganese and base metals (Department of Local Government and Regional Development and Pilbara Development Commission 2006).

Currently, no mineral extraction occurs within the planning area, although gravel has been extracted in the past.

Legislative and Policy Framework

Mining[7] on lands and waters managed by the Department is subject to the Mining Act, the Petroleum and Geothermal Energy Resources Act, the Environmental Protection Act, the Wildlife Conservation Act and various State Agreement Acts. It should be noted that the Mining Act and the Petroleum and Geothermal Energy Resources Act take precedence over the CALM Act and may prevail over the contents of this management plan.

Sections 24, 24A and 25 of the Mining Act define Ministerial responsibilities for approving mineral exploration and mining on various land and waters of the State. The Mining Act has the following implications for terrestrial lands to which the CALM Act applies (as they apply in the planning area) and which are managed by the Department:

[7]Mining includes exploration, fossicking, prospecting and mining operations.

1. Mining, including exploration, fossicking and prospecting, can be undertaken in the following terrestrial tenures subject to the concurrence of the Minister for Environment and the consent of both Houses of Parliament. The Conservation Commission provides advice to the Minister for Environment. The tenures that this applies to are:
   - any national parks; and
   - class A nature reserves;

2. Mining, including exploration, fossicking and prospecting, can be undertaken in the following terrestrial tenures subject to recommendations of the Minister for Environment. The tenures that this applies to are as follows:
   - *Land Administration Act 1997* reserves which are not class A; and
   - class A *Land Administration Act 1997* reserves (including conservation parks) outside the South West Land Division of the State (including the Esperance and Ravensthorpe Shires).

Approval to mine under the Mining Act cannot be given by the Minister administering that Act without meeting the requirements of the Environmental Protection Act. Mining projects that potentially may cause significant environmental impacts can be referred to the Environmental Protection Authority (EPA) under section 38 of the Environmental Protection Act by the proponent, the Department of Mines and Petroleum, the Conservation Commission, the Department and individuals.

As of 8 July 2004, the Environmental Protection Act now provides for the protection of native vegetation and control of clearing. Any clearing of native vegetation will require a permit under Part V of the Act except where exemptions are granted under Schedule 6 of the Act or prescribed by regulation in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. For the mineral and petroleum industries, applications for any clearing associated with their exploration, production or development activities will require a permit in all cases except where granted an exemption.

The Conservation Commission provides advice to the Minister for Environment with regards to all mining tenement applications for all reserves.

The document, *Guidelines for Mineral Exploration and Mining within Conservation Reserves and other Environmentally Sensitive Areas* (DME 1998), outlines the procedures and conditions to be applied to applications for mining tenements. Under a 2004 MOU between DMP and the EPA, all development type mining proposals within 2 kilometres of a national park, marine park, State forest or proposed conservation reserve will be automatically referred to the EPA for assessment.

In 2006 the EPA released Position Statement No. 9 *Environmental Offsets* (EPA 2006). Should mining or petroleum tenements be approved in proposed conservation estate, these should be subject to the principle of environmental offsets. In addition, there is an expectation under the Mining Act that areas disturbed by mining should be rehabilitated and it is the Department's position that the costs of rehabilitating mining and petroleum activities should be borne by the organisation(s) responsible for the activity.

State Agreements between developers and the State are generally enacted for major resource projects (such as bauxite, and iron ore) that require large capital investments and usually significant infrastructure. These agreements are ratified in Parliament as State Agreement Acts. Examples of these which apply in the Pilbara include*; Iron Ore (Robe River) Agreement Act 1964*, *Iron Ore Beneficiation (BHP) Agreement Act 1996* and the *Dampier Solar Salt Industry Agreement Act 1967*.

Mineral Resources and Prospectivity

The planning area covers rocks mostly of the Archaean Fortescue Group basalt and sandstone and minor Hamersley Group iron formation (see Section 15 – *Geology, Landforms and Soils*). No economic deposits have been found in the planning area to date. In the late 1960s to early 1980s, substantial exploration was undertaken for uranium-gold mineralisation in the sandstone and conglomerates of the Hardey Formation. This area is located at the base of the Fortescue Group, mainly to the north of the Millstream Chichester National Park and along the outer scarps of the Chichester and Mungaroona Ranges. Although no substantial uranium-gold mineralisation was found, anomalous uranium has been recorded and there is currently renewed interest in exploration for this.

Substantial exploration for iron ore occurred in the Marra Mamba Iron at the base of the Hamersley Group, which is exposed in the south-western part of the Millstream Chichester National Park, and for the concealed

Tertiary Robe Pisolith in the Fortescue Valley. No economically viable deposits were located, although future potential remains, particularly for the discovery of large deposits of pisolity ore (Ruddock 1999), mainly to the south of the planning area. The planning area is also prospective for copper and gold within the Fortescue Group (Lipple 1996) and for diamonds (Ruddock 1999).

There is potential for the planning area to be prospective for uranium-gold and iron-ore due to the size of the area, improving economics associated with extraction and processing of low grade ores and improved exploration technologies.

Currently, 40 exploration licences exist in the planning area (Table 8). Two of these are live and the remainder pending. There are also several live Miscellaneous Licences (ancillary titles for purposes such as roads, pipelines etc), which apply to the rail corridor through the park and associated infrastructure pursuant to the agreement approval by Iron Ore (Robe River) Agreement Act.

Table 8: Mining Tenements in the Planning Area

Tenement	Tenement Type	Lease Holder	Lease Status
Millstream Chichester National Park and proposed reserve additions			
E47/1107	Exploration Licence	De Beers Australia Exploration Ltd.	Live
E47/1108	Exploration Licence	De Beers Australia Exploration Ltd.	Live
E47/1146	Exploration Licence	Helix Resources Ltd	Pending
E47/1253	Exploration Licence	De Beers Australia Exploration Ltd.	Pending
E47/1254	Exploration Licence	De Beers Australia Exploration Ltd.	Pending
E47/1259	Exploration Licence	De Beers Australia Exploration Ltd.	Pending
E47/1260	Exploration Licence	De Beers Australia Exploration Ltd.	Pending
E47/1292	Exploration Licence	Croydon Gold Pty. Ltd.	Pending
E47/1293	Exploration Licence	Croydon Gold Pty. Ltd.	Pending
E47/1337	Exploration Licence	North, Donald Kimberley	Pending
E47/1383	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1454	Exploration Licence	Croydon Gold Pty. Ltd.	Pending
E47/1503	Exploration Licence	De Beers Australia Exploration Ltd.	Pending
E47/1556	Exploration Licence	Croydon Gold Pty. Ltd.	Pending
E47/1657	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1658	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1659	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1660	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1661	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1662	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1663	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1811	Exploration Licence	Seefingan Exploration Pty. Ltd.	Pending
E47/1816	Exploration Licence	Seefingan Exploration Pty. Ltd.	Pending
E47/1817	Exploration Licence	Seefingan Exploration Pty. Ltd.	Pending
L47/0047	Miscellaneous Licence	Cape Lambert Iron Associates, Mitsui Iron Ore Development, North Mining Ltd., Pannawonica Iron Associates, Robe River Mining Co Pty Ltd	Live
L47/0067	Miscellaneous Licence	Cape Lambert Iron Associates, Mitsui Iron Ore Development, North Mining Ltd., Pannawonica Iron Associates, Robe River Mining Co Pty Ltd	Live
L47/0080	Miscellaneous Licence	Cape Lambert Iron Associates, Mitsui Iron Ore Development, North Mining Ltd., Pannawonica Iron Associates, Robe River Mining Co Pty Ltd	Live
L47/0102	Miscellaneous Licence	Cape Lambert Iron Associates, Mitsui Iron Ore Development, North Mining Ltd., Pannawonica Iron Associates, Robe River Mining Co Pty Ltd	Live
L47/0103	Miscellaneous Licence	Cape Lambert Iron Associates, Mitsui Iron Ore Development, North Mining	Live

Tenement	Tenement Type	Lease Holder	Lease Status
		Ltd., Pannawonica Iron Associates, Robe River Mining Co Pty Ltd	
L47/0228	Miscellaneous Licence	Cape Lambert Iron Associates, Mitsui Iron Ore Development, North Mining Ltd., Pannawonica Iron Associates, Robe River Mining Co Pty Ltd	Live
Mungaroona Range Nature Reserve			
E45/2842	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1042	Exploration Licence	Creasy, Mark Gareth	Pending
E47/1043	Exploration Licence	Creasy, Mark Gareth	Pending
E47/1044	Exploration Licence	Creasy, Mark Gareth	Pending
E47/1045	Exploration Licence	Creasy, Mark Gareth	Pending
E47/1058	Exploration Licence	Best Bet Pty. Ltd.	Pending
E47/1059	Exploration Licence	Creasy, Mark Gareth	Pending
E47/1078	Exploration Licence	Best Bet Pty. Ltd.	Pending
E47/1174	Exploration Licence	Best Bet Pty. Ltd.	Pending
E47/1175	Exploration Licence	Best Bet Pty. Ltd.	Pending
E47/1176	Exploration Licence	Best Bet Pty. Ltd.	Pending
E47/1177	Exploration Licence	Best Bet Pty. Ltd.	Pending
E47/1664	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1671	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/1672	Exploration Licence	FMG Pilbara Pty. Ltd.	Pending
E47/598	Exploration Licence	Goldrim Mining Australia Ltd, Jaffrey, Owen Guy: Morey, Albert James	Pending

Basic Raw Materials

Basic raw materials (BRM), principally gravel, have previously been extracted from the planning area by the Department and surrounding Shires for road and rail construction and maintenance, recreational site development and building uses. Most requests for BRM are from Shires, Main Roads WA or mining companies for use on roads and railway lines that are enclaves within the planning area. It is preferred that these materials are obtained from lands not managed by the Department or from areas that are already disturbed or which are of lower conservation value. Transporting gravel and other industrial materials from areas outside the reserves, however, increases both the risk of weeds being introduced and the cost of road construction.

Access to BRM within the planning area will be permitted in accordance with the Conservation Commission's *Basic Raw Materials Policy – Government and Local Government Access to Conservation Estate* (Conservation Commission of Western Australia 2006). Extraction will be permitted where the use of the material assists in the protection and management of the area, a more environmentally acceptable alternative is not available and where the material is used within the boundaries or enclaves of the planning area. To minimise disturbance to conservation areas, alternative sources of BRM, located outside the planning area, are preferred. Where the extraction of BRM does occur, natural values of the planning area can be maintained by:

- siting pits in vegetation communities that are adequately represented and with the lowest natural values;
- applying best practice hygiene management; and
- applying best practice rehabilitation following extraction (see Section 35 – *Rehabilitation*).

Extraction of BRM in the planning area for use on roads and facilities managed by the Department within the conservation estate occurs under the CALM Act and approval is given by the Department's Pilbara Regional Office. Extraction of BRM by Local Government Authorities for use on road reserve enclaves within the conservation estate in the planning area occurs under the *Local Government Act 1955* (Local Government Act). The Local Government Act is used to give effect to the Conservation Commission Policy and Department procedures have been modified to the extent that a Notice of Entry (NOE) under the Local Government Act is used in lieu of a CALM Act lease to access BRM.

Extraction of BRM from reserves in the planning area by private contractors or individuals for use on private easements within conservation estate in the planning area occurs under the Mining Act (CCWA 2006) and approval is required from the Minister for Environment and the Conservation Commission. Under the Mining

Act, consent from two Houses of Parliament and assessment by the Environmental Protection Authority may be required before extraction of basic raw materials can take place in national parks and class A nature reserves. Parliamentary approval is not required for class A conservation parks outside the South West.

34 – Mineral and Petroleum Exploration and Development

Key Points

- Applications to mine in national parks and nature reserves are subject to the Mining Act, the Petroleum and Geothermal Energy Resources Act, the Environmental Protection Act and the Wildlife Conservation Act, appropriate environmental assessment and approval by relevant Ministers.
- Due to its considerable impacts upon the natural values of the area, mining in national parks and class A nature reserves is only permitted following approval by both Houses of Parliament.
- Currently, no mineral extraction occurs within the planning area.
- Currently, there are 40 exploration leases in the planning area, which are applied for and pending.
- Basic raw materials such as gravel, is important in the construction and maintenance of roads and railway lines in the Millstream Chichester National Park.

The objective is to protect the planning area from the impacts of mining, mineral exploration and the extraction of basic raw materials while being consistent with Government legislation and policy.

This will be achieved by:

1. in conjunction with DMP, evaluating the likely impact of any proposed mineral resource development activities within the planning area (and external areas which may impact upon it and make recommendations that minimise impacts within the context of Government policy;
2. monitoring, with DMP, existing mineral exploration that impact directly or indirectly on the planning area and requesting DMP to take any necessary action where conditions are breached;
3. referring, exploration or mining proposals with the potential to impact upon the planning area to the EPA for their consideration of assessment under the Environmental Protection Act;
4. if appropriate, under the EPA Draft Guidance on Environmental Offsets, seeking direct and complementary environmental offsets as conditions of environmental approval to counterbalance any residual environmental impacts due to mineral and petroleum exploration and mining activities to achieve no net environmental loss or preferable a net environmental benefit outcome;
5. in accordance with Conservation Commission and Department policy, permitting access to basic raw materials from the planning area where:
   - the use of the material assists in the protection and management of the area;
   - a more environmentally acceptable alternative is not available;
   - where the material is used within the boundaries or enclaves of the planning area; and
   - extraction is consistent with this management plan and purpose and tenure of the area.
6. considering the values of the planning area in selecting sites for basic raw materials extraction;
7. minimising the number of new gravel pits by developing working arrangements with agencies extracting gravel and basic raw materials from lands managed by the Department;
8. restricting the location of pits supplying gravel, sand or stone to an appropriate recreation visitor management setting (see Section 25 – *Visitor Opportunities – Visitor Management Settings*). Where possible, ensure pits are not visible from roads, tracks and paths (see Section 26 – *Visitor Access*);
9. ensuring that all sites in which any mining activity occurs are rehabilitated according to the Department's rehabilitation standards and guidelines (see Section 35 – *Rehabilitation*); and
10. ensuring all mining activities adhere to Departmental hygiene standards.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

35. REHABILITATION

Rehabilitation is the process of returning disturbed land to a predetermined stable, self-regulating state in terms of surface, vegetational cover, land-use and/or productivity, consistent with the purpose for which the area is managed. Rehabilitation within the planning area can be used following gravel pit working, mining, road works, track closure, recreation site closure or redevelopment, or activities associated with fire suppression. To ensure that rehabilitation works have the greatest degree of success as well as limiting the introduction of exotic (non-

local) plants and enabling new vegetation to blend into the existing environment, local indigenous species should be used.

The Department's *Policy Statement No. 10 – Rehabilitation of Disturbed Land* (CALM 1986) provides guidance for the rehabilitation of lands managed by the Department, based on the following principles:

- land should be managed as far as possible to avoid disturbance. Rehabilitation should be the last option in a series of management decisions designed to protect natural values;
- natural regeneration with indigenous vegetation is the preferred method of rehabilitation, and where necessary, steps should be taken to encourage it. Where this is not possible, or needs supplementing, local species, grown from seed or cuttings obtained locally, should be planted, with restoration as far as possible of the original species diversity, composition and spacing; and
- where conditions have been changed to such an extent that local species cannot grow (e.g. on areas where topsoil has been removed), or where a desired purpose, such as providing shade, cannot be met by local species, species suitable to the conditions and purpose should be planted. However, where more than one species is suitable, then that which occurs naturally closest to the rehabilitation site should be used, with seeds and cuttings collected from the nearest possible source.

In cases where other agencies/organisations have been responsible for disturbance within the planning area, it is the Department's policy that the agency is responsible for rehabilitation of these areas to a suitable standard. In such cases, the cost of rehabilitation should also be borne by the agency.

Previous rehabilitation works in the Millstream Chichester National Park have been of two types, with the aim of both being to re-establish natural vegetation in disturbed areas. The first includes the revegetation of disturbed areas such as old roads, camping areas, car parks, air strips, building sites, gravel pits and areas that have been affected by erosion and require stabilisation. Areas that have been burnt are also rehabilitated. The second involves planting native species into areas from which heavy infestations of date palms and other weeds have been removed. Where native vegetation still occurs, natural regeneration is encouraged. However, replanting is sometimes necessary.

Two main principles are followed for any rehabilitation works undertaken in the planning area. Firstly, seed used in rehabilitation plantings should have a local provenance, preferably from the Millstream area. Once seed has been collected from the area, it is generally sent elsewhere for cultivation, although a basic nursery does exist on site for the cultivation of small amounts of seedlings. Secondly, no soil is to be imported without sterilisation, including plants in pots. Any machinery used to rip or restore contours should be washed to remove any contaminated soil or seeds.

35 – Rehabilitation

Key Points

- Local native species are used in rehabilitation works and seed collected should be of local provenance.
- Rehabilitation aims to re-establish natural vegetation in disturbed areas and areas affected by erosion.
- Adequate hygiene methods are crucial.

The objective is to restore degraded areas to a stable condition resembling as close as possible the natural ecosystem function.

This will be achieved by:

1. managing the planning area, as far as practicable, to avoid disturbance;
2. developing a working plan for rehabilitation within the planning area, including allocating priorities for works based on:
   - existing and potential impacts on natural, cultural and visual landscape values;
   - type and extent of the disturbance;
   - likelihood of natural regeneration;
   - availability of resources;
   - level of participation of stakeholders; and
   - the capacity for long-term monitoring.
3. rehabilitating, closing or relocating roads and tracks that have the potential to erode or impact on visual amenity;
4. in the event of planned activities which will cause disturbance, establish conditions for the activities

which minimise the area and degree of disturbance, and define the type of rehabilitation required;
5. ensuring that, whenever possible, the cost of rehabilitation is borne by those responsible for the disturbance;
6. actively involving private and public groups, individuals and Traditional Owners in rehabilitation programs;
7. ensuring local indigenous plant species are used in rehabilitation of disturbed areas wherever possible;
8. monitoring, evaluating and recording progress of rehabilitation programs/projects; and
9. developing a rehabilitation program with proponents for gravel pit rehabilitation.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
35.1 Area of rehabilitated land within the planning area, including the rehabilitation of unnecessary tracks.	35.1 Increase in the area of disturbed land rehabilitated, including the rehabilitation of unnecessary tracks.	Every five years

36. UTILITIES AND SERVICES

Public utilities and services within the planning area are significant to local and regional communities. Utility corridors often link electricity, gas, telephone and water service networks to private property that may be surrounded by the planning area, or across Crown lands to shorten the route for these services to other nearby lands. In the Pilbara, many utilities and services are privately owned by mining companies servicing the various mine sites and transport corridors, some of which run through the conservation estate (see Map 13).

Leases over specific locations on lands managed by the Department for some utilities or services can be approved, provided that their impact on other values is minimised. The Department's *Policy Statement No. 18 – Recreation, Tourism and Visitor Services* (DEC 2006) guides the management of commercial operations (see Section 29 – *Commercial Operations*).

As of August 2008, there were two leases held by Pilbara Iron Pty. Ltd. for the provision of a powerline through the planning area and a repeater station. A third lease is held by Telstra for a microwave tower (see Section 29 – *Commercial Operations*).

Water extracted from the Millstream aquifer is pumped from Millstream to the towns of Karratha, Dampier, Roebourne, Wickham, Cape Lambert and Point Samson, under the West Pilbara Water Supply Scheme. The water flows through a 130 kilometres long pipeline, part of which traverses the western side of the Millstream Chichester National Park, along an easement excised from the Park. The pipeline is owned and maintained by the Water Corporation.

Mining companies in the Pilbara have constructed numerous railway lines to transport iron ore from mine sites to coastal port facilities. There are two privately owned railway lines and associated infrastructure which traverse the planning area. The Hamersley Iron railway line links Tom Price and Paraburdoo with Dampier and traverses the length of the western side of the Millstream Chichester National Park. The Robe River railway line links the Mesa J mine site near Pannawonica to port facilities at Cape Lambert near Point Sampson and Wickham and a small section passes through the north-west corner of the Millstream Chichester National Park. These railway lines are contained within easements excised from the park. The infrastructure, locomotives and rolling stock are owned by each of the respective mining companies, but the maintenance of these rail networks is done by a third company, Pilbara Rail.
Within the Pilbara, infrastructure and utility corridors result in long, linear areas of disturbance through otherwise minimally disturbed areas. The major effects of these infrastructure corridors include the provision of invasion routes for weeds, and interference with drainage and natural fire patterns. Rail corridors may also increase risk of fires due to rail grinding operations. Secondary effects also include the impairment of values of the planning area such as landscape and the enjoyment of natural peace and quiet. The Department may also seek environmental offsets from companies' constructing infrastructure and utilities within the planning area, similar to environmental offsets associated with mining developments (see Section 34 – *Mineral and Petroleum Exploration and Development*).

36 – Utilities and Services

Key Points

- Utilities and services within the planning area include powerlines, a repeater station, a water pipeline and railway lines. Most of these are privately owned.
- Problems associated with infrastructure and utility corridors include weed invasion, interference with drainage and fire patterns and degradation of landscape values.

The objective is to minimise the impact of utilities and services on the key values within the planning area.

This will be achieved by:

1. permitting new utilities and services within the planning area where they are consistent with the CALM Act, there are no viable alternatives, they are consistent with Government policy and where they minimise adverse impacts on Department operations and key values. Where possible, new services and utilities should be located outside the planning area;
2. encouraging new utilities and services within the planning area to be developed using existing utility sites and corridors;
3. ensuring that the establishment, operation and subsequent maintenance of utility and service infrastructure is in accordance with the relevant acts, ratified Government Agreements, Departmental policy and the existing administrative arrangements between DMP, the Department and the Millstream Park Council;
4. referring development proposals to the EPA for formal environmental impact assessment under the Environmental Protection Act where necessary;
5. applying appropriate assessment criteria to measure the physical, biological, visual, operational and social impacts of proposed infrastructure and services;
6. liaising with utility and service providers to ensure that development proposal and subsequent establishment, operation and maintenance is in accordance with Departmental requirements including visual landscape protection and the rehabilitation of disturbed land (see Section 35 – *Visual Landscape*);
7. minimising the impacts of any essential utility corridor that exists or is proposed in or nearby the planning area by implementing landscape management techniques (see Section 26 – *Visitor Access*);
8. controlling and monitoring the effects of utility corridors and infrastructure and their maintenance upon natural, cultural, landscape and recreation values; and
9. if appropriate, under the EPA Draft Guidance on Environmental Offsets, seeking direct and complementary environmental offsets as conditions of environmental approval to counterbalance any residual environmental impacts from the installation and maintenance of utilities and services.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

37. WATER EXTRACTION

The responsibility for the regulation, protection and management of water resources in the planning area rests with the Department and DoW.

Water is of fundamental importance to the natural and cultural values of the planning area and particularly to the Millstream wetlands. The reason that Millstream has such great significance is due to a permanent abundant supply of fresh water, due to the very large Millstream groundwater aquifer and the springs, which emanate from it (see Section 16 – *Hydrology and Catchment Protection*).

The Millstream aquifer is a highly important resource; water is extracted from the aquifer, piped to the coast and, together with the Harding Dam/Lake Poongkaliyarra to the north, makes up the West Pilbara Water Supply Scheme. The use of the Millstream aquifer for public water supply commenced in 1969 and this scheme provides water for domestic and industrial use.

Management and protection of the water resource at Millstream is the role of DoW who administers a licence under which the Water Corporation can extract water for commercial purposes.

37.1 Millstream Harding Consultative Committee

The Millstream Water Management Committee was first established in 1984. The name of this committee was later changed to the Millstream Harding Consultative Committee, with the construction of the Harding Dam. It continues to play an important role in water management in the Millstream Chichester National Park, the Harding Dam and surrounding areas. The terms of reference for the Committee include:

- the coordination and control of environmental monitoring plans;
- the modification of environmental monitoring plans to achieve environmental management objectives;
- the recommendation for environmental remediation at Millstream/Harding; and
- reviewing future development proposals within Water Reserves (Water Authority of Western Australia 1992).

As part of planning being undertaken by DoW in relation to water management in the Pilbara (see Section 37.2 – *Water Extraction –- Public Water Supply*), the terms of reference for this committee are currently under review.

The current membership comprises representatives from the Department, DoW, Water Corporation, and Indigenous Traditional Owners.

A Technical Working Group of local staff from DoW, Water Corporation and the Department manages day-to-day water matters and advises the Millstream Harding Consultative Committee. The Millstream Harding Consultative Committee provides advice to the Conservation Commission and the Millstream Park Council.

37.1 – Water Extraction – Millstream Harding Consultative Committee

Key Points

- The Millstream-Harding Consultative Committee is responsible for developing and maintaining environmental monitoring plans, recommending environmental remediation programs and reviewing development proposals within the Water Reserve.
- The Committee comprises government agency representatives and Traditional Owners, and is advised by the Technical Working Group who manages day to day matters associated with water management.

The objective is to provide a mechanism for key stakeholders to participate in the management of water to protect natural, cultural and other key values within the planning area.

This will be achieved by:

1. continuing to maintain an active role on the Millstream Harding Consultative Committee within the current terms of reference (or a revision thereof); and
2. in consultation with the Millstream Park Council, the Millstream-Harding Consultative Committee advising the Conservation Commission on water management matters.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

37.2 Public Water Supply

Since 1968-69, water has been abstracted from the Millstream aquifer to supply domestic and industrial water to the towns of Karratha, Dampier, Roebourne, Wickham, Cape Lambert and Point Samson, under the West Pilbara Water Supply Scheme. In 1985, the Harding Dam was constructed on the Harding River in an effort to reduce the pressure on the Millstream aquifer and to meet future demands. Since then, the Water Corporation has operated the Millstream bore field in conjunction with the Harding Dam to supply water for the Scheme. This Scheme provides a supply for both domestic and industrial water requirements (Welker Environmental Consultancy *et al.* 1998).

Under the current licence issued to the Water Corporation, the long term draw from the Millstream bore field is an average of 6 GL/annum and the peak draw from both the Millstream aquifer and the Harding Dam is 15 Gl/annum. The actual amount of water which can be abstracted from the Millstream aquifer in any year depends on how much water is available, the water quality in the Harding Dam and whether abstraction from Millstream can be done within the environmental management criteria (see *Environmental Water Provisions* below). In

addition, water in the Harding Dam must be used before large amounts of water can be taken from Millstream.

Environmental Water Provisions

By 1982, prior to the construction of the Harding Dam, an average of 10Gl[8]/year was being extracted from the Millstream aquifer. During this time aquifer levels at Millstream (measured as mean aquifer level or MAL derived from nine monitoring bores across the Millstream aquifer) showed a drop from 293.9m AHD[9] in early 1976 to an historic low of 293.0m AHD in January 1984. Over this same period of time, rainfall in the area was low and river flows either did not occur or occurred at levels well below the annual mean. The MAL is used as an indicator of aquifer condition, given the correlation between MAL and spring discharge rates. Spring discharges into Deep Reach and Chinderwarriner Pools and the subsequent outflows sustain most of the downstream wetland ecosystems. Low MALs are therefore of concern due to the potential impacts on the environment. Declining tree health was observed in the Millstream Delta during the early 1980s. The decline in MAL during this period and subsequent reduction in spring flows experienced in the early 1980s was considered the most plausible explanation for this decline (Welker Environmental Consultancy *et al*. 1998).

The first Millstream Water Management Plan was completed for the former Public Works Department in 1984, as a requirement of Government approval for the Harding Dam (which became operational in 1985) and for its conjunctive use with the Millstream bore field as part of the West Pilbara Water Supply Scheme (Dames and Moore, 1984). It was also required to address problems with tree deaths on the western side of the Millstream delta and to ensure the protection of other ecosystems between Deep Reach Pool (*Nhangghangunha*) and Livistona Pool. This plan established specific environmental water provision criteria to protect ecosystems between Deep Reach Pool (*Nhangghangunha*) and Livistona Pool.

The original conjunctive use licence issued to the Water Corporation allowed for the extraction of 20GL/annum from the Harding Dam and the Millstream aquifer. With the completion of the Harding Dam, abstraction from the Millstream bore field between 1985 and 1994 was considerably lower than in previous years. During this time, water management in the Millstream area was relatively uncomplicated due to the lower abstraction rates and the consequent high aquifer levels. As a result, the MAL increased gradually, enhanced by several 'wet' years in the period 1993 to 2000. In 1995, planning was initiated for a number of large proposed industrial developments in the Karratha area. This meant that the former WA Water Authority needed to plan again for the likelihood of higher abstraction levels from the Millstream bore field, which in turn required a review of annual and peak aquifer abstraction. Other water sources were also reviewed.

A study of the environmental water requirements of key Millstream ecosystems, including the potential impacts of various levels of drawdown, was completed in 1995 (Welker Environmental Consultants *et al*. 1995). The study also reviewed the possible peak draws that had been identified through previous studies. An important aspect of this work was to extend the study area beyond the prime management area to include the southern tributaries (Palm Creek and Peter Creek) and the area immediately upstream of Deep Reach Pool (*Nhangghangunha*). This study found that in the creeks, a drop of at least 1m in the water table at the springs may result in tree deaths. Although supplementation could overcome this problem, these declines in the aquifer level would not be acceptable. At Deep Reach Pool (Nhangghangunha), a decline in the water table by 1m may be detrimental, with some areas experiencing stress and the death of isolated cadjeputs (Welker Environmental Consultancy *et al.* 1995).

This study also highlighted that the rate of water extraction from the aquifer also affects surrounding vegetation. Declines in aquifer level of 200mm over 7 years (about 30mm per year) are natural and acceptable and are not likely to have significant impacts on the vegetation of the deltas and river areas. The impacts of aquifer declines vary depending on where they occur. Declines of greater than 70mm per year over a period of 5 years will lead to water stress in vegetation in the delta areas. In contrast, this same rate of decline in Palm Creek will not create problems for up to 7 or 8 years. In this area, long term declines of 70-100mm per year and up to 190mm per year over a shorter period would produce no obvious stress to vegetation (Welker Environmental Consultancy *et al.* 1995).

Another impact of water extraction highlighted by this study was an increase in groundwater salinity in the aquifer. This was found to be the lowest along the valley flanks and highest in the centre of the valley, where recharge from the Fortescue River (*Yarnda Nyirranha*) occurs, and was thought to be caused by evapotranspiration during periods of low flow in areas where the water table is very shallow.

[8] 1 gigalitre or GL = 1 million kilolitres or cubic metres.

[9] Australian Height Datum – Height in metres above Mean Sea Level +0.026m at Fremantle.

To this end, Water Corporation commissioned a revision of the Millstream Water Management Plan (Welker Environmental Consultancy *et al*. 1998). The Water Management Plan identified environmental criteria required to protect valued ecosystems in the Millstream area and established the management and monitoring program. The specific environmental criteria are outlined as the Environmental Water Provisions (EWPs). The criteria which make up the EWPs comprise:

- Aquifer water level criteria – which set minimum rates of aquifer decline (as measured by the MAL) in the short (12 months), medium (18 months) and long (5 years) term. These rates have been set in order to maintain water-dependent vegetation. An absolute minimum water level has also been set, based on the historical minimum. Development of these criteria as outlined in Welker Environmental Consultantancy *et al*. (1995) was based on that fact that there was no clear evidence of tree species of interest in the Palm Creek area being adversely affected by this degree of drawdown when experienced in the early 1980s; and
- Pool outflow criteria – which are set as outflows from Chinderwarriner and Crossing Pools and are designed to maintain adequate flows between Deep Reach Pool and Gregory Gorge. Dames & Moore (1984) originally developed this criterion based upon estimated evapotranspiration rates and previous work carried out by SMEC (1975). The criterion was redeveloped for the Millstream Water Management Plan 1998 by relating the loss of river flow between pools back to the environmental demand of the vegetation.

In the development of this plan, the then Water and Rivers Commission (now DoW) also revised the licence conditions and reduced the peak draw to 15 GL/annum from both the Millstream aquifer and the Harding Dam combined. While a draw of 15 GL/annum from Millstream is possible under the licence, this peak can only be drawn when Harding Dam is effectively empty and provided that the EWPs can be met. The licence provided by DoW also gives the Department the power to alter the licensed allocation and conditions for numerous reasons including, for example, if ecosystem protection objectives are not being met.

To maximise the yield from the scheme, water from Harding Dam is used while it is available and of a suitable quality. The Millstream source is of strategic importance as it is the sole supply when it is not possible to use water from the Harding Dam. Until November 2000, the greater use of water from the Harding Dam, population decreases and the implementation of successful water conservation practices resulted in less water being abstracted from the Millstream aquifer (compared with the early 1980s). However, between November 2000 and July 2004, water quality problems (caused by increases in the levels of trihalomethanes, or THMs which are a bi-product of the disinfection process) and low water levels (caused by successive years of drought) prevented the use of water from the Harding Dam and the Millstream aquifer was the sole water source for the West Pilbara Water Supply Scheme. For the ten years prior to 2001/02 extraction from the Millstream aquifer was around 8GL/annum. Between 2001 and 2004, this increased to between 9.29GL/annum and 9.35 GL/annum (D Abbott, pers. comm., 2007).

The impacts of these increased levels of extraction on the vegetation of the Millstream wetlands have not been determined, although it is likely that extraction at these levels may have serious implications for the Millstream wetlands and associated ecosystems. Declines in vegetation health can take some time to become evident and monitoring has been in place throughout this time and will continue to determine the impacts of higher rates of abstraction. The Department and the Conservation Commission support a precautionary approach towards increased rates of draw from the aquifer, particularly as the impacts of water stress in vegetation can take some time to become obvious. Until monitoring results are available that show that these higher rates of draw do not place stress on wetland ecosystems, the Department supports the existing long term annual average rates of draw of 6GL/annum.

In 2004, the Water Corporation constructed the Harding Dam water treatment plant in an effort to bring the Harding Dam back on line. This treats dam water by microfiltration, thus reducing THM levels and allowing the year-round use of water from the Harding Dam. Rainfall from Cyclone Monty in March 2004 filled the Harding Dam and, following the completion of the treatment plant, water from the Harding Dam has been used almost exclusively for the West Pilbara Water Supply Scheme since July 2004. Hence, the Harding Dam treatment plant enables the use of water from the Harding Dam when water levels permit and water from the Millstream aquifer is used when the dam levels are too low.

Aquifer levels are also strongly related to the time since the last recharge event. Aquifer levels decline naturally following recharge events and the rate of decline is exacerbated by extraction. The greater the rate of extraction, the greater the rate of aquifer decline.

The variable Pilbara climate also has an impact on the water balance of the Millstream aquifer. Periods of little or no rainfall can result in low or no recharge to the aquifer. The aquifer discharges mainly into Deep Reach Pool and, to a lesser extent, Chinderwarriner Pool, Woodley Creek, Palm Springs and Peter Creek, which all support groundwater dependent ecosystems. Discharge continues to occur during periods of low or no recharge which can lead to a natural decline in the aquifer level. Conversely, cyclones and subsequent river flows can increase recharge to the aquifer considerably. Recharge of more than 30GL was recorded following Cyclone Joan in 1975. Following cyclones in 2004 and 2006 the MAL was at record high levels, in excess of 295.0mAHD. However since then, the MAL has shown a steep rate of decline suggesting that the aquifer declines rapidly when levels are high.

Environmental Water Provisions for the Millstream aquifer are established in the West Pilbara Water Resource Management Operating Strategy (WRMOS), this being a condition of the licence issued to the Water Corporation by DoW. Detailed annual statements are prepared, outlining compliance with the Operating Strategy and the aquifer response to abstraction and recharge events. The Operating Strategy also identifies a series of environmental thresholds which act as trigger points for managing the impacts of abstraction on a number of dependent values, including a trigger aquifer level to cease abstraction. These are regularly reviewed in a process of active adaptive management. The Operating Strategy is reviewed when the licence is reviewed or when otherwise required. At the time of writing, DoW is in the process of reviewing the Operating Strategy, which coincides with the renewal of the Water Corporation's water extraction licence.

Trigger levels and rates have been set for the environmental criteria as has the required response to those triggers. These are also outlined in the Operating Strategy. When trigger levels and rates are being approached water demand management is required and Water Corporation will contact both domestic and commercial consumers in order to reduce water use. When trigger levels and rates are predicted to be met, Water Corporation is required to implement pool supplementation. If trigger levels and rates are breached then Water Corporation is required to cease pumping from the Millstream aquifer.

Management is supported by a monitoring program which aims to determine the influence of abstraction and recharge events and to measure water quality indicators such as conductivity, temperature, salinity and ion levels (Ross Doherty and Todd Baldock pers. comm. 2002, Welker Environmental Consultancy *et al*. 1998). The Department and the Water Corporation also carry out monitoring of vegetation health in the Millstream delta, in Palm and Peter Creeks and riverine areas between Deep Reach (*Nhangghangunha*) and Gregory Gorge.

At the time of writing, DoW is carrying out a number of planning processes focussing on water extraction from the Millstream aquifer and water use across the region in general. These processes include:

- The development of a numerical model of the Millstream aquifer, which will improve understanding of the aquifer, its recharge mechanisms, the relationship between aquifer level and discharge and the response of the aquifer to abstraction. This information will be used in a review of the ecological water requirements and subsequent EWP and water abstraction management;
- The Pilbara Water Smart Australia Project, which will investigate groundwater and surface water interactions and relationships with groundwater-dependent ecosystems at a number of key areas, including the Millstream aquifer. This aims to determine the water regimes required to maintain ecological and cultural values in a variable climate;
- The development of a Statutory Water Resource Management Plan, which will replace the existing Millstream Water Management Plan (1998) and will provide an assessment of the implementation and performance of water management objectives, criteria and measures and establish the opportunities and constraints of existing and potential water resources. The modelling and other investigations described above will support the development of such a plan for Millstream and other water sources in the Pilbara. The ecological water requirements and environmental water provisions for the Millstream aquifer are also being reviewed as part of this planning process to manage abstraction and aquifer levels and prevent impacts on aquifer-dependent ecosystems. These revised EWPs will be used to revise the water allocation and management rules for the Millstream aquifer;
- The development of the Pilbara Regional Water Plan which will identify an increasing demand for water across the region and the need to find alternative water sources;
- The completion the Pilbara Coast Water Study, a desktop survey looking at alternative water sources across the Pilbara, including water that might be available in other alluvial aquifers across the region; and
- The development of guidelines for water use and management by the mining industry.

Like DoW, the Water Corporation is also currently undertaking water source development planning, which involves the identification of water sources across the Pilbara, in addition to the Millstream aquifer and the

Harding Dam. This will ensure the long-term sustainability of the West Pilbara Water Supply Scheme, at a time when both the population and industries in the area are expanding.

Over-extraction from the Millstream aquifer occurs when monitoring indicates that MALs are too low and/or the rate of aquifer decline too high. Such a scenario provides a trigger for DoW to turn off supply from the Millstream aquifer. In these instances, the availability of alternative sources is critical. The development of a contingency plan, which provides alternative short-term water sources to be utilised when recharge to the aquifer is low, is therefore important for management of the Millstream aquifer. Such a plan would reduce the pressure on the Millstream aquifer by ensuring that over-abstraction does not occur at times when the groundwater-dependent ecosystems are more likely to be experiencing periods of water stress. Under conditions of the current licence, the Water Corporation must have such a contingency plan. The trigger mechanism for the implementation of a contingency plan is associated with the MALs and the rate of aquifer decline. Should monitoring show that aquifer levels are too low and/or the rate of aquifer decline too high, new water sources away from the Millstream aquifer will need to be used.

The identification of alternative sources is particularly important as various mining companies have negotiated statutory agreements which commit the Water Corporation to supplying their industrial water requirements. Other industrial water users may be identified in the future.

The Millstream Water Management Plan also recognises the cultural significance and importance of the Millstream area to Indigenous people and cultural considerations have been incorporated into the Operating Strategy. This outlines the operating, reporting and monitoring protocols to ensure that the Water Corporation can abstract water from Millstream without adversely impacting on both the natural and cultural values of key areas of significance.

37.2 – Water Extraction – Public Water Supply

Key Points

- A conjunctive use licence issued to the Water Corporation by DoW allows for the extraction of up to 15GL/annum of water from the Millstream aquifer and the Harding Dam.
- Water cannot be abstracted from the Millstream aquifer unless the environmental conditions, specified in the conjunctive use licence, are met.
- Planning being carried out by DoW and the Water Corporation is currently being undertaken to better manage and understand water extraction from the Millstream aquifer and to identify other water sources in the Pilbara for future use.
- The conjunctive use licence also recognises the cultural significance of the area to the Indigenous people.

The objective is to ensure that management of the Millstream aquifer complies with the conditions specified in the Department of Water's licence to Water Corporation including maintenance of cultural and natural values.

This will be achieved by:

1. engaging with DoW to ensure compliance with the conditions of the Water Corporation's licence and the associated Operating Strategy; and
2. ensuring that the Millstream Harding Consultative Committee reports to the Conservation Commission on a regular basis on water supply issues.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
37.1 Changes in the condition of riparian vegetation, in association with aquifer level declines and high rates of abstraction from the Millstream aquifer.	37.1 No decline in the condition of riparian vegetation, in association with aquifer level declines and high rates of abstraction from the Millstream aquifer.	Annually. Reporting will be to both the Conservation Commission and the Millstream Harding Consultative Committee.

37.3 Management and Monitoring

The Water Corporation operates the Millstream bore field under licence to DoW. A condition of the licence is to provide a strategy to operate the bore field. The Millstream Water Management Plan (Welker Environmental Consultancy *et al*. 1998) outlines the operation, monitoring and reporting requirements about the performance of the bore field. This document is currently being reviewed, although it is likely than any new document will also outline monitoring requirements.

Six supplementation bores are present in the bore field to regulate water levels in Deep Reach Pool (*Nhangghangunha)* and Chinderwarriner Pool (*Jirndawurrunha*). An extensive network of 79 bores is monitored to determine the impacts of water abstraction on the environment.

The purpose of the Millstream Water Management Plan is to provide guidelines for the management of water abstraction from the Millstream aquifer so as to not adversely impact on the natural and cultural values. The key water-dependent ecosystems are the riverine areas between the upper reaches of Deep Reach Pool (*Nhangghangunha)* and Gregory Gorge, including the Millstream delta and Palm Creek.

The monitoring program includes:

- intensive hydrological monitoring of pool outflows and channel flows as well as the installation of new monitoring bores;
- establishment of baseline information on vegetation communities, significant or threatened ecological communities (especially faunal communities such as macroinvertebrates and stygofauna in the aquifer and the Millstream wetlands), determination of changes in the distribution and density of vegetation, plant size and structure, and changes in the communities in the aquifer;
- study of changes in the Millstream delta caused by altering the distribution of water through channels through removal of weeds and other introduced species;
- regular monitoring of Chinderwarriner Pool (*Jirndawurrunha*) water quality and flow off the Millstream delta into the Fortescue River (*Yarnda Nyirranha*); and
- continued monitoring of bores in the Millstream aquifer.

Both the Department and the Water Corporation are responsible for implementing this monitoring program. Monitoring data is analysed monthly by the Millstream Technical Working Group to determine the likelihood of a breach of licence conditions.

37.3 – Water Extraction – Management and Monitoring

Key Points

- The terms of the Water Corporation licence require a strategy for the operation, monitoring and reporting of the performance of the Millstream bore field.
- Monitoring determines pool and channel flows, baseline information on vegetation and significant or threatened economical communities, changes in the Millstream delta as a result of weed removal, water quality of Chinderwarriner Pool (*Jirndawurrunha*) and the flow off the Millstream delta and aquifer levels.

The objective is to manage and monitor the water resource and water dependent ecosystems in accordance with the interdepartmental Millstream-Harding Consultative Committee and the Water Management Plan for Millstream.

This will be achieved by:

1. carrying out monitoring for which the Department is responsible for, according to the Millstream Water Management Plan (or a revision thereof); and
2. ensuring the Water Corporation provides an annual report reviewing water abstraction from the Millstream aquifer to the Millstream-Harding Consultative Committee.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

38. BEEKEEPING

Since the introduction of the honeybee (*Apis mellifera*) to Australia midway through the nineteenth century, commercial beekeeping has been a small but significant industry in Western Australia (primarily in the south-west), with an average annual total income in recent years of around $9 million and a total worth (including planned and incidental pollination of commercially exploited crops and plants) of approximately $120 million per annum (2002/03) to the State of Western Australia. Currently some 96 apiarists hold around 3,050 permits for registered sites on various categories of public land, for which the Department is the registration authority and collects annual rental fees. The Department of Agriculture provides technical advice on apiculture to the industry and the Department.

Apiarists in Western Australia have traditionally relied on large areas of native vegetation for honey production, and are increasingly dependent on lands managed by the Department as other areas are cleared for urban development and agriculture.

All apiary sites on Crown land in WA require a permit from the Department. In national parks, this permit is subject to conditions such as the use of existing tracks only and no interference to visitors or environmental management. Beekeepers are also required under the *Beekeepers Act 1963* to register with the Department of Agriculture and Food.

Apiarists use a network of sites between Geraldton and Albany and hives are moved according to nectar flow cycles of between two and eight years. During periods of low nectar flow in the lower south west, the apiarists place their hives in the northern sandplain country where there are enough resources to maintain hive strength and viability during winter.

The Department has a responsibility to protect the values of the planning area and apart from posing a risk, or causing disturbance, to visitors, honeybees may also affect biodiversity, including the functioning of ecological processes such as pollination. It is therefore necessary to assess the dynamics between the native pollinators (which includes mammals, birds and insects), native flora and native fauna species dependent on that flora, prior to allowing an introduced pollinator to persist within a conservation reserve. With almost half of the plant species being primarily bee-pollinated (including pollination by native bees) in the south west (Scheltema 1981), it is important to assess the level of dependence of native flora on honeybees for pollination.

While it is recognised that feral honeybees are more of a threat to the values of conservation reserves than managed honeybees, there is little knowledge about the range of conditions under which honeybees leave the hive and become feral. It is suggested that feral populations can be eliminated from areas after unfavourable conditions, such as drought or fire, as long as there is not a constant supply of managed hive bees swarming into the wild (Scheltema 1981).

General guidance for the management of beekeeping on Crown land is provided for by the Department's *Policy Statement No. 41 – Beekeeping on public land* (subject to final consultation). Under the draft policy, the Department will maintain (and renew) current apiary site permits on all classes (tenures) of land, but permit no additional apiary sites on land currently or proposed to be reserved primarily for nature conservation purposes, until a management plan has been prepared. In this instance, the Department, through the management planning process, will consider whether access for beekeeping is retained at the current level, increased, decreased or phased out.

The assessment of an area for its suitability for apiary sites is carried out by scientific experts within the Department and based on the best available knowledge. Using a number of environmental and management criteria adapted from the draft policy, the impacts between honeybees and values of the area will be predicted.

To date, no permits have been granted for apiary sites in the planning area. To be consistent with the criteria for assessing apiary sites on the conservation estate, no beekeeping will be permitted in the planning area, given there is no record of beekeepers using this area in the past. In addition, honeybees have only been present in the planning for a relatively short period of time and current impacts are thought to be quite low (see Section 21 – *Introduced and Other Problem Animals*). Consequently, the establishment of apiary sites in the planning area would only exacerbate this. If requests for the establishment of apiary sites are made in the future and the industry can prove that beekeeping occurred in the area in the past, the area will be fully assessed for its suitability for beekeeping.

43 – Beekeeping

Key Points

- Commercial beekeepers have always relied heavily on large areas of native vegetation, and are increasingly dependent on lands managed by the Department.
- Honeybees can affect biodiversity (including ecological processes such as pollination) as well as recreational values. Therefore, the Department will take a precautionary and pragmatic approach with regards to beekeeping in the planning area.
- There is no history of beekeeping in the planning area.

The objective is to minimise the impacts of commercial/introduced honeybees on key values.

This will be achieved by:

1. not permitting any apiary sites within the planning area that have no historical use;
2. considering assessing the suitability of the planning area for beekeeping if the industry is able to provide evidence of historical use; and
3. controlling feral bees within the planning area where possible (see Section 21 - *Introduced and Other Problem Animals*).

Key Performance Indicators:

There is no Key Performance Indicators for this section.

PART G. CARING FOR COUNTRY: INVOLVING THE COMMUNITY

39. COMMUNITY EDUCATION AND INTERPRETATION

The planning area provides a valuable opportunity for communication to people within the local, regional, and wider community about the values of the planning area, particularly the unique environment and its rich Indigenous cultural heritage, the wetlands, the Fortescue River (*Yarnda Nyirranha*), landforms, biota and other Australian cultural heritage. An effective communication program is vital to achieve the goals and objectives for the management of the planning area and generally involves three components:

- Information: provides details of facilities, activities, features and regulations and includes publicity, marketing and promotion;
- Education: provides resources and programs designed specifically for various educational groups and includes educational materials and learning activities; and
- Interpretation: explains natural and cultural features and management activities and includes on-site signs, exhibits, print and electronic products (e.g. multi-media, audio, video, CD and internet-based), brochures, and guided interpretive activities and experiences. The interpretation of values to visitors is integrated with recreation and tourism planning and site developments (see Chapter E – *Managing Visitor Use*).

Education and interpretation programs will concentrate on raising awareness of the natural and cultural values of the planning area and their vulnerability to human impact and the positive actions visitors can take to support the management of the planning area. It also fosters a sense of community ownership of the planning area and engenders support for management. At the same time it encourages appropriate behaviour to minimise adverse impacts on the environment.

Information will be designed to enable visitors to become orientated, be aware of the access routes and opportunities available, and to advise of any restrictions in the planning area and the reasons for these restrictions.

The main interpretive theme to be developed for the Millstream Chichester National Park will focus on the culture of the Yindjibarndi and Ngarluma people. This rich cultural heritage, including language, bush tucker, stories, songs and dancing will be presented using a range of interpretation methods, including, signs, exhibits, displays, artwork, publications (such as brochures, park notes and maps) along with guided tours and activities. Common logos and colours (i.e. branding) in the Park will also ensure continuity in interpretive products.

The Millstream Park Council has proposed a symbol to represent and promote the Millstream Chichester National Park. This is the little corella or *birdirra* (Juluwarlu Aboriginal Corporation, 2005). A logo featuring the little corella has been designed and will appear on the full range of interpretive materials.

Methods that may be employed in the interpretive program include:

- guided activities and experiences conducted by Indigenous Traditional Owners and delegates;
- ranger-led activities (both within and outside the park at venues such as schools);
- self-guided Indigenous cultural heritage and natural heritage walks;
- visitor displays in campgrounds, picnic areas, feature interpretive sites and trails, and entry points as appropriate;
- self-explanatory signs or panels at sites of natural or cultural significance;
- hides for bird observation; and
- a variety of literature such as Park brochures, biological checklists, and informative publications available in the park and throughout the State.

The Millstream Homestead Visitor Centre provides the focal point for information about the Millstream Chichester National Park. Currently it features rooms dedicated to the Yindjibarndi people, the early settlers and the natural environment. Other displays inform visitors of the park's attractions and management issues. The Visitor Centre will remain the focal point for park information and interpretation, with an emphasis on the

culture of the Yindjibarndi and Ngarluma people and the natural values of the park and broader area. There is also scope for the Visitor Centre to provide guided interpretive activities and experiences, house a gallery for the display and sale of Yindjibarndi artwork and a studio for artists-in-residence and arts workshops, a Ngarluma and Yindjibarndi language and cultural centre, a retail outlet for the sale of merchandise, a booking centre for cultural and other park guided activities and a self-service café or outlet serving refreshments. An outdoor amphitheatre is proposed for guided activities and experiences (eg. performances), talks and night movie screenings interpreting the cultural and natural values of the park.

Signage will assist in interpreting the natural and Indigenous cultural values of the planning area. Currently, there are interpretive signs along some of the park's walk trails that help explain the early history of the Homestead and the importance of some of the area's plants to the Yindjibarndi people. Guided and self-guided walk trails interpreting Indigenous culture are proposed around Chinderwarriner Pool (*Jirndawurrunha*) and at Cliff Lookout (see Section 32 – *Visual Landscape*). New walk trails will also provide signage to interpret the park's cultural and natural values. Indigenous artists in the region will also be encouraged to produce artwork for information and interpretation products (signs, publications, productions).

Site names within the planning area also provide a mechanism for interpreting the Indigenous cultural heritage of the Millstream Chichester National Park. Working with the Millstream Park Council, recreation sites, pools and other natural features within the park will be jointly named with their appropriate Yindjibarndi or Ngarluma name and English name. Similarly, new sites within the planning area will be given Yindjibarndi or Ngarluma names. This work will occur in collaboration with the Juluwarlu Aboriginal Corporation, based in Roebourne, which has done extensive works on documenting cultural information and Yindjibarndi language.

As a result of the construction of the sealed Karratha-Tom Price Road, the scenic and cultural drive trail, the "Warlu Way" links the Millstream Chichester National Park with other national parks, reserves and towns in the Pilbara Region, including the Ningaloo Marine Park, Cape Range National Park, Karijini National Park, the Burrup Peninsula, the Dampier Archipelago and the communities of Roebourne, Cossack and Point Sampson. Each destination along the Warlu Way promotes a particular interpretational theme. The Millstream-Chichester National Park will be promoted under the heading, "An Ancient Land, a Living Culture: exploring the connection of Indigenous people to the land". This provides an opportunity to promote the cultural, natural and other key values of the Park along the main visitor access route. The Warlu Way appeals to a range of visitors, as well as niche markets (which target visitors with particular interests).

Information and direction road signs are erected in the Millstream Chichester National Park; however many have not been updated in recent years. To project a positive image of cooperative and integrated management, it is proposed that signs will be progressively upgraded, in consultation with the Millstream Park Council. Over the life of the plan, signage within the Millstream-Chichester National Park will incorporate the Departmental initiative of using colours that reflect the character of particular regions. Colours are currently being developed for the Pilbara and will be used in the park. A consistent style, reflecting the Indigenous cultural heritage and landscape of the planning area will be implemented.

Printed materials (brochures, maps and leaflets) about the Millstream Chichester National Park are currently available. Such publications provide information on the park's values, facilities and attractions.

Interpretive stories enhance visitors' experiences and understanding of the area's natural and cultural values. The focus of guided activity programs within the Millstream Chichester National Park will be on Yindjibarndi and Ngarluma culture and the significance of cultural sites. Other topics may include:

- geological history of the park and reserve - the great age of rock formations and the implications for the study of Earth's earliest life forms (stromatolites at Mount Herbert);
- plant and animal adaptations to conditions of aridity, fire and flood;
- the Millstream wetlands and their environmental significance; and
- management of the Millstream aquifer.

A communications plan will be developed to identify the key themes and messages for the Millstream Chichester National Park and outline how interpretation will be provided and implemented in the park.

Bush Ranger and Other Educational Programs

The Bush Ranger program is a voluntary program for young Western Australians. It is part of a broader program known as 'Cadets WA', which aims to give all secondary school-aged youth the opportunity to participate in

personal development training that provides practical life skills, develops leadership, teamwork and initiative skills, and fosters qualities of community responsibility and service.

The objectives of the Bush Ranger program are to provide opportunities for students to:

- contribute to nature conservation though a variety of hands-on projects;
- develop first-aid, bushcraft, survival and navigation skills;
- learn about managing protected areas and other special places;
- help save threatened plant and animal species and their habitats;
- develop personal leadership skills; and
- learn about the complex issues of land and environmental management.

A Bush Ranger program is established at Onslow and was previously established at Newman (disbanded in 2008). In addition, there are Aboriginal youth from a number of Pilbara communities (including Jiggalong, Newman, Port Hedland and Punmu) who are part of the Bush Ranger program at Wongutha Christian Aboriginal Parent-directed boarding school. The Department also continues to liaise and is involved with local schools. There may be the community interest and management capacity within the life of this plan to establish more formal programs, such as Bush Rangers, elsewhere.

Education programs in local schools are also important in interpreting the natural and cultural values of the Millstream Chichester National Park. There are primary and secondary schools located in the surrounding towns, as well as a combined primary and secondary school located at the Ngurrawaana Aboriginal Community, adjacent to the Millstream Chichester National Park. Education programs will be developed with these schools, encouraging children to spend time on country with elders and participate in cultural classes within the Park.

In collaboration with the Juluwarlu Aboriginal Corporation, other Indigenous organisations and mining companies, there may also be the opportunity to develop cross-cultural community education programs and training courses within the Millstream Chichester National Park. This would promote greater understanding of their cultural heritage by Indigenous communities and the Indigenous and non-Indigenous employees of the Department, mining companies, government organisations and other agencies.

39 – Community Education and Information

Key Points

- Community relations at Millstream Chichester National Park comprises three areas; information, interpretation and education.
- The main theme for the park will be interpreting the rich Yindjibarndi and Ngarluma heritage of the area and its intrinsic association with the natural values of the Park.
- Methods of interpretation include signs, displays, publications and guided activities.

The objective is to promote community awareness, understanding and appreciation of the natural and cultural values of the planning area and engender support for effective management of the planning area.

This will be achieved by:

1. developing and implementing a communications plan for interpreting the values of the Millstream Chichester National Park;
2. redeveloping the Millstream Homestead Visitor Centre as a focal point for visitor information in the park, with an emphasis on Yindjibarndi and Ngarluma culture;
3. developing interpretation projects and guided activities program within the Millstream Chichester National Park, with a theme focused on the interpretation of the Yindjibarndi and Ngarluma cultural heritage as well as the natural values;
4. promoting the use of Yindjibarndi and Ngarluma names for recreation sites, pools and natural attractions in the planning area;
5. promoting and using the little corella (*birdirra*) as a symbol for the park and Yindjibarndi country;
6. further developing interpretation associated with the scenic and cultural drive trail, the "Warlu Way" which passes through the Millstream Chichester National Park;
7. obtaining advice from the Millstream Park Council on information, education and interpretation programs and their implementation, in particular in relation to Indigenous cultural heritage;
8. treating Indigenous cultural information used in the interpretive program with sensitivity and ensuring

approval by Millstream Park Council occurs prior to public release;
9. locating interpretive facilities at selected sites including entry stations for orientation and other sites for experiencing natural and cultural values;
10. developing a style guide so that all print, electronic and sign products to conform to Departmental standards while expressing the local character of the planning area;
11. supporting educational programs in local schools and considering the establishment of the Bush Ranger program during the life of the plan where there is community interest and management capacity;
12. seeking funds, including sponsorship, for the continued development of cultural and environmental interpretation in the park;
13. providing training for the tourism industry in interpreting the Department's role and the planning area's cultural and natural values; and
14. involving organisations such as Juluwarlu Aboriginal Corporation in providing staff training, community development programs and cross-cultural awareness programs within the planning area, according to guidelines developed by the Millstream Park Council, emphasising preservation of the park's unique natural and cultural environment.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
39.1 The number of participants in education and guided interpretive programs offered in the planning area.	39.1 An increase in participation, including recurrent participation, in education and guided interpretive programs offered within the planning area.	Annually
39.2 Visitor satisfaction with the information and interpretation products and programs in the planning area	39.2 No decrease in the visitor satisfaction levels over the life of the plan.	Every five years.

40. COMMUNITY INVOLVEMENT AND VOLUNTEERS

Community involvement is an integral part of the Department's operations and involvement of the community in planning and management at all levels is encouraged. It helps the community to understand what the Department's responsibilities are, enables them to share knowledge, and provide hands-on assistance with certain projects.

A range of less formal public involvement in other Departmental planning matters is also desirable, with the Department seeking to co-operate with local communities and establish projects of mutual interest where appropriate. This is dealt with in the *Department's Statement No. 15 – Community Involvement* (CALM 1991) and the Public Participation Manual (CALM 2000), which provides information for staff on how to design and implement effective public participation programs.

Examples of community and Departmental interaction include:

- stakeholder involvement with management plan preparation;
- the protection of specific areas of high conservation value off the conservation estate, such as Land for Wildlife and voluntary nature conservation covenants;
- staff involvement on regional and local tourist committees, agricultural shows, tourism and trade expos and festivals;
- the Department providing advice about landscaping and tree planting and assistance to bodies such as Greening Australia, land councils, local government and Indigenous communities;
- co-operation with schools (e.g. work experience and Arbor Day, school programs and tertiary education, the Bush Rangers Program);
- various community advisory committees, 'Friends of' groups and other volunteer groups;
- Departmental involvement with land conservation district committees and catchment management advisory bodies;
- liaison with bushfire brigades;
- public workshops, seminars and talks to interested groups; and
- nature-based tourism and ecology programs conducted by the Department.

Public participation programs require considerable staff resources to plan, implement and review. The Department will at all times attempt to meet its obligations in this regard because of the great importance it places on community involvement.

Numerous organisations and groups have a keen interest in the management of the planning area. State and local Government agencies, other organisations, neighbouring pastoralists, Indigenous groups, users of the planning area, public interest groups, research organisations and the mining and tourism industries are all interested in the management of the planning area. Although these groups have been actively canvassed during the management planning process, continuing liaison is essential to achieve management objectives and to enable management to be responsive to changing community attitudes. The community benefits substantially from income associated with tourism in the region and so community participation in promoting and maintaining values of the planning area is important.

A Department of Corrective Services work camp has been operational in the Millstream Chichester National Park since January 2000. Low security Indigenous prisoners from the Roebourne Regional Prison have provided a valuable work force to complete a range of on-ground works. The camp is located in the Millstream Homestead precinct, adjacent to the ranger's accommodation. Prisoners have been involved in a range of projects within the park, such as the maintenance of recreation sites, the restoration and maintenance of walk trails and weed removal. These projects give prisoners the opportunity to develop valuable skills, to return to country and to increase their cultural awareness. The prisoners are currently housed in accommodation adjacent to the Millstream Homestead visitor precinct. This work camp will require expansion and upgrade throughout the life of the plan and relocation away from the Millstream Homestead precinct (see Section 28 – *Visitor Accommodation*).

Potential exists for the public to become directly involved in implementing this plan. Numerous local community groups have become involved in management of the Millstream Chichester National Park and have participated in projects such as weed removal, rubbish collection and fencing. A "Friends of Millstream Chichester National Park", honorary Department officers, campground hosts and other volunteers are possible ways of involving individuals and groups in park management.

Indigenous Involvement

Indigenous people have a strong interest to be involved in the management of much of the conservation estate in Western Australia. Working together with Indigenous people to 'care for country' will assist heritage preservation and conservation of the environment, as well as enrich cross-cultural awareness.

The Government has shown a commitment to explore joint management arrangements with Traditional Owners. In the Millstream Chichester National Park, this is facilitated via the Millstream Park Council (see Section 8 – *Management Arrangements with Indigenous People*). In addition, cooperative partnerships with groups such as the Juluwarlu Aboriginal Corporation, the Ngarluma-Yindjibarndi Foundation and other Indigenous groups in the region will assist in developing opportunities for joint management in the planning area.

Volunteers

Volunteer activities are of value to the Department not only because the Department's work capabilities and skills base can be expanded at minimal cost, but also because such activities build communication links and understanding with the community.

The Department's *Policy Statement No. 15 – Community Involvement (Public Participation and Volunteers* (CALM 1991) provides a policy and administrative framework for volunteer activities, which includes initiatives to provide more volunteer opportunities and to provide training to volunteers and Departmental staff in their management. Matters including the industrial relations aspects of volunteer activities, workers compensation insurance, and public liability are managed by the Community Involvement Coordinator based in the Department's Perth office.

The CALM Act provides for honorary Departmental officers, positions of considerable responsibility and privilege for volunteers of exceptional commitment.

Roles for volunteers in the planning area vary from time-to-time, but may include:

- assisting with flora and fauna surveys or research;

- acting as campground hosts;
- the rehabilitation of injured or orphaned fauna ('Wildlife Carers'); and
- assisting with reserve management (e.g. clean-ups and busy bees).

It is essential that work provided is meaningful to ensure continued satisfaction and motivation. Another way of maintaining enthusiasm is through a recognition and reward system. The Department offers a range of incentives and rewards to individuals who undertake volunteer work. During 2005/06, volunteers contributed 62 537.35 hours in the Pilbara Region.
Ongoing community support is essential for the successful implementation of this management plan once finalised. Community groups are encouraged to take part in volunteer activities throughout the planning area such as clean up days and help with maintenance such as erosion control and track maintenance.

Volunteers are currently accommodated in a transportable building within the Millstream Ranger's residence/accommodation precinct in the Millstream Chichester National Park. These facilities will be upgraded over the life of the plan to better accommodate these groups while spending time in the Park (see Section 28 – *Visitor Accommodation*)

40 – Community Involvement and Volunteers

Key Points

- The community has been involved in various stages of the management planning process.
- A range of community groups and organisations are involved in the management of the Millstream Chichester National Park.
- Joint management with Indigenous people in the planning area is facilitated through the Millstream Park Council.

The objective is to develop, encourage and facilitate liaison with the community and involvement in implementing the management plan.

This will be achieved by:

1. managing community involvement and support and effective neighbour relations in accordance with Department policies;
2. liaising with neighbouring land owners and land managers, local authorities, relevant Government agencies and other stakeholders in the management of cross boundary issues;
3. continuing to provide and promote opportunities for community involvement in management of the planning area;
4. supporting the continued involvement of prisoners from the Department of Corrective Services Work Camp in maintenance projects and other on-ground works in the Millstream Chichester National Park and reviewing the formal agreement between to the Department and the Department of Corrective Services;
5. continuing to support volunteer involvement in Departmental programs, and maintain the Department's volunteer database; and
6. recognising the value of volunteers through a rewards and recognition program.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
40.1 The number of registered volunteers and the level of volunteer hours contributed over the life of the plan.	40.1 An increase in the number of registered volunteers and the level of volunteer hours contributed over the life of the plan.	Annually.

PART H. MONITORING AND IMPLEMENTING THE PLAN

41. ADMINISTRATION

For administrative purposes, the Department is structured into nine Regional centres that are further sub-divided into Districts. The planning area is located in the Pilbara Region. The day-to-day implementation of the final management plan will be the responsibility of the Regional Manager, Pilbara Region, who coordinates the operational management of parks and reserves in the planning area.

42. RESEARCH AND MONITORING

Research and monitoring are essential components of management and are required to successfully implement this management plan. Research improves knowledge and understanding of the planning area's values, and the processes that affect them, including impacts of human activities. Monitoring the condition of key values facilitates performance assessment and provides a scientific basis for improving and adapting future management to achieve best practice.

The Department's 'Science Division' undertakes research within the planning area, with assistance from regional and district staff, and as part of larger state-wide projects. Additional research and monitoring is conducted or facilitated by the Parks and Visitor Services Division, principally through the Visitor Satisfaction Survey, the Visitor Statistics (VISTAT) Program, and the Nature-based Tourism Research Reference Group. The latter focuses on developing relationships with universities to facilitate nature-based tourism or social research. Several current research projects employ co-operative arrangements between voluntary organisations and the Department. These provide valuable guidelines for management of natural values in the planning area.

Within the planning area, the focus for monitoring is outlined in the plan's performance assessment process. The protection of key values within the planning area have an associated key performance indicator (KPI) with a performance measure, target and reporting requirement, which guides monitoring within the planning area (see Section 11 – *Performance Assessment*).

Research Requirements

The natural and cultural values of protected areas make them desirable sites for research. Research activities are supported where they contribute to the Department's understanding of natural, cultural or social processes within the area, and where such activities do not threaten or disrupt these processes. However, research itself has the potential to adversely impact upon the values of the planning area. Proposals for research should be assessed as to their likely impacts and be subject to appropriate conditions if necessary.

It is appropriate that research and monitoring involve a wide range of organisations and groups. The involvement of volunteers, educational institutions and individual researchers can increase the efficiency of research and monitoring costs, and provide quality information for the benefit of the broader community. External researchers often operate under a permit system managed by the Department's Wildlife Branch and it is a condition of the permit system that research 'results' are forwarded to the Department.

Departmental research gives priority to:

- describing and documenting Western Australia's biological diversity;
- providing knowledge on how best to conserve the State's biodiversity;
- evaluating impacts of threatening processes on biodiversity assets;
- minimising impacts of threatening processes; and
- increasing knowledge of visitor use patterns and profiles (e.g. demographics, level of use of recreation sites, visitor expectations and perceptions).

Allocating priority for research and monitoring may result in conducting programs that have relatively little direct management application to the planning area, but significant direct application to the conservation estate and species or communities elsewhere.

Research Projects in the Planning Area

Research activities in the Millstream Chichester area are supported where they contribute to our understanding of natural or social processes within the area, and where such activities do not themselves threaten or disrupt these processes. Research activities will result in a comprehensive inventory of natural and cultural values. In addition to its intrinsic value and interest, this information will also be valuable in management of the area.

Research efforts should be integrated so that a clearer picture about the ecology of the area can be built up, using a number of contributions to achieve a greater depth of knowledge. As part of wider management programs the knowledge base becomes broader and further integration and information exchange occurs in a more holistic manner.

The Millstream Chichester area presents a diverse array of natural environments, ranging from arid rangelands through to extensive wetlands and subterranean aquatic systems. Past research has concentrated on the Millstream wetland environments. Much more work remains to be undertaken, however, before even a basic biological inventory is complete.

Preliminary work on vertebrates has been undertaken in the vicinity of Millstream, and some work on aquatic invertebrates was undertaken prior to the removal of date palms at Millstream.

In the case of this management plan, research and monitoring should also assist in meeting the requirements of the KPIs. This will include gaining a better understanding of those values identified as being most at risk and management practices most likely to have adverse ecological and social impacts. Consideration of research projects that examine the impacts of changes to conditions, such as adjoining land use, should also be given priority. Further research within the planning area may include:

- groundwater hydrology;
- stygofauna associated with the Millstream aquifer;
- overland flow, erosion, river bed scouring and paeleo processes;
- the status of threatened flora and fauna;
- vegetation health and distribution, especially significant ecosystems such as riparian and wetland vegetation and communities at risk, which may be impacted by water extraction;
- the distribution and impact of weeds and feral animals, particularly those with a high level of significance;
- surveys of native flora and fauna species and ecosystems;
- studies to assess the impact of fire and the proposed fire management strategy on flora and significant ecosystems, especially threatened ecological communities;
- impacts of fire on the age-class distribution and diversity of vegetation associations/communities;
- continuing social research is required to increase current knowledge by determining profiles on visitors to the planning area, the level of use of recreation sites, patterns of usage and visitor perceptions for future management;
- the impact of recreation, facilities and tourist operations on the environment of the planning area should be monitored, including compliance with measures designed to protect the water quality of the Millstream aquifer. The establishment of a program to monitor visitor impacts associated with walk trails, day-use sites and camping areas is required. The need for additional facilities also requires monitoring, taking into consideration population changes in nearby areas, visitor management settings and access; and
- social research and monitoring should determine if recreation, environmental education and interpretation are meeting visitor needs. The impacts of all activities should be monitored, and changes made if impacts are unacceptable.

Other government agencies also have responsibility for monitoring within the planning area. DoW and the Water Corporation for example monitor water quality and quantity and DoW have conducted research into environmental water requirements for the Millstream aquifer.

42 – Research and Monitoring

Key Points

- Research in the Millstream Chichester National Park will contribute to a greater understanding of the natural and social processes in the area and the development of more effective management strategies.
- In the past, nature conservation research has focused on wetland environments vertebrates and aquatic invertebrates.

The objective is to increase knowledge and understanding of natural, cultural and recreation values to provide for better management of the planning area and to monitor the impacts associated with implementing the management plan.

This will be achieved by:

1. conducting research and monitoring, as resources permit and according to priority, that focus on issues and key values required to report on this management plan, and the establishment of baseline information;
2. ensuring relevant information gained through broader Departmental research, monitoring and experience is also stored in regional and district office libraries/databases, updated when required and used, where necessary, to modify management practices;
3. encouraging and facilitating, wherever possible, external agencies, organisations, volunteers and individuals to carry out research and monitoring projects within the planning area;
4. applying a permit system for research proposals from outside the Department which will specify conditions under which work may be carried out and results disseminated;
5. continuing to issue permits for research on wildlife within the planning area as appropriate;
6. storing, updating (when required) and using information gained through research, monitoring and experience, if necessary, to modify management practices;
7. ensuring that research and monitoring activities do not adversely impact on the values of the planning area;
8. developing and maintaining a database of historical, current and required research on the planning area;
9. incorporating research and monitoring findings into interpretive and educational material where appropriate;
10. proposing nature-based tourism research projects through the Nature-based Tourism Research Group;
11. pursuing external funding sources to assist in achieving research and monitoring objectives;
12. referring all research proposals to the Millstream Park Council for agreement; and
13. encouraging volunteers, educational institutions and other organisations to participate in social research projects.

Key Performance Indicators:

There is no Key Performance Indicators for this section.

43. TERM OF THE PLAN

This management plan for the Millstream Chichester National Park and Mungaroona Range Nature Reserve will guide management of the planning area for a period of 10 years from the date the final management plan is gazetted. During this time, amendments to the final management plan are allowed under section 61 of the CALM Act. If an amendment is necessary, the proposed changes will be released for public comment.

At the end of the 10-year period, the management plan may be reviewed and a new management plan prepared. The new management planning process requires full public consultation and approval from the Minister for Environment. If the plan is not reviewed and replaced by the end of the 10-year period, section 55(2) of the CALM Act allows the plan to remain in force in its original form, unless it is either revoked by the Minister or until a new plan is approved.

GLOSSARY

1080	A naturally occurring toxin (sodium fluoroacetate) found in many native Australian plants known as poison peas (*Gastrolobium* sp.).
A Class Reserve	Classification under the Land Administration Act 1997 reflects security of tenure, level of approval required to alter the reserve's area, purpose or classification.
Aeolian	Wind-deposited materials.
Anticline	A-shaped folds resembling an arch.
Aquatic	Living or growing in or on water
Aquifer	A layer of rock which holds and allows water to move through it, and from which water can be extracted.
Autonomous	Existing or capable of existing independently
Avifauna	The birds or the kinds of birds of a region, period or environment
Benthic	Occurring at, or relating to, the bottom of a body of water
Biodiversity	The variety of all life forms: the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form; often considered at three levels: genetic diversity, species diversity and ecosystem diversity
Biogeography	The study of both geography and biology including the relationships between plants, animals, soils, water, climate and humans.
Bioregion	A land and water territory whose limits are defined not by political boundaries, but by geographical limits of human communities and ecological systems.
Biotic	Of, or relating to living things; caused or produced by living organisms.
Burning or Prescribed Burning	Fire that is used or applied by people to achieve particular management objectives. This is opposed to wildfire (see definition later in the table).
CAR (Comprehensive, Adequate and Representative) Reserve System	The terms comprehensive, adequate and representative together describe the attributes of an ideal reserve system. These terms are defined in the Australian and New Zealand Environment and Conservation Council's *Guidelines for Establishing the National Reserve System* as: • comprehensiveness – inclusion of the full range of ecosystems recognised at an appropriate scale within and across each bioregion; • adequacy – the maintenance of the ecological viability and integrity of populations, species and communities; and • representativeness – the principle that those areas that are selected for inclusion in reserves reasonably reflect the biotic diversity of the ecosystems from which they derive. In addition to using the scientifically-based CAR criteria, spectacular landforms and scenery as well as natural areas of high public use are also commonly included in parks and reserves.
Catchment	The surface area from which water runs off to a river or any other collecting reservoir
Climate Change	Climate change is a result of global warming, caused by increases in the concentrations of greenhouse gases such as carbon dioxide, methane and nitrous oxide.
Commercial concession	A lease or licence, administered by the Department to conduct commercial operations on lands or waters held by the Conservation Commission or the Marine Parks and Reserves Authority.
Conservation	The protection, maintenance, management, sustainable use, restoration and enhancement of the natural environment
Conspecific	Belonging to the same species.
Critical weight mammals	Mammals weighing between 35 grams and 5.5 kilos.
Cultural Significance	In accordance with the meaning in the Burra Charter, cultural significance means aesthetic, historic, scientific or social value for past, present or future generations.
Culturally Significant Place	The use of the term place in this context has the meaning defined in the Burra Charter that is, of a site, area, land, landscape, building or other work, group of

	buildings or other works, and may include components, contents, spaces and views.
Declared rare flora/fauna	Threatened flora or fauna gazetted under the Wildlife Conservation Act.
Declared species	Either plants that are declared as weeds or animals that are declared as pests. A list of declared species, with their levels of declaration in various areas of the State is published annually in the Government Gazette pursuant to Section 37 of the *Agricultural and Related Resources Protection Act 1976*.
Disjunct	Populations are said to be disjunct when they are geographically separated from the main range.
Ecological community	A naturally occurring biological assemblage that occurs in a particular type of habitat.
Ecosystem	A community or an assemblage of communities of organisms, interacting with one another and the environment in which they live.
Ecological Water Requirements (EWR)	The groundwater regime that will maintain natural values. EWR are often expressed as water level and quality parameters.
Ecosystem	A community or an assemblage of communities of organisms, interacting with one another and the environment in which they live.
Ecotourism	Tourism focused on appreciation of natural values, such as to see particular biota or to visit national parks and other reserves
Eco-lodge	A category of accommodation that meets the philosophy and principles of ecotourism, that requires special care in design, construction and operation so as not to destroy the very resources or qualities tourists come to experience. An eco-lodge should utilise sustainable power, be low energy and incorporate passive design, have minimal water use, and have ecologically sensitive waste disposal and recyclable processing of all waste with no pollutant product.
El Niño Southern Oscillation	A term referring to the extensive warming of the central and eastern Pacific that leads to a major shift in weather patterns across the Pacific.
Endemic	Flora or fauna that is confined in its natural occurrence to a particular region
Environmental Offsets	Environmental offsets aim to ensure that significant and unavoidable adverse environmental impacts are counterbalanced by a positive environmental gain, with a goal of achieving a 'net environmental benefit'.
Environmental Water Provisions (EWP)	The actual water abstraction allocation levels made after consideration of the economic and social requirements for the water.
Environmental weed	An unwanted plant species growing in natural ecosystems that modifies natural processes, usually adversely, resulting in the decline of the communities they invade; usually an introduced plant.
Epoch	A unit of geologic time that is a division of a period.
Estuarine	Relating to a water passage where the tide meets a river current; especially an arm of the sea at the lower end of a river.
Eutrophication	The enrichment of water by nutrients, such as compounds of nitrogen or phosphorus. It causes an accelerated growth of algae and higher forms of plant life. These consume more oxygen often leading to a oxygen deficit, which can have a major detrimental effect on the fish other aquatic organisms
Exotic	A species occurring in an area outside its historically known natural range as a result intentional or accidental dispersal by human activities.
Extant	Still existing.
Fauna	The animals inhabiting an area; including mammals, birds, reptiles, amphibians and invertebrates. Usually restricted to animals occurring naturally and excluding feral or introduced animals.
Feral	A domesticated species that has become wild.
Fire regime	The combination of season, intensity, interval, extent and patchiness of fire in a given area over time.
Flora	The plants growing in an area; including flowering and non flowering plants, ferns, mosses, lichens, algae and fungi (although fungi are strictly speaking not plants). Usually restricted to species occurring naturally and excluding weeds
Floristic diversity	Diversity relating to plants
Fungus	Saprophytic and parasitic spore-producing organisms usually referred to as plants that lack chlorophyll but actually a separate kingdom to plants and animals and include moulds, rusts, mildews, smuts, mushrooms, and yeasts
Genetic	To do with the hereditary units that are composed of sequences of DNA

Geoheritage	State-wide to nationally significant features of geology, including igneous, metamorphic, sedimentary, structural, palaeontologic, geomorphic, pedologic or hydrologic attributes that offer important information or insights into the formation or evolution of the continent; or that can be used for research, teaching or as a reference site.
Geology	The study the history of the earth and its life especially as recorded in rocks.
Geomorphology	The study of the earth surface features and their formation
Germplasm	The genetic material with its specific molecular and chemical makeup that comprises the physical foundation of the hereditary qualities.
Gondwana	The southern supercontinent Gondwana (originally Gondwanaland) included most of the landmasses which make up today's continents of the southern hemisphere, including Antarctica, South America, Africa, Madagascar, India, Australia-New Guinea, New Zealand, and New Caledonia.
Groundwater	All free water below the surface in the layers of the Earths crust.
Habitat	A component of an ecosystem providing food and shelter to a particular organism.
Herpetofauna	Reptiles and amphibians.
Holocene	The present geological time period commencing 10,000 years ago.
Host	The organism from which a parasite obtains its nutrition or shelter
Hydrology	The scientific study of the characteristics of water, especially of its movement in relation to the land
Indigenous	Native or belonging naturally (to a place).
Introduced species	See *Exotic.*
Invertebrate	Animals without backbones, for example, insects, worms, spiders and crustaceans
Jurassic Period	The Jurassic period is a major unit of the geologic timescale that extends from about 195 million years BP at the end of the Triassic to 135 million years BP at the beginning of the Cretaceous. The Jurassic constitutes the middle period of the Mesozoic era, also known as the Age of Dinosaurs. The start of the period is marked by the major Triassic-Jurassic extinction event.
Karst	Term used to describe landscapes that are commonly characterised by closed depressions, subterranean drainage and caves. Karst landscapes are formed principally by solution of the rock, most commonly limestone.
Key performance indicators	The minimum set, which if properly monitored, provides rigorous data describing the major trends in, and impacts on, Australian biodiversity.
Landform	All the physical, recognisable, naturally formed features of land having a characteristic shape; includes major forms such as a plain, mountain or plateau, and minor forms such as a hill, valley or alluvial fan.
Landscape Character Type	A broad scale area of land with common visual characteristics based on an amalgamation of landform, climate, vegetation, water form and land use patterns
Late Cretaceous	The Cretaceous period spans the time between the Jurassic period (~135M BP) through to the beginning of the Tertiary period (65M BP). The Late Cretaceous is significant for all the major body plans of modern life were in place (birds, flowering plants and primitive mammals). The end of the Late Cretaceous is sharply defined, being placed at an iridium rich layer found worldwide that is believed to be associated with the Chicxulub impact crater in Yucatan and Gulf of Mexico dated at 64.3 M BP).
Laurasia	Laurasia was a supercontinent that broke off from the Pangaean supercontinent in the late Mesozoic era. Around 200 million years ago, Laurasia divided into the continents after which it is named: Laurentia (now North America) and Eurasia (excluding India). The southern supercontinent created is called Gondwana.
Lithology	The study and description of the general, gross physical characteristics of a rock, especially sediments composed mainly of broken fragments of pre-existing minerals or rocks that have been transported from their places of origin, including colour, grain size, and composition
Macropod	A member of a super-family that includes kangaroos, rat-kangaroos and wallabies.
Midden	A mound or deposit containing shells, animal bones, and other refuse that

	indicates the site of a human settlement.
Miocene	Fourth epoch of the Tertiary Era. Time period from 23.8 to 5.3 million years ago.
Motile	Exhibiting or capable of movement
National Park	National parks have national or international significance for scenic, cultural or natural values, and can accommodate recreation without detracting from these values. They are managed to conserve wildlife and the landscape for scientific study and to preserve features of archaeological, historical or scientific interest. They are also managed to allow forms of recreation that do not adversely affect their ecosystems or landscapes.
Nature-based tourism	Tourism that is dependent upon the resources of the natural environment and incorporates a range of tourism experiences including adventure tourism, eco-tourism and aspects of cultural and rural tourism
Obligate	Restricted to a single mode of behaviour or environmental condition, such as an obligate aerobe that is dependent on the presence of molecular oxygen to breathe
Palaeocene	Is the first geologic epoch of the Tertiary period of the modern Cenozoic era. Meaning 'early dawn of the recent' it stretches from 64-58 M BP and commenced immediately following the mass extinction event at the end of the Cretaceous, known as the K-T boundary that marks the demise of the dinosaurs.
Palaeontology	The study of life in the geological past.
Paleochannels	Ancient stream or riverbeds, cut into the surrounding soil or rock, which have been re-buried by other sediments after the stream changed its course or dried up.
Pathogen	Any organism (bacterium or virus) or factor that causes disease within a host.
Physiographic Unit	A prominent landform as considered in relation to its origin, cause, or history
Pleistocene	The geological time period commencing about 2 million years ago and ending at the Holocene 10,000 years ago.
Potable	Suitable for drinking.
Priority Flora and Fauna Listings	<u>Priority 1: Poorly known species.</u> Species that are known from one or a few collections or sight records (generally less than 5), all on lands not managed for conservation and under threat of destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. <u>Priority 2 : Poorly known species</u> Species that are known from one or a few collections or sight records (generally less than 5), some of which are on lands not under immediate threat of destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. <u>Priority 3: Poorly known species</u> Species that are known from collections or sight records from several localities not under imminent threat, or from few widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. <u>Priority 4: Rare, Near Threatened and other species in need of monitoring.</u> 1. Rare. Species are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. 2. Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependant, but that are close to qualifying for Vulnerable. 3. Species that have been removed from the list of threatened species during

	the past 5 years for reasons other than taxonomy. Priority 5: Conservation dependant species Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within 5 years.
Quaternary	The present geological period commencing around 2 million years ago, includes the Pleistocene and recent Holocene time periods.
Rehabilitation	The process necessary to return disturbed land to a predetermined state, in terms of surface, vegetational cover, land use and/or productivity.
Relictual/relict species	A surviving individual, population, community or species that is characteristic of an earlier period in evolutionary history. Also an area to which a once more widespread population, species or community is now confined.
Representative	In terms of a comprehensive, adequate and representative protected area reserve system; representative enough that the reserves reflect the biotic diversity of the ecosystems.
Safari camp	A term referring to a tented camp, either semi-permanent or permanent, offering a specific form of accommodation and experience.
Sclerophyll	Pertaining to vegetation with leaves stiffened by mechanical tissue with heavily thickened cell walls, which prevents the leaves from wilting in dry conditions.
Soil erosion	A combination of processes in which soil is loosened, dissolved, or worn away, and transported from one place to another by climatic, biological or physical agents
Spores	Primitive, usually unicellular, reproductive body produced by plants and some micro-organisms and capable of development into a new individual either directly or after fusion with another spore
Statutory	Enacted or required by law.
Stygofauna	Animals that live in underground waters such as those in caves, most being small invertebrates. The term is used to describe an array of subterranean fauna that utilise groundwater habitats to varying degrees, e.g. stygobites are obligatory subterranean species inhabiting groundwater, whereas those that occasionally exploit resources in the groundwater system are referred to as stygophiles.
Sustainability	An aspirational goal to meet the needs of current and future generations through integration of environmental protection, social advancement and economic prosperity.
Swamp	A wetland often partially or intermittently covered with water
Taxa (taxon)	A defined unit (for example, species or genus) in the classification of plants and animals.
Teleost	Of or belonging to the Teleostei – a large group of fishes with bony skeletons, including most common fishes.
Temperate	Of mild temperature, the Temperate Zone is the area or region between the tropic of Cancer and the arctic circle in the Northern Hemisphere or between the tropic of Capricorn and the Antarctic circle in the Southern Hemisphere
Tertiary	The geological period commencing around 65 million years ago and ending at the Quaternary period 2 million years ago includes five defined time periods.
Tethyn	Reference to the tethyn layer of geologic stratification allied with the Tethys Ocean that existed from the Triassic to the Jurassic as Pangea was split into Gondwana and Laurasia.
Threatened ecological community	Threatened ecological communities are assessed by the Department and endorsed by the Minister of Environment and Heritage. They are non-statutory (although some protection is afforded under the Acts of the Department of Environment and Department for Planning and Infrastructure) unless listed under the Commonwealth EPBC Act. There are four categories of threatened ecological communities: presumed totally destroyed, critically endangered, endangered (may be destroyed within 20 years) and vulnerable (may be destroyed within 50 years). As with flora, there are also possible threatened ecological communities that are allocated Priority 1 to 5 within the Department.
Threatened Fauna	Under the WA Wildlife Conservation Act, fauna may be declared as likely to become extinct, rare or otherwise in need of special protection: S1 – Fauna that is rare or likely to become extinct

	S2 – Fauna presumed extinct but might be rediscovered S3 – Birds protected under an international agreement S4 – Other specially protected fauna. Under the Commonwealth EPBC Act, fauna listed under Section 179 may be: EX – Extinct EW – Extinct in the wild CR – critically endangered EN – endangered VU – vulnerable CD – Conservation dependent Under IUCN Red List categories, fauna may be listed the same as under the EPBC Act.
Total Grazing Pressure	The total impact of all grazing animals on a particular area including the impact of native and feral animals (and domestic stock if applicable).
Tourism	Generally considered in this management plan to be recreational activity undertaken by visitors who have travelled from outside the area and/or stay one night or more away from their usual place of residence (Department *Policy Statement No. 18 – Recreation, Tourism and Visitor Services* [DEC 2006]).
Troglobites	Subterranean fauna that lives within and has obligatory dependence upon subterranean air filled voids such as cave environments, and that exhibits adaptation to underground life (e.g. eyeless, non-pigmented, with long antennae and limbs).
Troglofauna	Animals that live in subterranean air filled voids such as caves, most being small invertebrates. The term is used to encompass an array of fauna that utilise subterranean environments to varying degrees, e.g. troglophiles which use caves facultatively and trogloxenes which frequently occur in caves but do not complete their life cycle there and usually feed outside of caves.
Tropical	A region or climate that is frost-free with temperatures high enough to support year-round plant growth given sufficient moisture, the Tropical Zone is the land between the tropic of Cancer and the tropic of Capricorn
Turbidity	Discolouration of water due to suspended silt or organic matter.
Understorey	The shrubs and plants that grow beneath the main canopy of a forest
Vascular plants	Plants that have a specialised circulatory or conducting system that includes xylem and phloem.
Vectors	An organism that transmits a pathogen
Vegetation complex	A combination of distinct site vegetation types usually associated with a particular geomorphic, climatic, floristic and vegetation structural association.
Vertebrate	Animals that have a spinal column which includes fish, amphibians, reptiles, birds and mammals
Visual Landscape	Appearance or visual quality of an area determined by its geology, soils, landforms, vegetation, water features and land use history.
Wetland	Land or areas (as tidal flats or swamps) containing much soil moisture
Wilderness	Is a region where the land is left in a state where human modifications are minimal and has not historically been significantly modified by direct or indirect human activity.
Wildfire	Fire that burns in an uncontrolled manner.

ACRONYMS

ANZECC	Australian and New Zealand Environment and Conservation Council
ARRP Act	Agricultural and Related Resources Protection Act
AS	Australian Standard
BRM	Basic Raw Materials
CALM	Department of Conservation and Land Management
CAMBA	China Australia Migratory Bird Agreement
CAR	Comprehensive, adequate and representative protected area reserve system.
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTO	Commercial Tour Operator
DEC	Department of Environment and Conservation
DEWHA	Department of Environment, Water, Heritage and the Arts (Federal)
DIA	Department of Indigenous Affairs
DAFWA	Department of Agriculture & Food
DMP	Department of Mines and Petroleum
DOIR	Department of Industry and Resources
DoF	Department of Fisheries
DoW	Department of Water
DPI	Department for Planning and Infrastructure
DRF	Declared Rare Flora
EPA	Environment Protection Authority
EPBC Act	Environmental and Biodiversity Conservation Act
EWS	Environmental Weed Strategy for Western Australia
FESA	Fire and Emergency Services Authority
FMU	Fire Management Unit
FNA	Fly Neighbourly Advice
FPC	Forest Products Commission
IBRA	Interim Biogeographic Regionalisation for Australia
IMCRA	Interim Marine and Coastal Rationalisation for Australia
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JAMBA	Japan Australia Migratory Bird Agreement
KPI	Key Performance Indicator
LCU	Landscape Conservation Unit
LCT	Landscape Character Type
MRWA	Main Roads Western Australia
NRM	Natural Resource Management
NRSP	National Reserve System Program
NWI	National Wilderness Inventory
NVIS	National Vegetation Information System
RATIS	Recreation and Tourism Information System
ROKAMBA	Republic of Korea Australia Migratory Bird Agreement
STCRC	Sustainable Tourism Cooperative Research Centre
TEC	Threatened Ecological Community
UCL	Unallocated Crown land
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WAM	Western Australian Museum
WATSSC	Western Australian Threatened Species Scientific Committee

YINDJIBARNDI LANGUAGE GLOSSARY

Yindjibarndi Name	English Name	Yindjibarndi Name	English Name
Balingu	fish	Jiruna	pelican
Bargunyji	Pilbara olive python	Jurdirri	kingfisher
Baru, Yalhi	spinifex	Karlamilyi	Rudall River
Bawuny	grass	Marruwa, Warndayin, Burduwayi, Burlurru, Barbirrny, Gurrarra, Murnungu, Yirringan, Ganyji, Gurganyan, Muwarlingu, Garrga, kanji	acacias
Bayuwanarra, Bajarri	kangaroo	Mayangarli	shelter
Birna, Gumbujuja, Murrunmurrun, Ngardawinkura, Nguyawinkura, Nhankamirndij	beetles	Minkala	the Sky God
Biyangarra	white dragon tree	Murlumurlu	Ptilotus
Biyangarra	*Stemodia grossa*	Murlunmunjurna	Crossing Pool
Bunaangu	bloodwood	Ngardangarli	Indigenous people
Buwaa	cormorant	Ngardangarliyarndu	Indigenous people's
Gagingarli	birds	Ngarrawirri	flat-shelled turtle
Galharra	skin system	Ngurra Nyujung Gamu	The Dreaming (When the World was Soft)
Galharra	Yindjibarndi kinship system	Nhangganguna	Deep Reach Pool
Ganbarr-ngarli	spider	Nyindangarli, Wundungarli	pools
Garandarri	wood duck	Thaawu-ngarli, Jagajagara	gecko
Garduwarli	bilby, burrowing bettong	Thaawuthungganha	Palm Pool
Garjadi-ngarli, Gajadi	monitor lizard	Waramurrungga	bat
Garlawirrura	dragonfly	Warlu-ngarli, Warlu	snake
Gurdarnkurdarn	parrot	Warra-ngarli	damselfly
Gurdi	pebble mound mouse	Warrgi	possum, spectacled hare-wallaby
Gurlimba, Majgan, Muyiling, Wirranggaa, Yayin, Wirlu	eucalypts	Wirlu	coolabah
Gurndi	land snail	Wirndamarra	mulga
Gurndi	water mites	Wirrangarli, Yarrangarli, Murrudungarli, Walbarrangarli, Gujadangarli, Wanungarli	ornaments
Jamingarli	medicine	Wirranggaa	rivergum
Janyjin Nhundayarndu	ceremonies	Wundungarli	rivers and creeks
Jarraarn-ngarli	frog	Yarnda Nyirranha	Fortescue River
Jinawarrmarnda Gajadi-ngarli	legless lizard	Yirriwardu	marsupial
Jirndawurrunha	Chinderwarriner Pool	Yirryinha	Mt Florence
Jirriny	Millstream palm	Yujurli, Yujurli-ngarli	skink

Yindjibarndi Name	English Name	Yindjibarndi Name	English Name
Marba	cadjeput		
Marrgangarli	man		

YINDJIBARNDI AND NGARLUMA PRONUNCIATION GUIDE

a as in the **a** in **father**
aa longer than **a,** as the **a** in **far**
i as the **i** in **fin**
ii as the **i** in **ski**
u as the **u** in **put**
uu as the **u** in **flu**
b between the English **p** and **b**
d between the English **t** and **d**
rd between English **t** and **d**, said with the tip of the tongue curled back
g between English **g** and **k**
k between English **k** and **g** (only appears after **n** (**nk**) to prevent confusion with the **ng** sound)
j similar to the **j** in jaw except further back; **j** made with the tongue in the middle of the roof of your mouth. English does not have this sound.
l as the **l** in **law**
lh as the **l** in **law** but with the tongue blade pressed against the top of the front teeth.
rl as the **l** in **law** but the tip of the tongue curled back.
ly as the **lli** in **million**
m as the **m** in **mother**
n as the **n** in **nature**
ng as the **ng** in **sing**
nh as the **n** in **niece** but with the tongue blade pressed against the top of the top front teeth.
rn as the **n** in **nature** but with the tip of the tongue curled back
ny as the **ny** in **canyon**
rr trilled
th similar to the **th** in **think** but with the tongue blade pressed against the top front teeth and the sound stopped quickly. English does not have this sound.
w as the **w** in **water**
y as the **y** in **yellow**.

In Yindjibarndi the main stress of a word always falls on the first syllable:

***tharn*-ku**	bullant
***ja*-rru**	march fly
***ba*-ru**	hard Spinifex
***garr*-ga**	Maitland's wattle

If the word has more than two syllables, the first and third syllables are stressed.

***yi*-rri-*wa*-rdu**	northern quoll
***gu*-rru-*man*-thu**	goanna
ma*-rru-*wa	snakewood
***barl*-ga-*rri*-ngu**	Hamersley bloodwood (Juluwarlu Aboriginal Corporation ?, 2005)

REFERENCES

Anthony, J.M. and Dixon, I.R. (2006). *Research and Development for Integrated Control of* Acetosa vesicaria *(ruby dock) in the Pilbara Region of Western Australia.* Botanic Gardens and Parks Authority, West Perth

Australia/ICOMOS (2000). *The Burra Charter: the Australia ICOMOC Charter for Places of Cultural Significance.* Australia ICOMOS Incorporated.

Baker, B., Barnett, G and Howden, M. (2000). Carbon sequestration in Australia's rangelands. In: Keenan, R., Bugg, A.L., Ainslie, H. (eds) *Management Options for Carbon Sequestration in Forest, Agricultural and Rangeland Ecosystems.* Cooperative Research Centre for Greenhouse Accounting. Canberra.

Beard, J. S. (1975). *Vegetation Survey of Western Australia. Pilbara. 1:1,000,000 Vegetation Series. Explanatory Notes to Sheet 5.* University of Western Australia Press, Nedlands

Bettenay, E., Churchward, H. M. and McArthur, W. M. (1967). *Atlas of Australian Soils. Explanatory Data for Sheet 6. Meekatharra - Hamersley Range Area.* CSIRO Australia. Melbourne University Press.

Biota Environmental Sciences Pty Ltd (2005). *Fauna Habitats and Fauna Assemblages of the Broc kilometresan Syncline 4 Project, near Tom Price. Seasonal Survey Report. Prepared for Hamersley Iron Pty. Ltd.* Biota Environmental Sciences Pty. Ltd., North Perth.

Burbidge, A.A. (1971). *Results of a Biological Survey of the Millstream Area. Report VII*. Department of Fisheries and Fauna, Western Australia. Perth.

Burbidge, A. A. (1985). Fire and mammals in hummock grasslands of the arid zone. In: Ford, J. R. (ed.), *Fire Ecology and Management in Western Australian Ecosystems.* Western Australian Institute of Technology, Environmental Studies Group Report No. 14.

Burbidge, A.A. and McKenzie, N.L. (1989) Patterns in the modern decline of Western Australia's vertebrate fauna: causes and conservation implications. *Biological Conservation* 50: 143-198.

Burrows N.D. (2004) *Draft Guiding Principles for Fire Management in Spinifex Grasslands of Western Australia. Internal Workshop*, Department of Conservation and Land Management, Perth.

Burrows, N. (2002). *Fire Regimes for Conservation of Biodiversity in South-West Forests and Associated Ecosystems: A Concept for Discussion.* Draft paper.

Burrows N.D., Burbidge, A.A., and Fuller, P.J. (2000). *Nyaruninpa: Pintupi Burning in the Australian Western Desert.* Department of Conservation and Land Management, Kensington.

Burrows, N., Ward, B. and Robinson, A. (1991). Fire behaviour in spinifex fuels on the Gibson Desert Nature Reserve, Western Australia. *Journal of Arid Environments*, 20:189-204.

Burrows, N.D. and Christensen, P.E.S. (1991). A survey of Aboriginal fire patterns in the Western Desert of Australia. In S.C Nodvin and T.A Waldrop (eds.) *Fire and the Environment: Ecological and Cultural Perspectives: Proceedings from an International Symposium*, Knoxville, Tennessee.

Bushfires Council of the Northern Territory (1997). *History*. www.nt.gov.au/ipe/bfc/history.htm. Accessed 23 September 2005.

CALM (1986a). *Policy Statement Number 10 – Rehabilitation of Disturbed Lands.* Department of Conservation and Land Management, Perth.

CALM (1986b). *Policy Statement Number 14 – Weeds on CALM Land.* Department of Conservation and Land Management, Perth.

CALM (1988). *Policy Statement Number 25 – Community Education and Interpretation.* Department of Conservation and Land Management, Perth.

CALM (1989). *Policy Statement Number 34 – Visual Resource Management on Lands and Waters Managed by CALM*. Department of Conservation and Land Management, Perth.

CALM (1991). *Policy Statement Number 15 – Community Involvement (Public Participation and Volunteers).* Department of Conservation and Land Management, Perth.

CALM (1994). *Reading the Remote. Landscape Characters of Western Australia*. Department of Conservation and Land Management, Western Australia.

CALM (1996). *Exotic Palm Control at Millstream Chichester National Park. Interim Management Guidelines.* Department of Conservation and Land Management, Karratha.

CALM (1997). Policy Statement Number 53 - *Visitor Risk Management*. Department of Conservation and Land Management, Perth.

CALM (1999a). *Karijini National Park Management Plan 1999-2009. Management Plan No. 40.* Department of Conservation and Land Management, Perth.

CALM (1999b). *Environmental Weeds Strategy for Western Australia.* Department of Conservation and Land Management, Como.

CALM (2000) *Public Participation Manual.* Department of Conservation and Land Management, Kensington.

CALM (2003). *Establishment of Comprehensive, Adequate and Representative Terrestrial Conservation Reserve System in Western Australia.* Department of Conservation & Land Management, Kensington.

CALM (2004). *Policy Statement Number 62 – Identification and Management of Wilderness and Surrounding Areas.* Department of Conservation and Land Management, Perth.

CALM (proposed). *Policy Statement Number 9 – Conservation of Threatened Flora in the Wild. (revision - subject to final consultation).* Department of Conservation and Land Management, Perth

CALM (proposed). *Policy Statement Number 41 – Beekeeping on Public Land. (revision - subject to final consultation).* Department of Conservation and Land Management, Perth

CALM (proposed). *Policy Statement – Environmental Weed Management. (revision - subject to final consultation).* Department of Conservation and Land Management, Perth

Chester, B. (1998). *River Management Options for Crossing Pool on the Fortescue River at Millstream.* Water and Rivers Commission, Perth.

Clark, R. N. and Stankey, G. H. (1979). *The Recreation Opportunity Spectrum: A Framework for Planning, Management, and Research.* General Technical Report PNW9. US Department of Agriculture.

Collins, D.A., Della-Marta, P.M., Plummer, N. and Trewin, B.C. (2000). Trends in annual frequencies of extreme temperature events in Australia. *Australian Meteorological Magazine* 49: 277-92.

CONCOM (1985). *Concession Management in National Parks and Other Protected Areas.* Report of the Council of Nature Conservation Ministers (CONCOM) Working Group.

Conservation Commission of Western Australia (2006). *Basic Raw Materials: Government and Local Government Access to Conservation Estate (National Parks, Nature Reserves and Conservation Parks).* Conservation Commission of Western Australia, Perth.

Copp, I. (2005). *Geology and Landforms of the Pilbara*. Department of Conservation and Land Management, Kensington.

CRC for Australian Weed Management (2008). *Weed Management Guide: Buffel Grass (*Chenchrus ciliaris*).* CRC for Australian Weed Management, Adelaide

CSIRO (2001). *Climate Change: Impacts for Australia*. www.dar.csiro.au/iawg/impacts2001.pdf Accessed 3 January 2006.

CSIRO (2007) *Climate Change in Australia*. Commonwealth Scientific and Industrial Research Organisation and Bureau of Meteorology. Australia. Technical Report 2007.

Dames and Moore (1975). *Environmental Investigations: Gregory and Dogger Gorge Dam Sites, Fortescue River, Western Australia. Part I – Report.* A Report to the Public Works Department Western Australia.

Dames and Moore (1984). *Millstream Water Management Program.* Report to Engineering Division, Public Works Department Western Australia.

Davidson, W.A. (1969) Millstream Hydrological Investigation. Geological Survey of Western Australia Record No. 1969/3. Geological Survey of Western Australia, East Perth.

D.C. Blanford and Associates (1999). *Millstream Erosion Survey: A Review of Erosion Status and Management Options for Crossing Pool.* Prepared for Sinclair Knight Merz Pty. Ltd.

de la Rue, K. B. (1979). *Pearl Shell and Pastures: The Story of Cossack and Roebourne, and Their Place in the History of the North West From the Earliest Explorations to 1910.* Cossack Project Committees.

DEC (2006). *Policy Statement Number 18 – Recreation, Tourism and Visitor Services.* Department of Environment and Conservation, Kensington

DEC (2007a). *Good Neighbour Policy – July 2007.* Department of Environment and Conservation, Perth

DEC (2007b). *Disability Access and Inclusion Plan*. Department of Environment and Conservation, Perth.

Department of Aboriginal Sites (1978). *Aboriginal Sites on the Fortescue: Portland River to Millstream. March 1978.*

Department of Agriculture (2002). *Greenhouse, Land Management and Carbon Sequestration in Western Australia.* Department of Agriculture, South Perth.

Department of Agriculture and Agricultural Protection Board of WA (2005). *Western Australia Wild Dog Management Strategy 2005.* Department of Agriculture and Agricultural Protection Board of WA, South Perth.

Department of Conservation and Land Management (2002). *Corporate Plan 2002-2005*. Department of Conservation and Land Management, Perth.

Department of Environment (2004). *Land Use Compatibility in Public Drinking Water Source Areas. Water Quality Protection Note.* Department of Environment, Western Australia.

Department of the Environment and Heritage (1995). *Action Plan for Australian Rodents.* http://www.deh.gov.au/biodiversity/threatened/action/rodents/rodap6.html Accessed 18 October, 2005.

Department of the Environment and Heritage (1999). *The Action Plan for Australian Bats.* http://www.deh.gov.au/biodiversity/threatened/action/bats/16.html Accessed 18 October, 2005.

Department of the Environment and Heritage (2000). *The Action Plan for Australian Birds.* http://www.deh.gov.au/biodiversity/threatened/action/birds2000/pubs/star-finch-s.pdf. Accessed 18 October, 2005.

Department of the Environment and Heritage (2004a) *National Biodiversity and Climate Action Plan 2004-2007* http://www.deh.gov.au/ biodiversity/publications/nbccap Accessed 2 February 2005.

Department of the Environment and Heritage (2004b) *Biodiversity Hotspots.* http://www.deh.gov.au/biodiversity/hotspots/index.html Accessed 24 April, 2006.

Department of the Environment and Heritage (2006). *Australian Faunal Directory* http://www.deh.gov.au/cgi-bin/abrs/fauna/details.pl?pstrVol=ODONATA;pstrTaxa=887;pstrChecklistMode=1 Accessed 22 November 2006.

Department of Fisheries (2005). *A Five-Year Management Strategy for Recreational Fishing in the Pilbara/Kimberley Region of Western Australia. Final Report of the Pilbara/Kimberley Recreational Fishing Working Group. Fisheries Management Paper No. 193*. Department of Fisheries, Perth.

Department of Industry and Resources (1998). *Guidelines for Mineral Exploration and Mining within Conservation Reserves and other Environmentally Sensitive Lands in Western Australia.* Information Series 11, Department of Industry and Resources, Perth.

Department of Local Government and Regional Development and Pilbara Development Commission (2003). *Pilbara Economic Perspective. An Update on the Economy of Western Australia's Pilbara Region.* Department of Local Government and Regional Development and Pilbara Development Commission, West Perth.

Department of Mineral and Petroleum Resources (2002). *Stromatolites: Earths Earliest Life Forms From Western Australia's Pilbara Region.* http://www.dme.wa.gov.au/comandenvir/ancientfossils/wa.htm Accessed 24 April 2006

Department for Planning and Infrastructure (2005). *The 2015 Exclusion Process*. http://www.dpi.wa.gov.au/pastoral/process.html

Environment Australia (1998).*Conservation Guidelines for the Management of Wild River Values.* Environment Australia. Canberra. http://www.heritage.gov.au/anlr/wild_riv/guide/home.html Accessed 2 January 2007.

Environment Australia (2001a). *A Directory of Important Wetlands in Australia* http://www.deh.gov.au/cgi-bin/wetlands/report.pl Accessed 6 January 2006.

Environment Australia (2001b). *An Interim Biogeographical Regionalisation of Australia* www.ea.gov.au/parks/nrs/ibraimcr/ibra_spatial/pil.html Accessed 21 October 2005.

Environment Conservation Council (2001). Apiculture. *In: Box-Ironbark Forests and Woodlands Investigation – Final Report.* http://www.nre.vic.gov.au/ecc/BOX-IRON/Final/chapters/BIfinalchap9s.pdf

EPA (2006) *Environmental offsets*. Position Statement No. 9. Environmental Protection Authority. Perth, Western Australia.

Federal Chamber of Automotive Industries (2005). *Vehicle Sales.* http://www.fcai.com.au/sales/ Accessed 29 December 2005.

Finston, T.L. and Johnson, M.S. (2004). Geographic patterns of genetic diversity in subterranean amphipods of the Pilbara, Western Australia. *Marine and Freshwater Research* 55: 619-628

Fischlin, A., G.F. Midgley, J.T. Price, R. Leemans, B. Gopal, C. Turley, M.D.A. Rounsevell, O.P. Dube, J. Tarazona, A.A. Velichko, 2007.

Ecosystems, their properties, goods, and services. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, 211-272.

Government of Western Australia (2003). *Indigenous Ownership and Joint Management of Conservation Lands in Western Australia*. Consultation Paper. Perth, Western Australia.

Gregory, Sir A. C. (1981). *Journals of Australian Explorations.* W.A.Hesperian Press, Victoria Park.

Griffin, G. F., Price, N. F. and Portlock, H. F. (1983). Wildfires in the central Australian rangelands. *Journal of Environmental Management*, 17: 311-323.

Gross, C. L. (2001). The effect of introduced honeybees on native bee visitation and fruit-set in *Dillwynia juniperina* (Fabaceae) in a fragmented ecosystem. *Biological Conservation* 102: 89-95.

Gross, C. L. and Mackay, D. (1998). Honeybees reduce fitness in the pioneer shrub *Melastoma affine* (Melastomataceae). *Biological Conservation* 86: 169-178.

Harvey, M.S. (2002). Short-range endemism among Australian fauna: some examples form non-marine environments. *Invertebrate Systematics*. 16: 555-570

Haynes, C.D. (1991). Use and impacts of fire. In C.D. Haynes, M.G Ridpath and M.A.J. Williams (eds) *Monsoonal Australia: Landscape, Ecology and Man in the Northern Lowlands.* Balkema Rotterdam.

Howden, M., Hughes, L., Dunlop, M., Zethoven, I., Hilbert, D., and Chilcott, C. (2003). *Climate Change Impacts on Biodiversity in Australia. Outcomes of a Workshop Sponsored by the Biological Diversity Advisory Committee, 1-2 October.* Commonwealth of Australia, Canberra.

Hughes, L. (2003). Climate change and Australia: Trends, projections and impacts. *Austral Ecology* 28: 423-443.

Humphreys, W.F. (2003). *Life in Caves.* http://www.wetlandcare.com.au/Content/anmviewer.asp?a=89&print=yes per cent94 Accessed 27 January 2004.

Hussey, B.M.J, Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd S.G. (1997). *Western Weeds. A Guide to the Weeds of Western Australia.* The Plant Protection Society of Western Australia. Victoria Park.

IPCC (2001). *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. http://www.grida.no/climate/ipcc_tar/wg1/index.htm\ Accessed 10 February 2005

IPCC (2007a) Summary for Policy Makers. In: Climate Change 2007. The Physical Science Basis. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. [Solomon, S., D. Qin, M. Manning,
Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC, (2007b): Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E.Hanson, Eds., Cambridge University Press, Cambridge, UK.

Juluwarlu Aboriginal Corporation (?). *Wanggalili. Yindjibarndi and Ngarluma Plants.* Juluwarlu Aboriginal Corporation, Roebourne.

Juluwarlu Aboriginal Corporation (2005) *Gurruragan. Yindjibarndi Fauna.* Juluwarlu Aboriginal Corporation, Roebourne.

Kanowski, P.J., Cork, S.J., Lamb, D. and Dudley, N. (2001). Assessing success of off-reserve forest management in contributing to biodiversity conservation. In R.J. Raison, A.G Brown and D.W Flinn. (eds) *Criteria and Indicators for Sustainable Forest Management.* IUFRO 7 Research Series CABI Publishing, United Kingdom.

Kendrick P (2002). Pilbara 2 (PIL2 – Fortescue Plains subregion). In: J.E. May and N.L. McKenzie (eds). *A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002.* Department of Conservation and Land Management, Wanneroo pp 559-567.

Kendrick, P and McKenzie, N (2002). Pilbara 1 (PIL1 – Chichester subregion. In: J.E. May and N.L. McKenzie (eds). *A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002.* Department of Conservation and Land Management, Wanneroo pp 547-558

Kendrick, P. and Stanley, F. (2002). Pilbara 4 (PIL4 – Roebourne synopsis). In: J.E. May and N.L. McKenzie (eds). *A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002.* Department of Conservation and Land Management, Wanneroo pp 581-593.

Kee, S (1985). *Report of the Archaeological Salvage Project at Aboriginal Sites P5138 and P5139/P5140 Chichester Range, Pilbara, WA.*

Kriewaldt, M. and Ryan, G.R. (1976). *Pyramid, Western Australia [kit]*. Bureau of Mineral Resources, Geology and Geophysics, Canberra.

Jaensche, R, P. (2001). Millstream Pools – WA069. In: *A Directory of Important Wetlands,* Third Edition. Environment Australia, Canberra.

Lane P (2004). *Geology of Western Australia's National Parks: Geology for Everyone*. Peter Lane, Margaret River.

Latz, P. (1994). Fire in the desert. Increasing biodiversity in the short term, decreasing it in the long term. In: D. Bird Rose (ed.). *Country in Flames. Proceedings of the 1994 Symposium on Biodiversity and Fire in North Australia.* Biodiversity Unit, Department of the Environment, Sport and Territories and North Australia Research Unit, The Australian National University, Canberra and Darwin.

Lipple, S. (1996). *Land Access Report EV124. Millstream Chichester and Mungaroona Range Management Plan: Comments on Geology and Mineral Potential.* Department of Minerals and Energy, Perth.

Main Roads Western Australia (1996). *Strategic Directions: Main Roads Western Australia. Managing a Multi-billion Dollar Asset.* Main Roads Western Australia, Perth.

Matthews, E. (1984). To bee or not....?! Bees in National Parks? *Australian National Parks Association Magazine*, South Australia.

May, J.E. and McKenzie, N.L. (2003). *A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002.* Department of Conservation and Land Management, Perth. pp724.

Maslin, B.R. and van Leeuwen, S (2005). *Wattles of the Pilbara Project.* <http://www.worldwidewattle.com/infogallery/misc/pilbara.php>. Accessed 29 September 2005.

McKenzie, N.L., May, J.E. and McKenna, S. (2003). *Bioregional Summary of the 2002 Biodiversity Audit for Western Australia.* Department of Conservation and Land Management, Como.

Morgan, D.L. and Gill, H.S. (2004). Fish fauna in the inland water of the Pilbara (Indian Ocean) Drainage Division of Western Australia – evidence for three subprovinces. *Zootaxa* 636: 1-43.

Morton, S.R., Short, J. and Barker, R.D. (1995). *Refugia for Biological Diversity in Arid and Semi-arid Australia. Biodiversity Series, Paper No. 4.* Department of Environment and Heritage, Canberra. <http://www.deh.gov.au/biodiversity/publications/series/paper4/biol1029.html> Accessed 10 June 2005.

New South Wales National Parks and Wildlife Service (2002). *Competition from Feral Honeybees as a Key Threatening Process - An Overview.* New South Wales National Parks and Wildlife Service.

Ngurawaana Community (1995). *Ngurawaana Community Plan*. Developed by the Community and Committee Members of Ngurawaana with assistance from the Pilbara Development Commission.

Nicholson, P.H. (1981). Fire and the Australian Aborigine – an enigma. In A.M Gill, R.H Groves, and I.R. Noble (eds.). *Fire and the Australian Biota*. Australian Academy of Science, Canberra.

Paczkowska, G and Chapman, A.R., (2000). *The Western Australian Flora: A Descriptive Catalogue.* Wildflower Society of Western Australia, Western Australian Herbarium, CALM and Botanic Gardens and Parks Authority, Nedlands.

Paton, D.C. (1993). Honeybees in the Australian environment: does *Apis mellifera* disrupt or benefit the native biota? *BioScience* 43: 95-103.

Paton, D.C. (1996). *Overview of Feral and Managed Honeybees in Australia: Distribution, Abundance, Extent of Interactions with Native Biota, Evidence of Impacts and Future Research.* ANCA, Canberra.

Paton, D.C. (2000). Disruption of bird-plant pollination systems in southern Australia. *Conservation Biology* 14: 1232-1234.

Pilbara Development Commission (2002). *Pilbara Development Commission.* www.pdc.wa.gov.au Accessed 23 May 2003.

Pilbara Development Commission (2006). *Pilbara Economic Perspective.* Pilbara Development Commission, Department of Local Government and Regional Development, Port Headland. http://www.pdc.wa.gov.au/DataStore/PilbaraEconomicPerspective2006.pdf. Accessed 17 January 2007.

Pouliquen-Young O. and Newman P. (2000). *The Implications of Climate Change for Land-Based Nature Conservation Strategies. Final Report 96/1306.* Australian Greenhouse Office, Environment Australia, Canberra; Institute for Sustainability and Technology Policy, Murdoch University, Perth

Prosser, G. (1986). The Limits of Acceptable Change: An Introduction to a Framework for Natural Area Planning. *Australia Parks and Recreation*. Summer 1986.

Pyne, S.J. (1991). *Burning Bush: A Fire History of Australia.* Henry Holt and Company, New York.

Quin B. (2003). *The Pilbara: Cradle of an Ancient Civilisation*. Pilbara Tourism Association and Department of Aboriginal Affairs. Western Australia.

Regional Development Council (2001). http://www.regional.wa.gov.au/snapshot/regeco.asp

Ride, W.D.L. (1959). A Museum expedition to the Hamersley Range. *Australian Museum Magazine* 13 (3): 94-98.

Rijavec, F., Solomon, R., Harrison, N. and Nurigen Aboriginal Corporation (2005). *Exile and the Kindom (videorecording).* Film Australia, Linfield.

Robertson, M., Vang, K. and Brown, A. J. (1992). *Wilderness in Australia: Issues and Options. A Discussion Paper.* Written for the Minister for the Arts, Sport, Environment and Territories. Australian Heritage Commission, Canberra.

Ruddock, I. (1999) Mineral occurrences and exploration potential of the west Pilbara. *Geological Survey Western Australia Report 70.*

Ruprecht, J and Ivanescue, S. (2000). *Surface Hydrology of the Pilbara Region. Summary Report.* Surface Water Hydrology Series. Unpublished Report. SWH 32. Water and Rivers Commission, East Perth

Scheltema, M. (1981). *To Bee or Not To Bee: Honey Bee Utilisation of National Parks in Western Australia.* Perth, Western Australia.

Schwarz, M.P. and Hogendoorn, K. (1999). Biodiversity and conservation of Australian native bees. In W Ponder and D. Lunney, (eds.) *The Other 99 per cent. The Conservation and Biodiversity of Invertebrates.* Royal Zoological Society of New South Wales, Mosman: 388-393.

Sharp, E. I. (1979). *Some Ghosts, Some Not.* Published by the author.

Sinclair Knight-Merz (1999). *River Management Options for Crossing Pool on Fortescue River at Millstream. Final Report.* Sinclair Knight Merz, Perth.

Standards Australia (2001). *Australian Standard Walking Tracks: Part 1 Classification and Signage. AS 2156.1.* Standards Australia International, Sydney.

Strahan, R (1995). *The Mammals of Australia.* Reed Books, Sydney.

Taylor, N. E. W. (1987). *Yeera-muk-a-doo: A Saga of the North West. An Authentic History of the First Settlement of North West Australia Told Through the Withnell and Hancock Families, 1861-1890.* W.A.: Hesperian Press, Carlisle.

Thackway, R. and Cresswell, I.D. (1995). *An Interim Biogeographic Regionalisation of Australia: A Framework for Establishing the National System of Reserves, Version 4.0.* Australian Nature Conservation Agency, Canberra.

Thomson, P. C. (1984). The use of buffer zones in dingo control. *Western Australian Journal of Agriculture* 25: 32-33.

Tindale, N.B (1974). *Aboriginal Tribes of Australia*. ANU Press, Canberra.

Tourism Western Australia (2007). *Australia's North West. Destination Development Strategy. An Action Plan Approach Update 2007-2017.* Tourism Western Australia, Perth.

Tourism Western Australia (2005). *Pilbara Tourism Fact Sheet 2004.* Tourism Western Australia, Perth.

Town of Port Hedland (2005). *Town of Port Hedland*. http://www.porthedland.wa.gov.au/ Viewed 31 October, 2005.

Tropical Savannas CRC (1997). *Impact of Aboriginal Burning.* www.savana.ntu.edu.au/publications/savana_links4/aboriginal_burning.html Accessed 20 October 2005.

Tu, M. (2002). *Element Stewardship Abstract for* Cenchrus ciliaris L. The Nature Conservancy's Wildland Invasive Species Team, Department of Vegetable Crops and Weed Sciences, University of California.

van Leeuwen, S. (1984). *Rare and Geographically Restricted Plants of the Fortescue Botanical District.* Unpublished Report No. 24. Fisheries and Wildlife Department of WA.

Van Vreeswyk, A.M.E, Payne, A.L., Leighton, K.A and Hennig (2004). *An Inventory and Condition Survey of the Pilbara Region, Western Australia.* Technical Bulletin No. 92. Department of Agriculture, South Perth.

Water and Rivers Commission (1999). *Millstream Water Reserve. Water Source Protection Plan. West Pilbara Water Supply Scheme.* Water and Rivers Commission Report WRP 32. Water and Rivers Commission, East Perth.

Water and Rivers Commission (2001). *Central Pilbara Groundwater Study. Hydrogeological Record Series HG8.* Water and Rivers Commission, East Perth.

Water and Rivers Commission (2003). *Policy and Guidelines for Recreation Within Public Drinking Water Source Areas on Crown land. State-wide Policy 13.* Water and Rivers Commission, Perth.

Water Authority of Western Australia (1992). *Millstream Environmental Management Program.* September 1992. Water Authority of Western Australia, Perth.

Water Corporation (2001). *Briefing note – West Pilbara Water Supply – Harding Dam Water Treatment Plant.*

Water Corporation (2002) *Media Release: Water Corporation Will Continue to Work with Regulators to Ensure Millstream Not Over Stressed.* http://www.watercorporation.com.au/m/media_detail.cfm?id=2969 Accessed 10 May 2007.

Welker Environmental Consultancy (1995). *Millstream Environmental Water Requirements Study. Report to the Water Authority of Western Australia. Report No. 95/7.*

Welker Environmental Consultancy, A. J. Peck and Associates Pty Ltd, Muir Environmental (1998) *Millstream Water Management Plan.* Report to the WA Water Corporation. Report Reference WCO 96-1.

Western Australian Museum (2003). *Faunabase.* http://www.museum.wa.gov.au/faunabase/prod/index.htm Accessed 23 May 2005.

Western Australian Tourism Commission (1996). *Western Australian Travel Survey (WATS) for the Pilbara Region, 1994-1995. Summary of Key Findings*. Western Australian Tourism Commission.

Western Australian Tourism Commission and CALM (1997). *Nature Based Tourism Strategy for Western Australia*. Western Australian Tourism Commission.

Western Australian Tourism Commission (2003). *Pilbara Region: Tourism Product and Infrastructure Development Plan, 2004-2013*. Western Australian Tourism Commission, Karratha.

Whitlock, F.L. (1923). A trip to the Fortescue River and Hamersley Ranges, North-west Australia. *Emu* 22: 259-273.

PERSONAL COMMUNICATIONS

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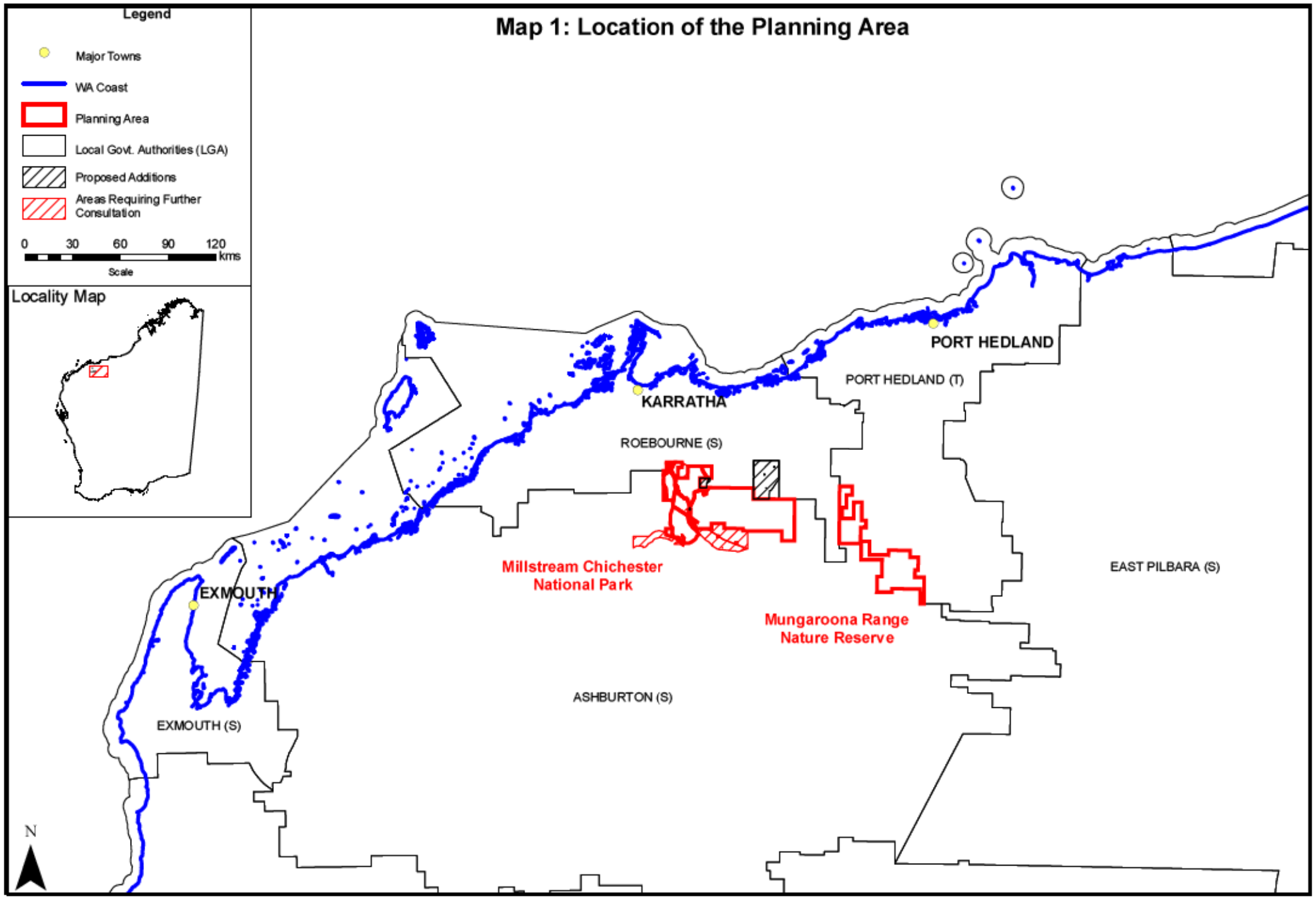
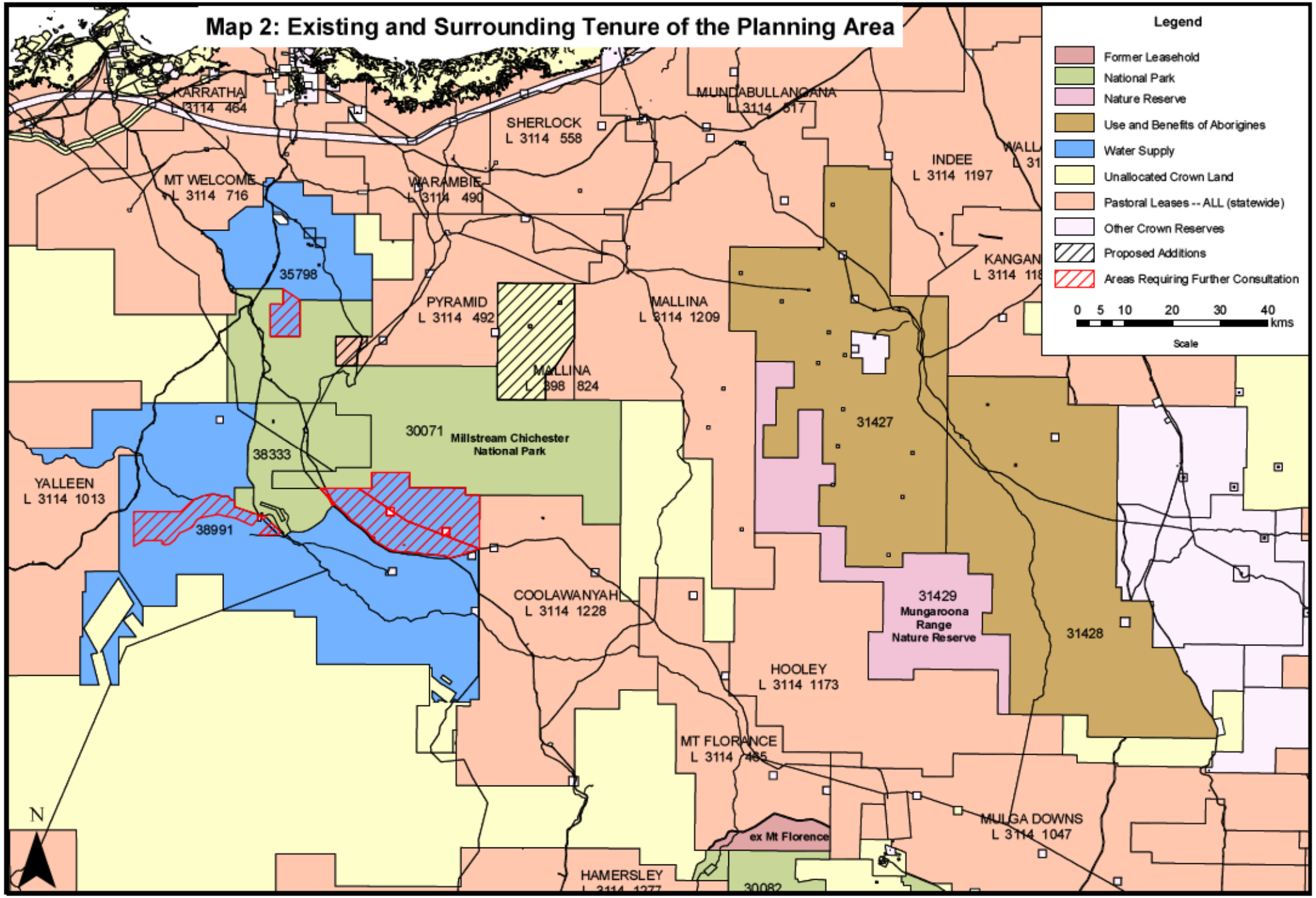
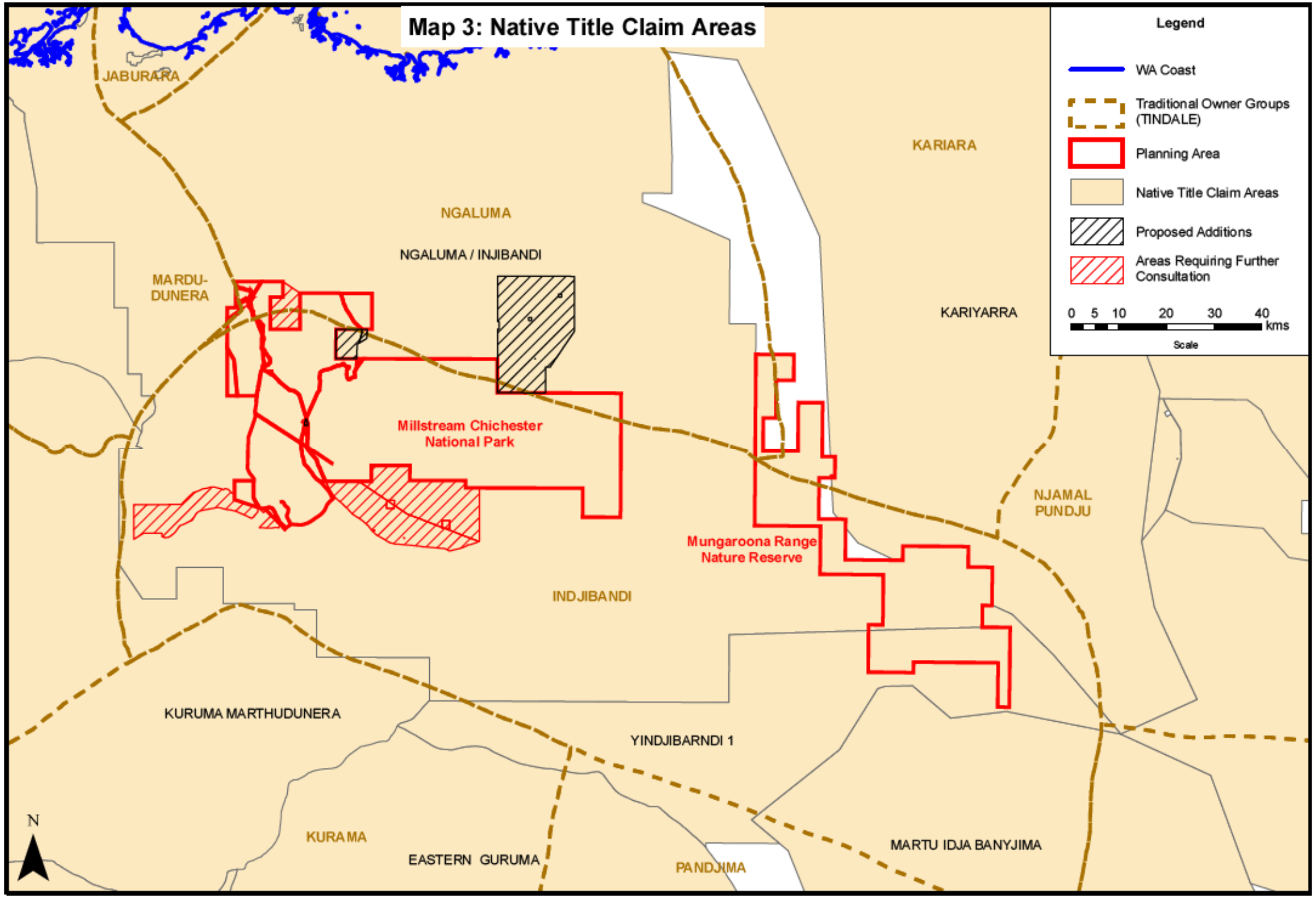
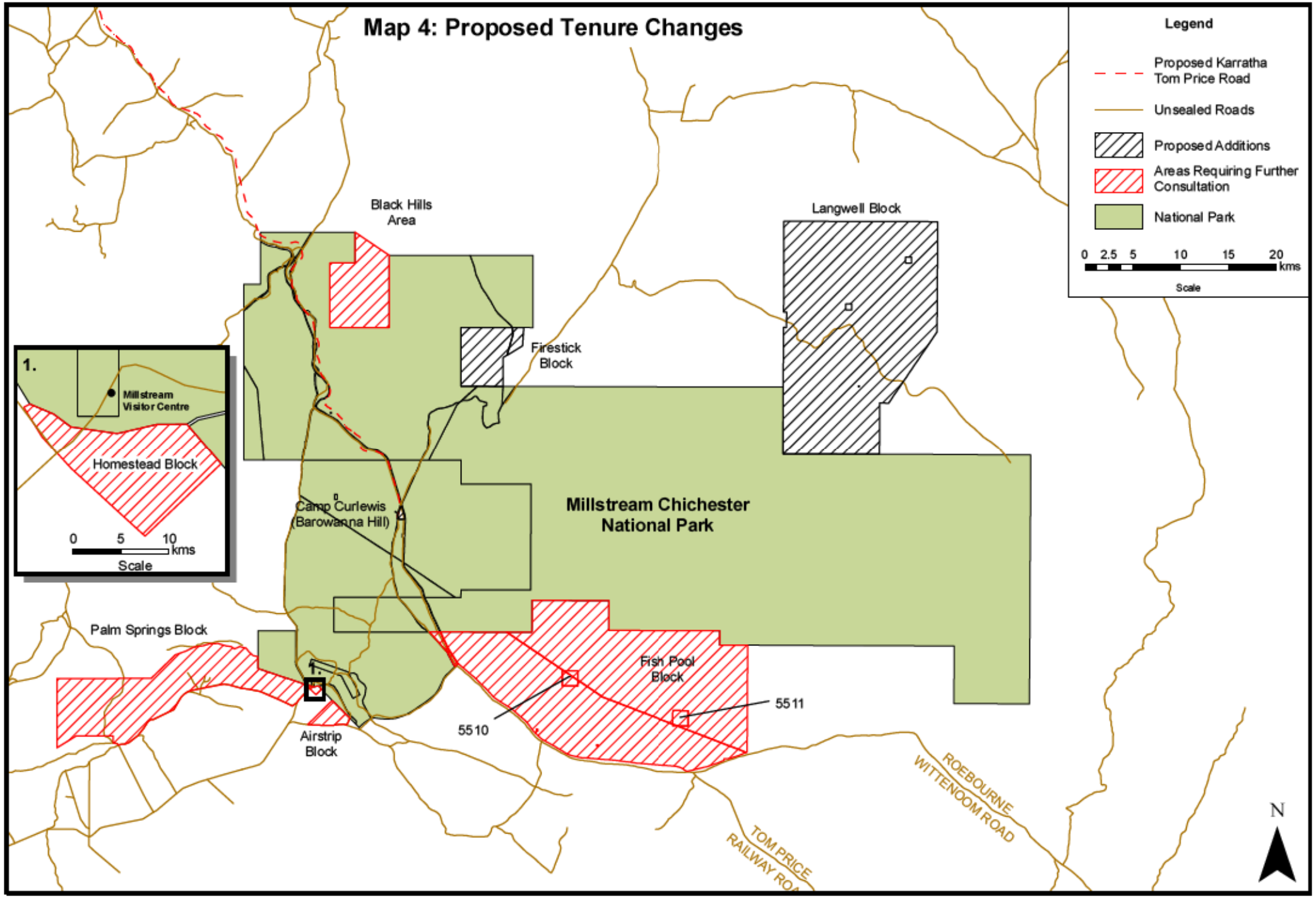
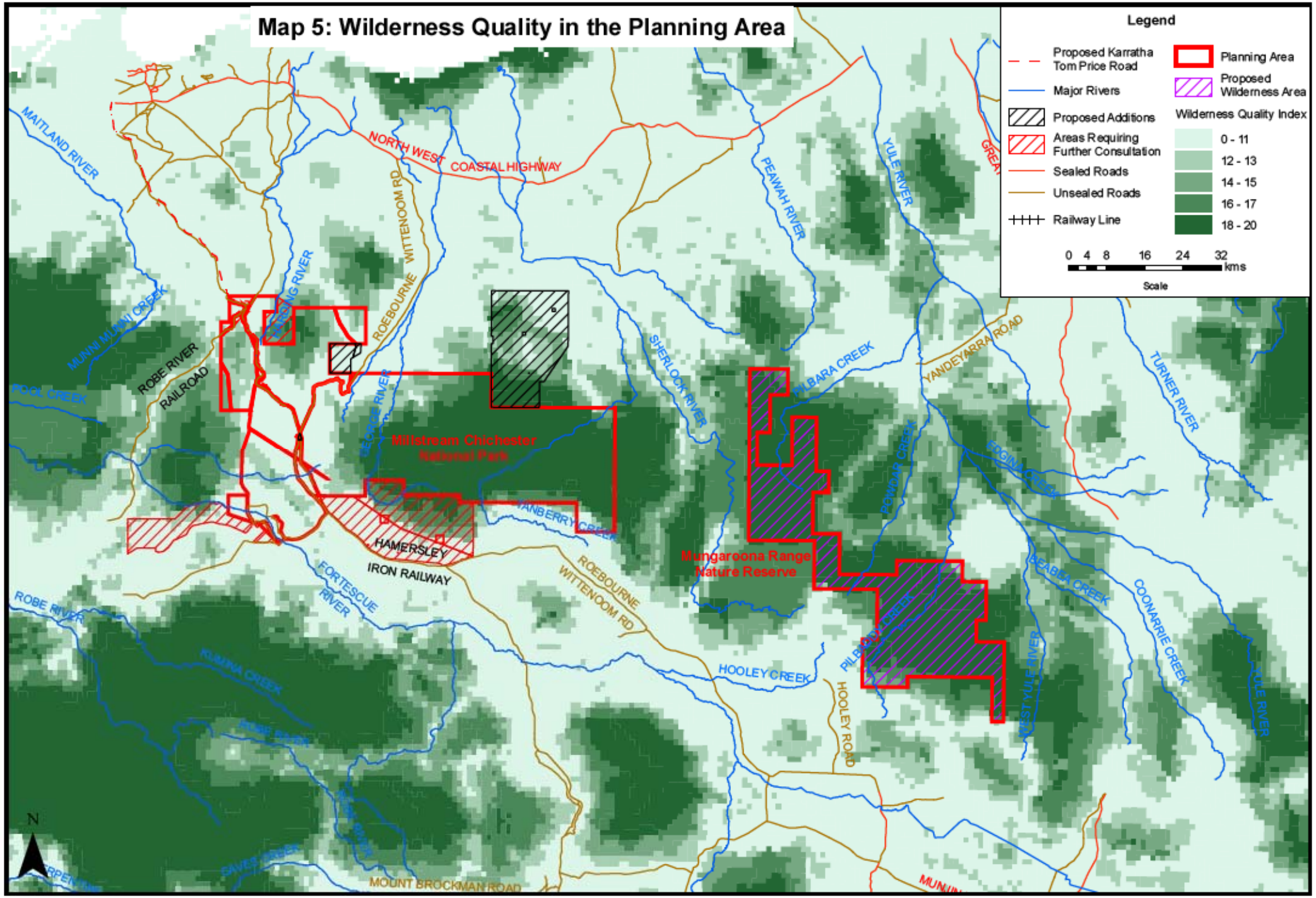
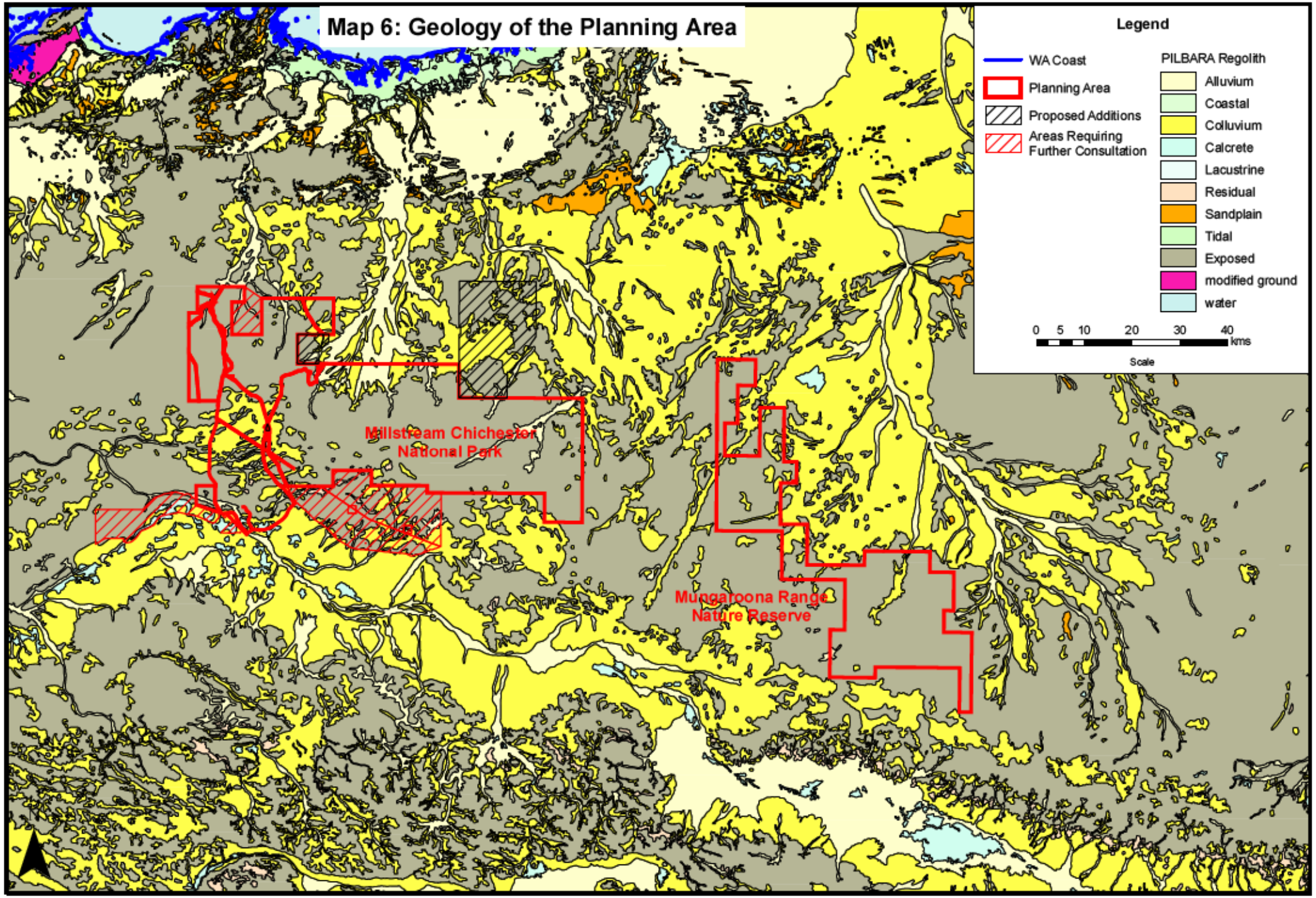

Map 1: Location of the Planning Area
Legend
Major Towns
WA Coast
Planning Area
Local Govt. Authorities (LGA)
Proposed Additions
Areas Requiring Further Consultation
0 30 60 90 120
kms
Scale
Locality Map
PORT HEDLAND
PORT HEDLAND (T)
KARRATHA
ROEBOURNE (S)
Millstream Chichester National Park
Mungaroona Range Nature Reserve
EAST PILBARA (S)
EXMOUTH
EXMOUTH (S)
ASHBURTON (S)
N

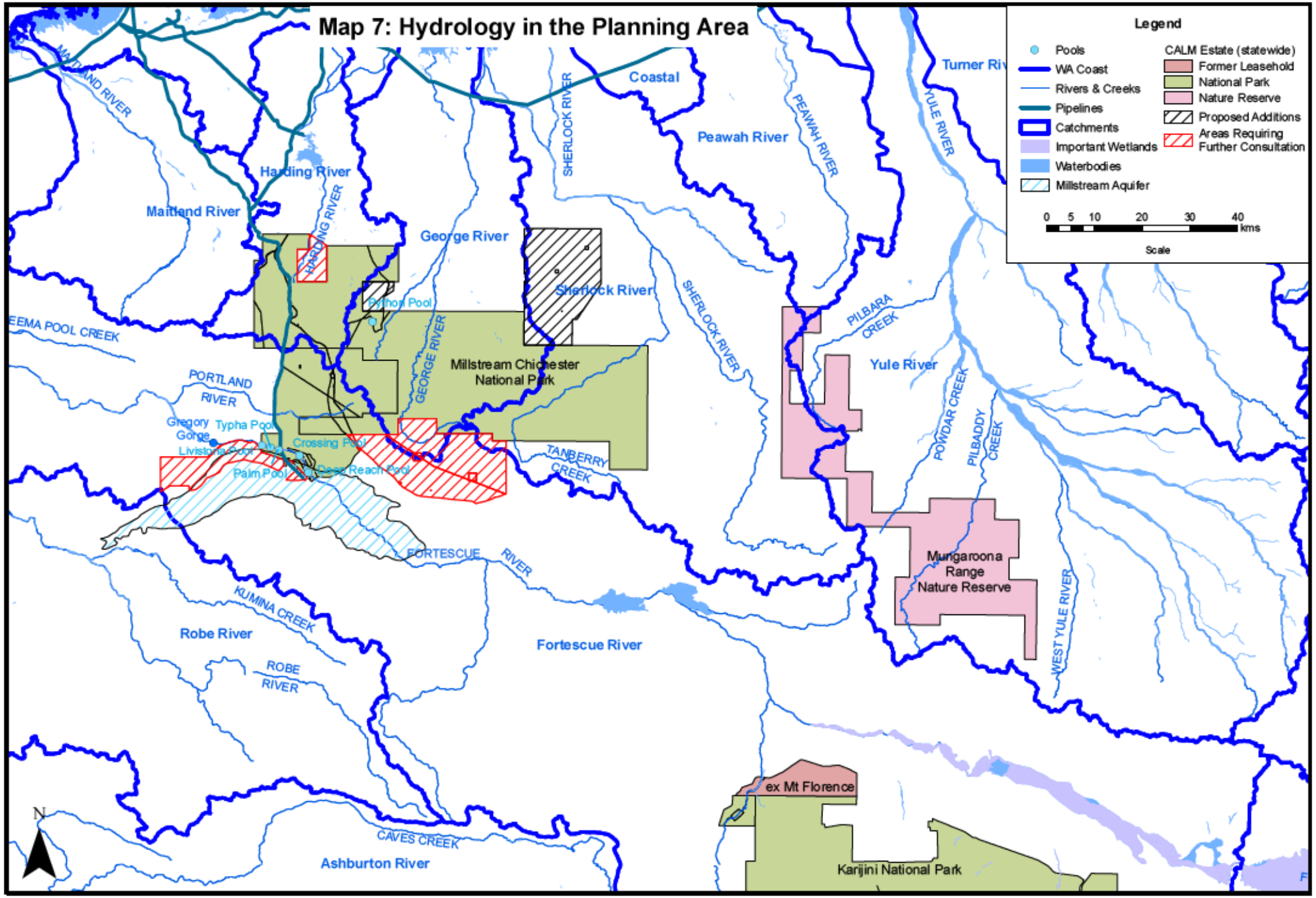

Map 2: Existing and Surrounding Tenure of the Planning Area
Legend
Former Leasehold
National Park
Nature Reserve
Use and Benefits of Aborigines
Water Supply
Unallocated Crown Land
Pastoral Leases -- ALL (statewide)
Other Crown Reserves
Proposed Additions
Areas Requiring Further Consultation
0 5 10 20 30 40 kms
Scale
KARRATHA L 3114 464
SHERLOCK L 3114 558
MUNDABULLANGANA L 3114 517
INDEE L 3114 1197
MT WELCOME L 3114 716
WARAMBIE L 3114 490
35798
PYRAMID L 3114 492
MALLINA L 3114 1209
MALLINA 398 824
30071 Millstream Chichester National Park
38333
31427
YALLEEN L 3114 1013
38991
COOLAWANYAH L 3114 1228
31429 Mungaroona Range Nature Reserve
31428
HOOLEY L 3114 1173
MT FLORANCE L 3114 485
ex Mt Florence
MULGA DOWNS L 3114 1047
HAMERSLEY
30082
N


Map 3: Native Title Claim Areas
Legend
WA Coast
Traditional Owner Groups (TINDALE)
Planning Area
Native Title Claim Areas
Proposed Additions
Areas Requiring Further Consultation
0 5 10 20 30 40
kms
Scale
JABURARA
KARIARA
NGALUMA
NGALUMA / INJIBANDI
MARDU-DUNERA
KARIYARRA
Millstream Chichester National Park
NJAMAL PUNDJU
Mungaroona Range Nature Reserve
INDJIBANDI
KURUMA MARTHUDUNERA
YINDJIBARNDI 1
N
KURAMA
EASTERN GURUMA
PANDJIMA
MARTU IDJA BANYJIMA

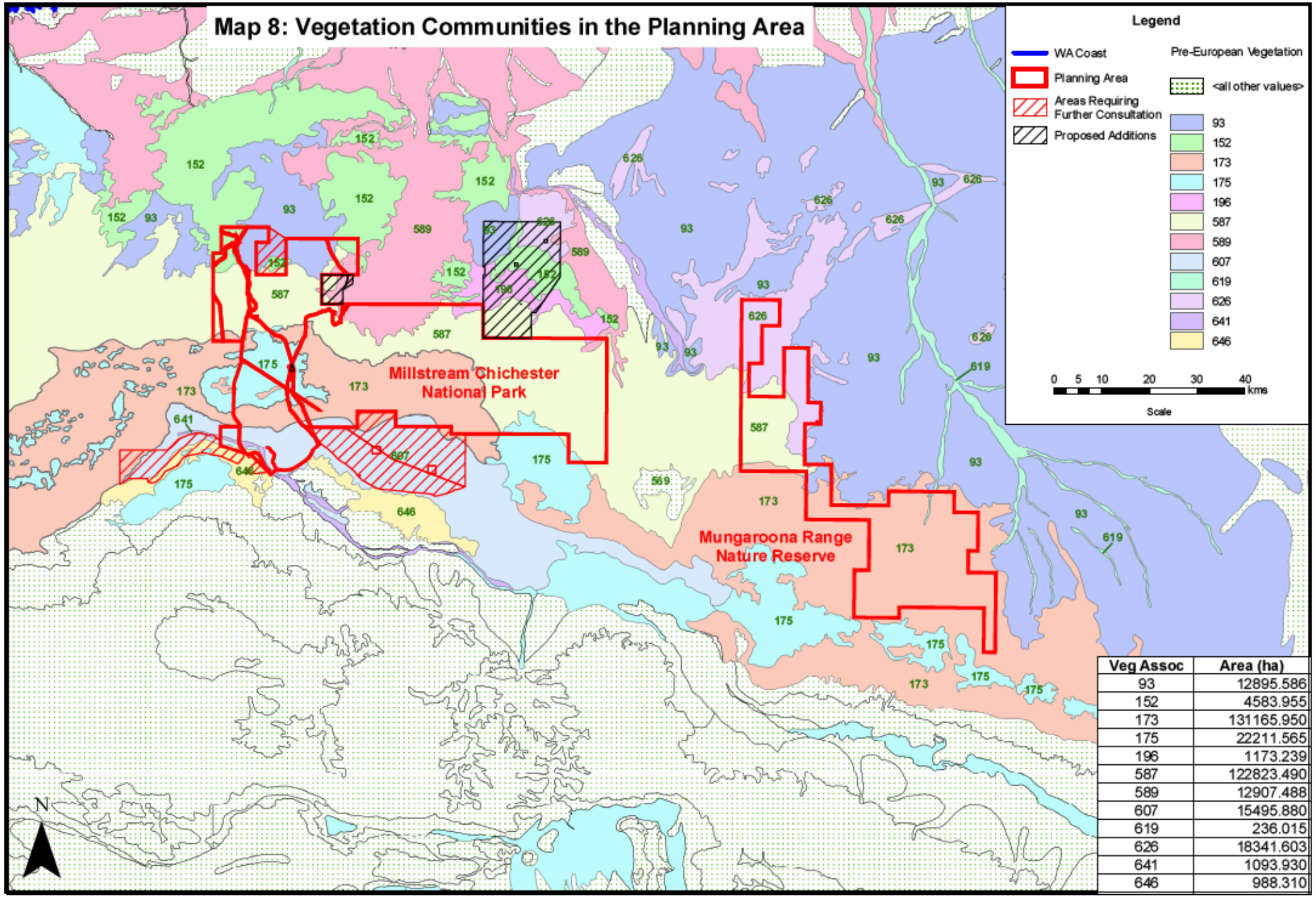

Map 4: Proposed Tenure Changes
Legend
Proposed Karratha Tom Price Road
Unsealed Roads
Proposed Additions
Areas Requiring Further Consultation
National Park
0 2.5 5 10 15 20 kms
Scale
Black Hills Area
Langwell Block
Firestick Block
Millstream Chichester National Park
Camp Curlewis (Barowanna Hill)
1.
Millstream Visitor Centre
Homestead Block
0 5 10 kms
Scale
Palm Springs Block
Airstrip Block
Fish Pool Block
5510
5511
ROEBOURNE WITTENOOM ROAD
TOM PRICE RAILWAY ROA
N


Map 5: Wilderness Quality in the Planning Area
Legend
Proposed Karratha Tom Price Road
Major Rivers
Proposed Additions
Areas Requiring Further Consultation
Sealed Roads
Unsealed Roads
Railway Line
Planning Area
Proposed Wilderness Area
Wilderness Quality Index
0 - 11
12 - 13
14 - 15
16 - 17
18 - 20
0 4 8 16 24 32
kms
Scale
MAITLAND RIVER
NORTH WEST COASTAL HIGHWAY
WITTENOOM RD
PEAWAH RIVER
YULE RIVER
MUNNI MUNNI CREEK
ROBE RIVER
RAILROAD
POOL CREEK
HARDING RIVER
ROEBOURNE
GEORGE RIVER
Millstream Chichester National Park
SHERLOCK RIVER
PILBARA CREEK
YANDEYARRA ROAD
TURNER RIVER
POWDAR CREEK
FORTESCUE RIVER
HAMERSLEY IRON RAILWAY
YANBERRY CREEK
Mungaroona Range Nature Reserve
BEABMA CREEK
COONARRIE CREEK
KUMINA CREEK
HOOLEY CREEK
HOOLEY ROAD
WEST YULE RIVER
MOUNT BROCKMAN ROAD
N


Map 6: Geology of the Planning Area
Legend
WA Coast
Planning Area
Proposed Additions
Areas Requiring Further Consultation
PILBARA Regolith
Alluvium
Coastal
Colluvium
Calcrete
Lacustrine
Residual
Sandplain
Tidal
Exposed
modified ground
water
0 5 10 20 30 40 kms
Scale
Millstream Chichester National Park
Mungaroona Range Nature Reserve


Map 7: Hydrology in the Planning Area
Legend
Pools
WA Coast
Rivers & Creeks
Pipelines
Catchments
Important Wetlands
Waterbodies
Millstream Aquifer
CALM Estate (statewide)
Former Leasehold
National Park
Nature Reserve
Proposed Additions
Areas Requiring Further Consultation
0 5 10 20 30 40
kms
Scale
Coastal
Peawah River
Turner Ri
Harding River
Maitland River
George River
Sherlock River
Python Pool
Millstream Chichester National Park
Yule River
Typha Pool
Crossing Pool
Deep Reach Pool
Palm Pool
Livistona Pool
Gregory Gorge
Mungaroona Range Nature Reserve
Robe River
Fortescue River
Ashburton River
ex Mt Florence
Karijini National Park
N

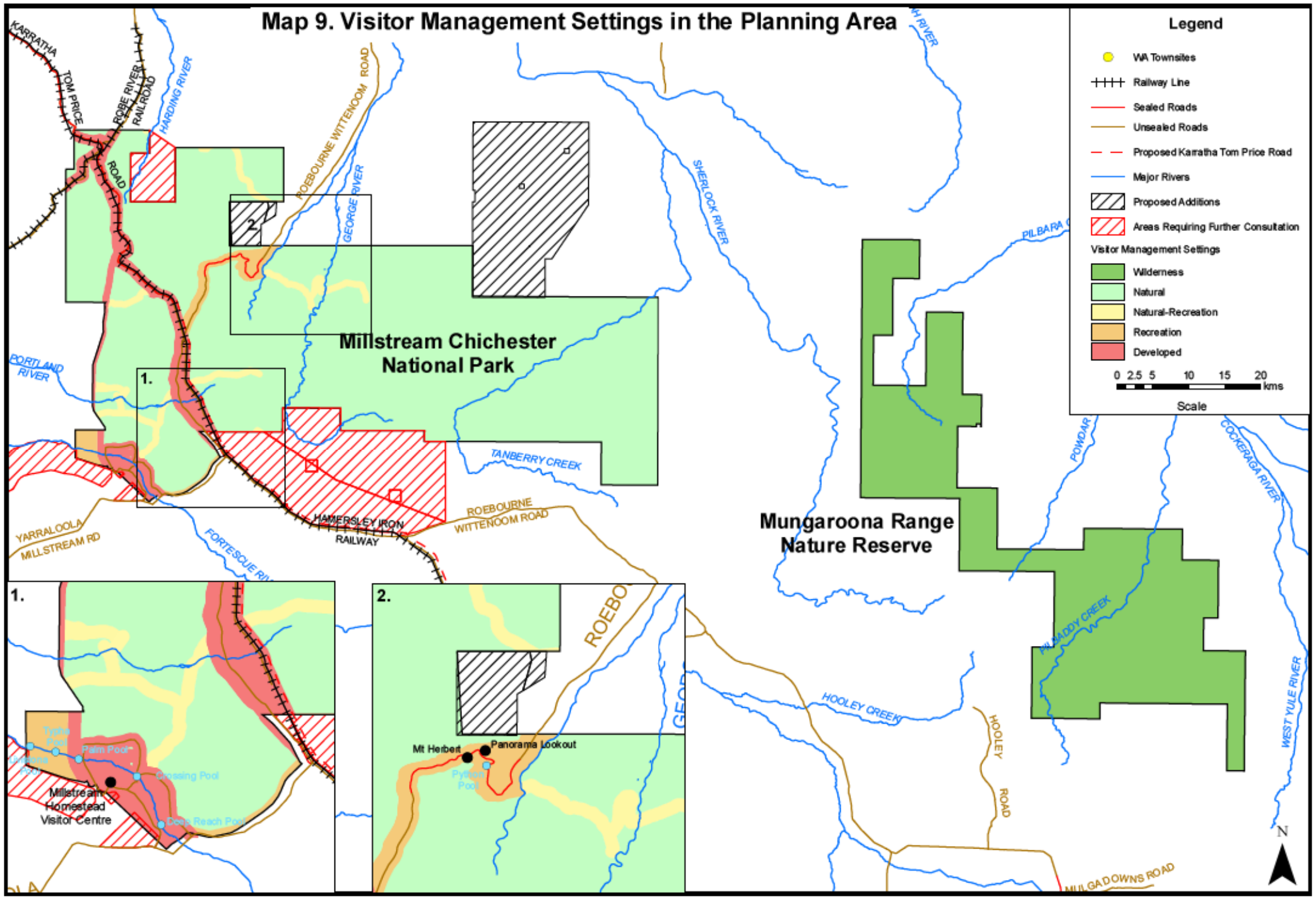
Map 8: Vegetation Communities in the Planning Area

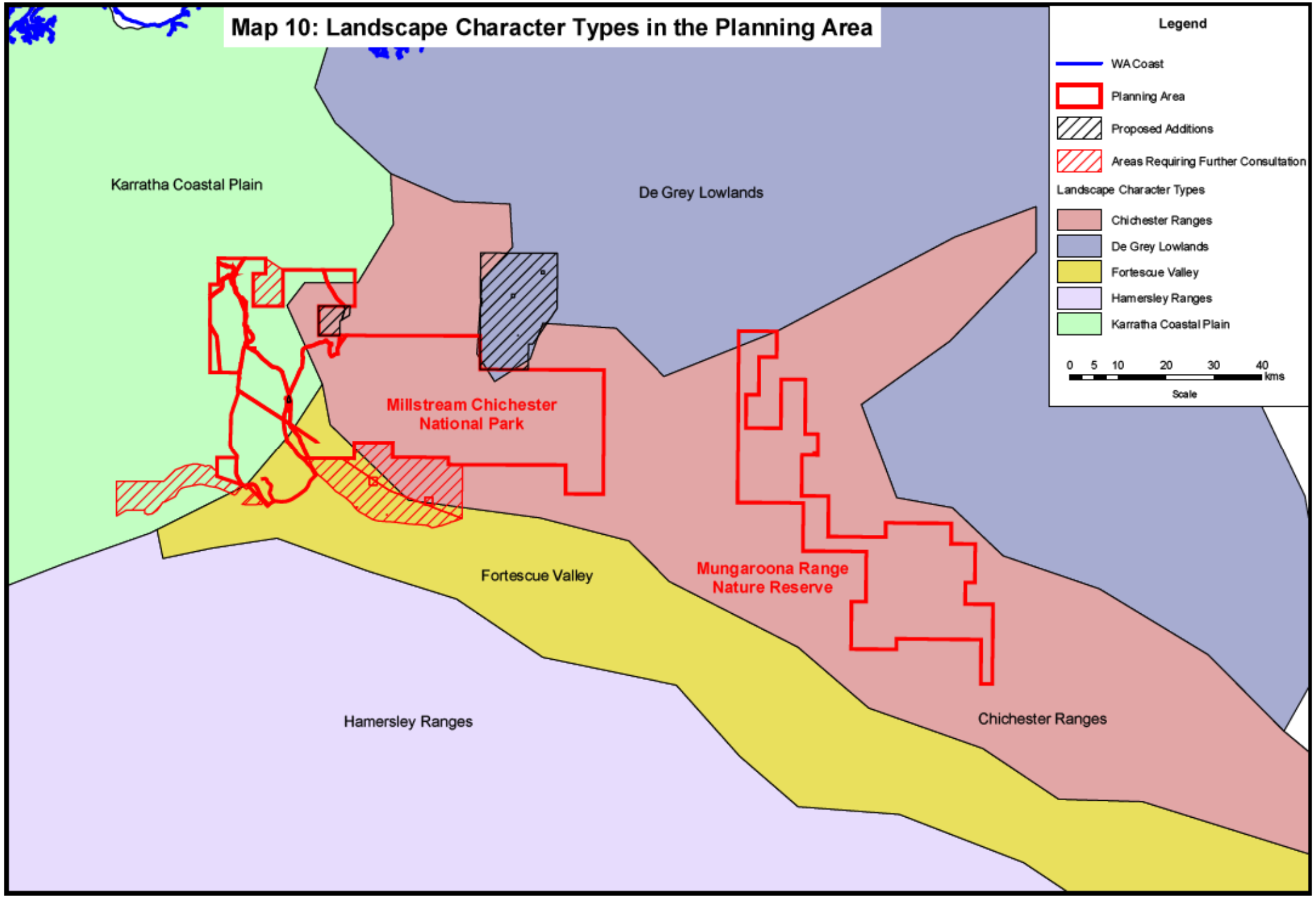


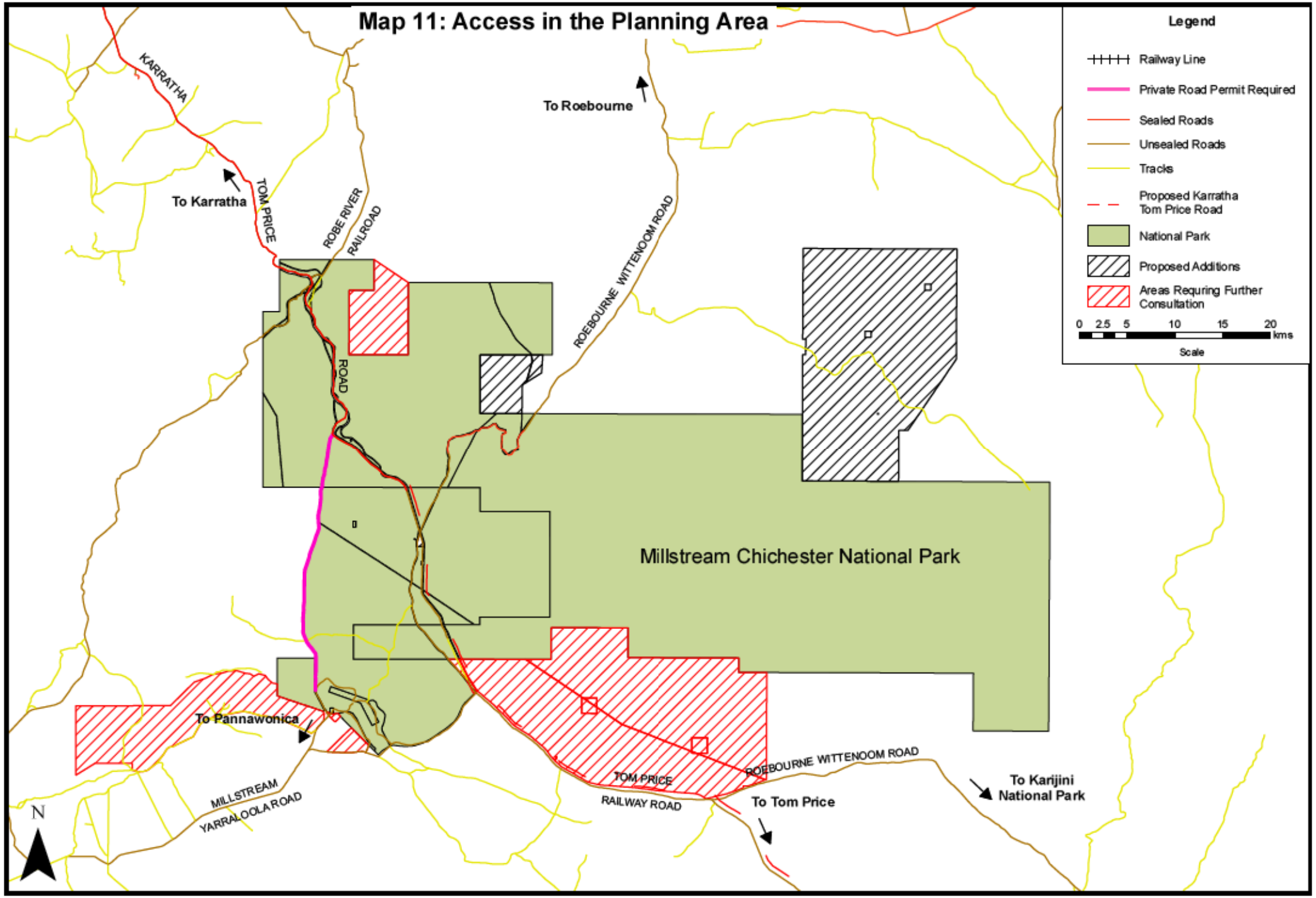
Veg Assoc	Area (ha)
93	12895.586
152	4583.955
173	131165.950
175	22211.565
196	1173.239
587	122823.490
589	12907.488
607	15495.880
619	236.015
626	18341.603
641	1093.930
646	988.310

Numbers on the map correspond to the following vegetation association descriptions.

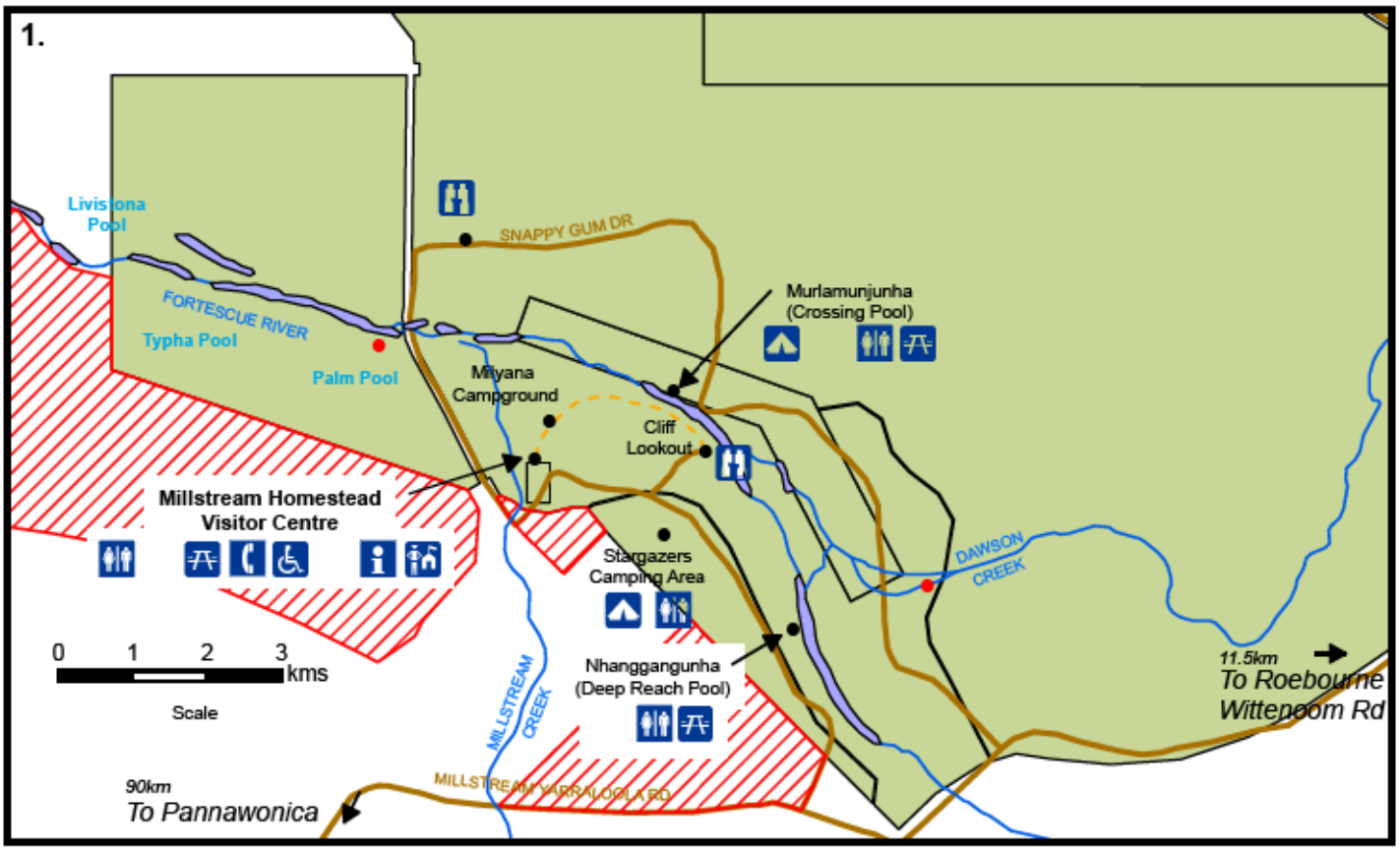
Vegetation Association Number	Description
93	Hummock grasslands, shrub steppe; kanji over soft spinifex
152	Hummock grasslands, grass steppe; soft & hard spinifex soft spinifex
173	Hummock grasslands, shrub steppe; kanji over soft spinifex & *Triodia wiseana* on basalt
175	Short bunch grassland - savanna/grass plain (Pilbara)
196	Hummock grasslands, shrub steppe; kanji over *Triodia wiseana* on hills of dolerite and shale
587	Mosaic: Hummock grasslands, open low tree-steppe; snappy gum over *Triodia wiseana* / Hummock grasslands, shrub-steppe; kanji over *Triodia pungens*
589	Mosaic: Short bunch grassland - savanna / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex
607	Hummock grasslands, low tree steppe; snappy gum & bloodwood over soft spinifex & *Triodia wiseana*
619	Medium woodland; river gum (*Eucalyptus camaldulensis*)
626	Hummock grasslands, shrub-steppe; kanji over soft spinifex & *Triodia brizioides*
641	Medium woodland; coolabah & river gum
646	Hummock grasslands, shrub steppe; snakewood over *Triodia basedowii*

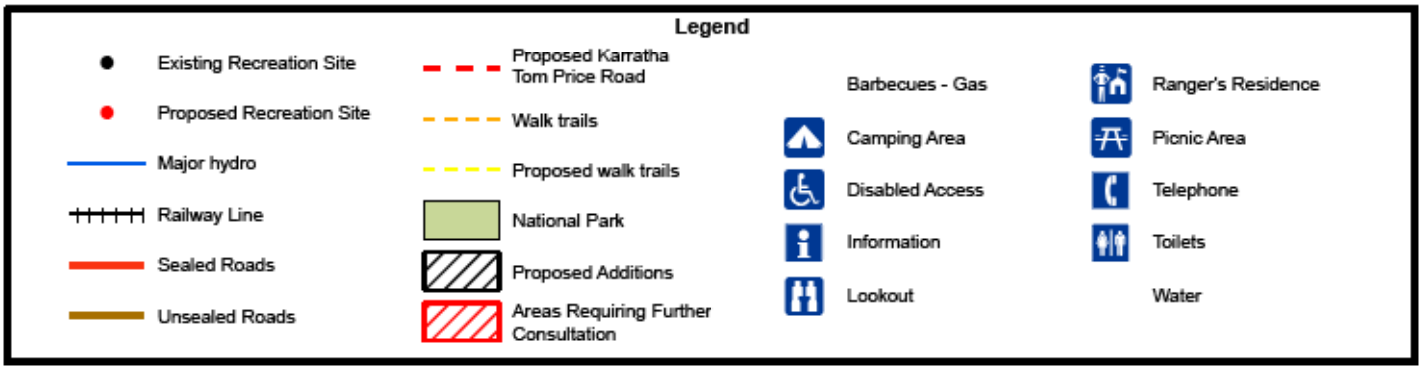

Map 9. Visitor Management Settings in the Planning Area
Legend
WA Townsites
Railway Line
Sealed Roads
Unsealed Roads
Proposed Karratha Tom Price Road
Major Rivers
Proposed Additions
Areas Requiring Further Consultation
Visitor Management Settings
Wilderness
Natural
Natural-Recreation
Recreation
Developed
0 2.5 5 10 15 20 kms
Scale
Millstream Chichester National Park
Mungaroona Range Nature Reserve
KARRATHA
TOM PRICE ROAD
ROBE RIVER RAILROAD
HARDING RIVER
ROEBOURNE WITTENOOM ROAD
GEORGE RIVER
SHERLOCK RIVER
PILBARA
PORTLAND RIVER
TANBERRY CREEK
YARRALOOLA MILLSTREAM RD
HAMERSLEY IRON RAILWAY
ROEBOURNE WITTENOOM ROAD
FORTESCUE RIVER
POWDAR
COCKERAGA RIVER
MILLADDY CREEK
WEST YULE RIVER
HOOLEY CREEK
HOOLEY ROAD
MULGA DOWNS ROAD
1.
2.
Tyche Pool
Palm Pool
Crossing Pool
Millstream Homestead Visitor Centre
Deep Reach Pool
Mt Herbert
Panorama Lookout
Python Pool
N

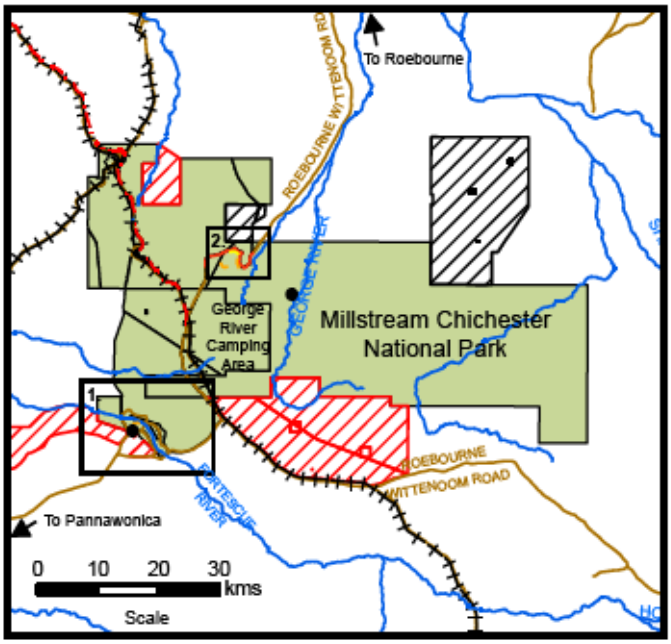

Map 10: Landscape Character Types in the Planning Area
Legend
WA Coast
Planning Area
Proposed Additions
Areas Requiring Further Consultation
Landscape Character Types
Chichester Ranges
De Grey Lowlands
Fortescue Valley
Hamersley Ranges
Karratha Coastal Plain
0 5 10 20 30 40
kms
Scale
Karratha Coastal Plain
De Grey Lowlands
Millstream Chichester National Park
Fortescue Valley
Mungaroona Range Nature Reserve
Hamersley Ranges
Chichester Ranges

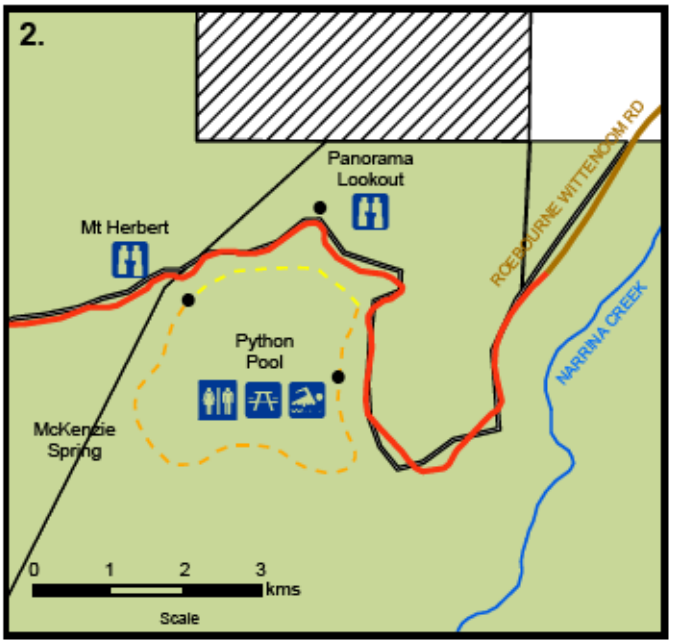

Map 11: Access in the Planning Area
Legend
Railway Line
Private Road Permit Required
Sealed Roads
Unsealed Roads
Tracks
Proposed Karratha Tom Price Road
National Park
Proposed Additions
Areas Requring Further Consultation
0 2.5 5 10 15 20
kms
Scale
KARRATHA
To Karratha
TOM PRICE
ROBE RIVER
RAILROAD
To Roebourne
ROEBOURNE WITTENOOM ROAD
ROAD
Millstream Chichester National Park
To Pannawonica
MILLSTREAM
YARRALOOLA ROAD
TOM PRICE
RAILWAY ROAD
ROEBOURNE WITTENOOM ROAD
To Tom Price
To Karijini National Park
N

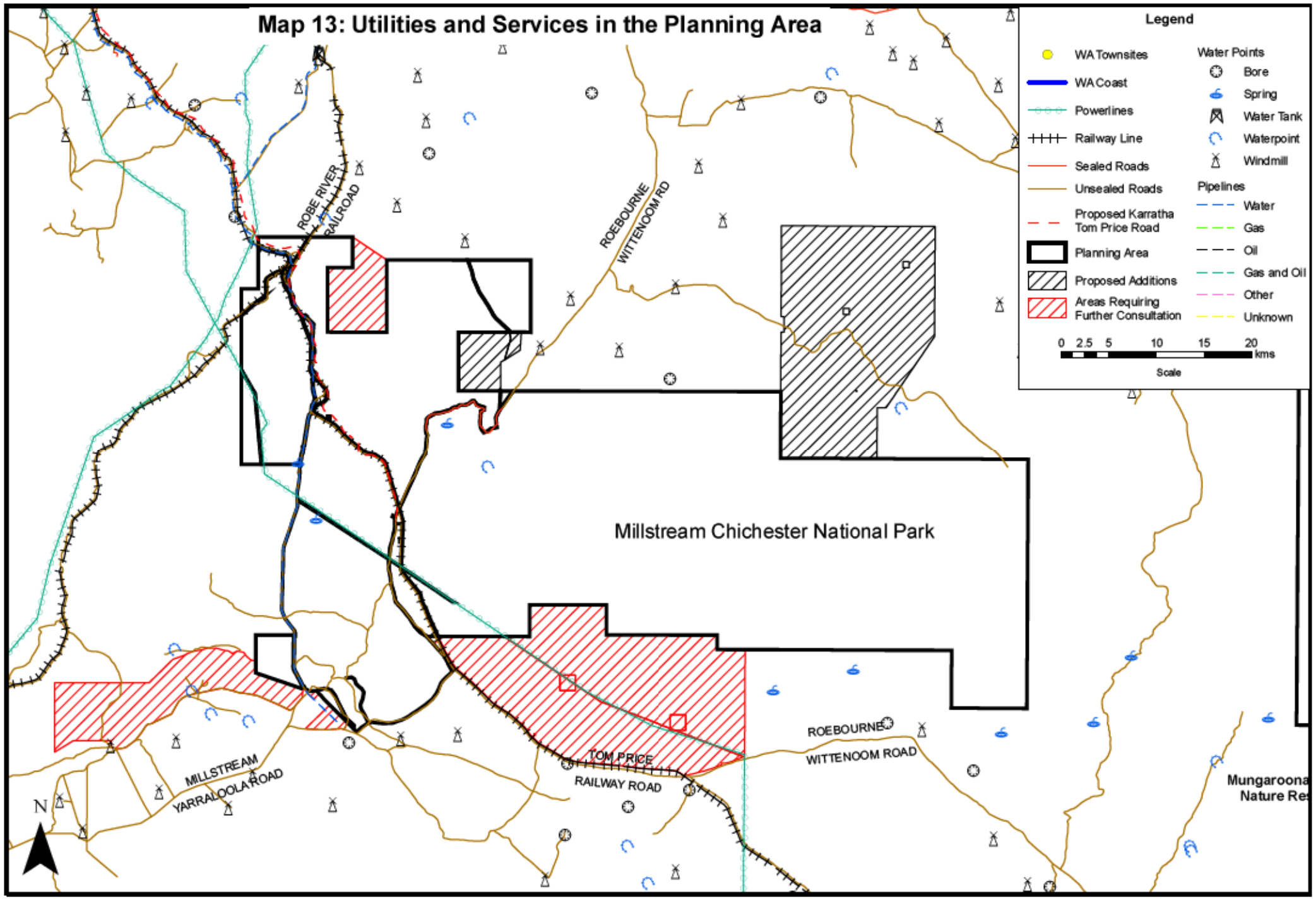
Map 12: Existing and Proposed Recreation Facilities in the Planning Area



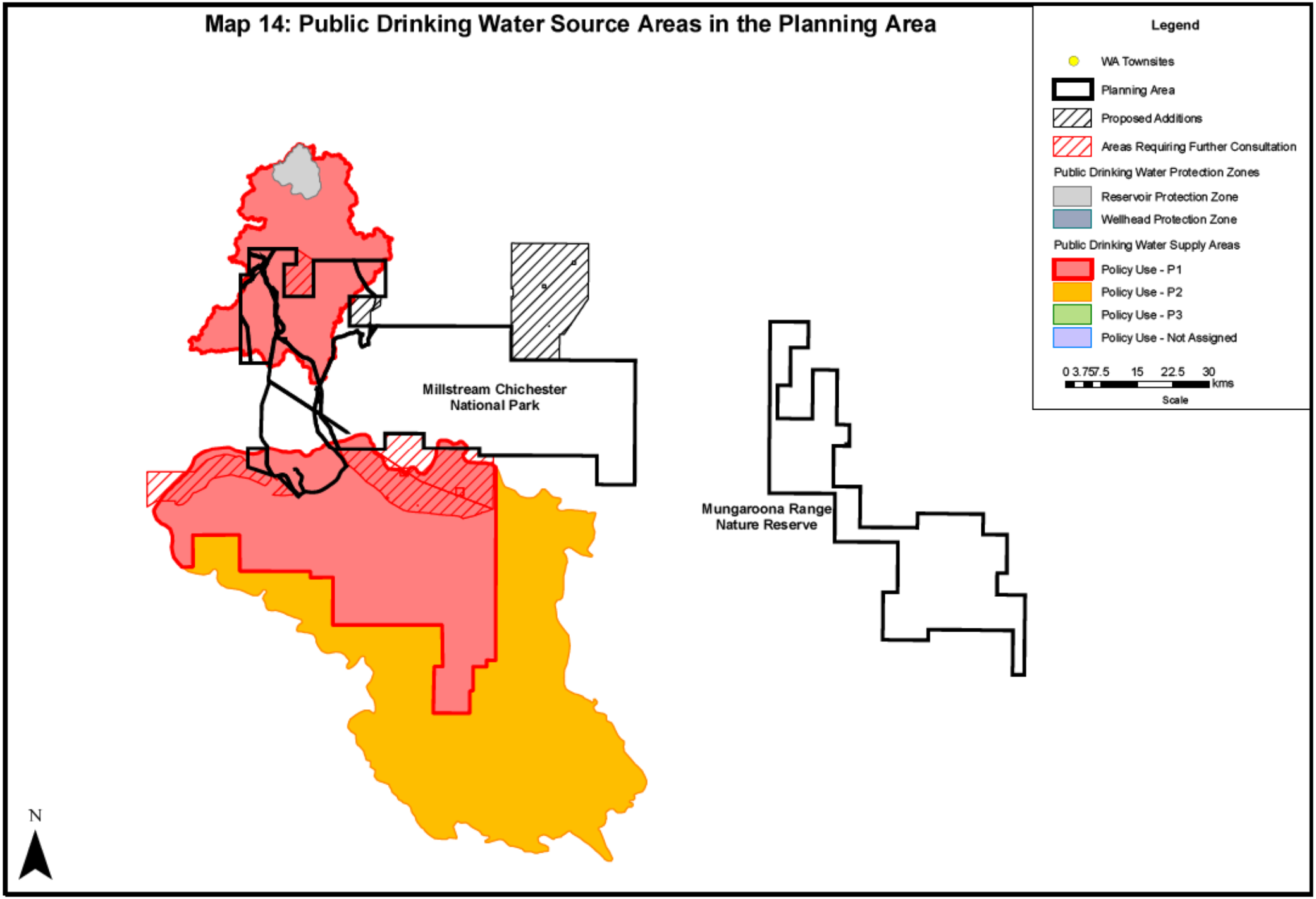







Map 13: Utilities and Services in the Planning Area
Legend
WA Townsites
WA Coast
Powerlines
Railway Line
Sealed Roads
Unsealed Roads
Proposed Karratha Tom Price Road
Planning Area
Proposed Additions
Areas Requiring Further Consultation
Water Points
Bore
Spring
Water Tank
Waterpoint
Windmill
Pipelines
Water
Gas
Oil
Gas and Oil
Other
Unknown
0 2.5 5 10 15 20
kms
Scale
ROBE RIVER RAILROAD
ROEBOURNE WITTENOOM RD
Millstream Chichester National Park
MILLSTREAM YARRALOOLA ROAD
TOM PRICE RAILWAY ROAD
ROEBOURNE
WITTENOOM ROAD
Mungaroona Nature Re
N

Map 14: Public Drinking Water Source Areas in the Planning Area



APPENDIX 1: PERFORMANCE ASSESSMENT

Key Values	Key Objectives	Key Performance Indicators		
		Performance Indicator/Measure	Target	Reporting Requirements*
Part B: Management Directions and Purpose				
	Section 8: Management Arrangements with Indigenous People			
An opportunity to engage with Indigenous people and consider their aspirations in the management of the planning area and implement meaningful joint management with Indigenous people.	The objective is to provide a mechanism for joint management between the Department and the Indigenous people.	8.1 The continuation of the Millstream Park Council. 8.2 Satisfaction levels of Park Council members.	8.1 The successful continued operation of the Millstream Park Council. 8.2 Park Council members continue to be satisfied with the operation of the Millstream Park Council.	Annually Every three years
	Section 9: Existing and Proposed Tenure			
	The objective is to incorporate identified lands into the conservation estate to assist in the protection of the natural and cultural values of the planning area, to provide maximum security of tenure, and contribute to the establishment of a CAR reserve system.	9.1 Changes in land tenure and purpose as outlined in Table 2.	9.1 To implement the tenure actions as outlined in Table 2 within the life of the plan.	Every five years
Part D: Caring for Country: Managing the Natural Environment				
	Section 12: Biogeography			
	The objective is to establish a comprehensive, adequate and representative reserve system to protect biodiversity within the planning area.	12.1 Percentage of IBRA regions and sub-regions represented in the planning area.	12.1 The percentage of IBRA regions and sub-regions represented in the planning area increases over the life of the plan.	Every five years
	Section 13 : Wilderness			
Remote qualities of the area and the opportunity to create wilderness areas under the CALM Act.	The objective is to provide statutory protection to the Mungaroona Range Nature Reserve wilderness area, to maintain the option for wilderness	13.1 Gazettal of a wilderness area under section 62 of the CALM Act	13.1 Gazettal of a wilderness area within 2 years.	After two years

Key Values	Key Objectives	Key Performance Indicators		
		Performance Indicator/Measure	Target	Reporting Requirements*
	elsewhere and to maintain or enhance wilderness qualities within this wilderness area.	13.2 The extent and level of wilderness quality.	13.2 The extent and level of wilderness quality does not diminish from 2011 levels.	Every five years.
	Section 16: Hydrology and Catchment Protection			
The Millstream aquifer provides part of the 15GL of public water supply.	The objective is to protect and conserve the quality and quantity of water and to maintain the hydrological regimes in the planning area.	16.1 Compliance of Department activities with the by-laws of the CAWS Act.	16.1 There are no cases of non-compliance of Department activities with the by-laws of the CAWS Act.	Annually
	Section 17: Native Plants and Plant Communities			
A significant wetland ecosystem, which provides habitat for a wide range of flora and fauna species.	The objective is to protect the diversity and distribution of specially protected and other native plants and plant communities within the planning area.	17.1 Populations of priority or otherwise significant flora species, subject to natural variation. 17.2 Changes in species composition and structure within the Millstream wetlands.	17.1 No decrease in the number of populations of priority or otherwise significant flora species, over the life of the plan, subject to natural variation. 17.2 Maintain or improve the species composition and structure within the Millstream wetlands, subject to natural variation.	Every five years or as per recovery plans, if applicable. Every five years
	Section 18: Native Animals and Habitats			
A significant wetland ecosystem, which provides habitat for a wide range of flora and fauna species. A subterranean aquifer, providing habitat for significant subterranean aquatic stygofauna.	The objective is to identify, protect and conserve specially protected and other native fauna and their habitats within the planning area.	18.1 Diversity of native fauna species and habitat. 18.2 Population numbers and range of specially or otherwise significant fauna species.	18.1 No decline in known species or habitat diversity over the life of the plan. 18.2 Remains stable or increases over the life of the plan subject to natural variations.	Every five years. Every five years or as per recovery plans if applicable.
	Section 20: Environmental Weeds			
	The objective is to minimise the impact of environmental weeds on values of the planning area.	20.1 Area of Parkinsonia, date palm, water fern and ruby dock treated in the planning area. 20.2 Changes in the area covered	20.1 The area of Parkinsonia, date palm, water fern and ruby dock treated in the planning area increases. 20.2 Reduction in the area covered by	Every five years. Every five years.

Key Values	Key Objectives	Key Performance Indicators		
		Performance Indicator/Measure	Target	Reporting Requirements*
		by Parkinsonia, date palm, water fern and ruby dock in the planning area. 20.3 The introduction of new environmental weed species to the planning area and the response to these.	Parkinsonia, date palm, water fern and ruby dock over the life of the plan. 20.3 No new introductions of environmental weed species to the planning area. Ensuring that where there are new introductions, there is a rapid response.	 Every five years.
	Section 21: Introduced and Problem Animals			
	The objective is to minimise and, where possible, negate the impacts of introduced and problem animals on the values of the planning area.	21.1 Area of the planning area significantly impacted by cattle.	21.1 Decreases over the life of the plan.	Every three years
	Section 22: Fire			
	The objectives are; 1. to enhance biodiversity by establishing and maintaining a fire induced mosaic of fire history at a landscape and vegetation scale; 2. to reduce the frequency and extent of wildfires; and 3. to protect life, property and community assets and natural and cultural values of the planning area from wildfire.	22.1 The impact of wildfire on life, property or significant community assets 22.2 Number of hectares burnt and patchiness of prescribed fire for biodiversity protection. 22.3 Size of large intense wildfires in the planning area.	22.1 No loss of life, property or significant community assets or serious injury attributable to the Department's fire management. 22.2 An increase in the number of hectares burnt and patchiness of prescribed fire for biodiversity protection. 22.3 Limit the size of large intense wildfires to 50 kilometres^2 or a more appropriate size based on biological parameters.	Annually. Annually Annually
Part E: Caring for Country: Managing our Cultural Heritage				
	Section 23: Indigenous and Non-Indigenous Heritage			
One of the most significant Indigenous cultural and mythological sites of importance in WA and possibly Australia.	The objectives are; 1. to protect the Indigenous cultural heritage and cultural resources of the planning area; 2. to provide a mechanism where by the significance of the planning	23.1 Protection of known or identifiable Indigenous and non-Indigenous heritage sites.	23.1 No disturbance without formal approval and consultation.	Annually

Key Values	Key Objectives	Key Performance Indicators		
		Performance Indicator/Measure	Target	Reporting Requirements*
An important site for use by Traditional Owners for cultural activities and ceremonies. An important site for non-Indigenous cultural heritage, with old buildings, stockyards, wells and stock routes.	area to the Indigenous Traditional Owners may be better appreciated by others; and 3. to protect the non-Indigenous heritage of the planning area.			
Part F: Caring for Country: Managing Recreation and Tourism				
	Section 25: Visitor Opportunities			
Intact and varied landscape of high scenic quality ranging from arid rangelands to large open pools on the Fortescue River (*Yarnda Nyirranha*). An environment that provides a wide range of landscapes and caters for a diversity of experiences such as swimming, camping, canoeing, sightseeing, bushwalking, wildflower viewing, bird-watching and photography. Natural and cultural values which attract nature-based tourism and contribute to regional expenditure (approximately $225.9 million a year in revenue is generated by visitors to the Pilbara Region who would	The objective is to provide the visitors with a range of sustainable visitor opportunities to facilitate their enjoyment, understanding and appreciation of the natural, cultural and recreation values of the area.	25.1 Visitor satisfaction levels. 25.2 The perceived level of environmental degradation at high-use sites from visitor impacts as determined by visitor surveys. 25.3 The range of visitor management settings and opportunities (i.e. from wilderness to highly modified).	25.1 Visitor satisfaction levels are maintained or increased from 2011 levels over the life of the plan. 25.2 The perceived level of environmental degradation at high-use sites from visitor impacts does not increase over the life of the plan. 25.3 Maintain visitor management settings over the life of the plan.	Every five years Every five years Every five years.

Key Values	Key Objectives	Key Performance Indicators		
		Performance Indicator/Measure	Target	Reporting Requirements*
have visited natural areas and participated in nature-based activities.				
	Section 26: Visitor Access			
An environment that provides a wide range of landscapes and caters for a diversity of experiences such as swimming, camping, canoeing, sightseeing, bushwalking, wildflower viewing, bird-watching and photography.	The objective is to provide and maintain access which is consistent with the maintenance of natural and cultural values and with the diverse range of visitor needs.	26.1 The satisfaction that visitors express with their visit in relation to the use and condition of access in the planning area. 26.2 Changes in the condition of the George River track.	26.1 Visitors continue to be satisfied with access in the planning area. 26.2 Track condition is maintained or improved from 2011 levels over the life of the plan.	Every five years Annually.
	Section 27: Visitor Activities - Bushwalking			
An environment that provides a wide range of landscapes and caters for a diversity of experiences such as swimming, camping, canoeing, sightseeing, bushwalking, wildflower viewing, bird-watching and photography.	The objective is to provide a range of bushwalking opportunities appropriate to visitor management settings that do not significantly impact on natural, cultural and other key values.	27.1 The satisfaction that visitors express with their visit in relation to the use of walk trails.	27.1 Visitors continue to be satisfied with walk trails.	Every five years.
	Section 27: Visitor Activities – Day Use			
An environment that provides a wide range of landscapes and caters for a diversity of experiences such as swimming, camping, canoeing, sightseeing, bushwalking, wildflower viewing, bird-watching and photography.	The objective is to provide day-use facilities appropriate to the environment and desired visitor management setting that encourage visitor enjoyment and understanding of the values of the planning area.	27.2 Visitor satisfaction over the life of the plan as a result of day use activities in designated areas.	27.2 No decrease in visitor satisfaction over the life of the plan as a result of day-use activities in designated areas.	Every five years.
	Section 28: Visitor Accommodation – Built Accommodation and Camping			
An environment that provides	The objective is to provide a range	28.1 Visitor satisfaction levels in	28.1 No decrease in the visitor	Every five years

Key Values	Key Objectives	Key Performance Indicators		
		Performance Indicator/Measure	Target	Reporting Requirements*
a wide range of landscapes and caters for a diversity of experiences such as swimming, camping, canoeing, fishing, sightseeing, bushwalking, wildflower viewing, bird-watching and photography.	of quality built accommodation and camping opportunities in designated areas in the planning area.	relation to camping within the planning area according to visitor surveys. 28.2 Perceived levels of environmental degradation (e.g. erosion, littering, vandalism) according to visitor surveys.	satisfaction levels over the life of the plan. 28.2 No increase in perceived levels of degradation (e.g. erosion, littering, vandalism) according to visitor surveys.	 Every five years
	The objective is to reduce the impact of campfires on the environment of the planning area.	28.3 Number of wildfires caused by escapes from campfires.	28.3 No incidence of wildfires caused by escapes from campfires.	Annually
	Section 29: Commercial Operations			
An opportunity to engage with Indigenous people and consider their aspirations in the management of the planning area and implement meaningful joint management with Indigenous people.	The objectives are; 1. to encourage and promote Indigenous ownership of, and participation in commercial enterprises involving Indigenous cultural heritage, and to ensure that the use of Indigenous cultural material by commercial tour operators is appropriate; and 2. to ensure that commercial tourism activities are compatible with other management objectives and to extend the range of services and recreational experiences available in the planning area through the involvement of private enterprise and the Traditional Owners.	29.1 The number of unlicensed commercial operators operating within the planning area. 29.2 The development of sustainable Indigenous commercial opportunities.	29.1 The number of unlicensed commercial operators operating in the planning area decreases over the life of the plan. 29.2 Indigenous commercial opportunities established in the planning area.	Annually Every five years
	Section 30: Visitor Safety			
	The objective is to maintain visitor experiences in the planning area by minimising risks to public safety wherever possible.	30.1 The number and severity of incidents occurring within the planning area and reported to the Department.	30.1 The number and severity of incidents occurring within the planning area and reported to the Department remains stable or decreases from 2011 levels.	Annually

Key Values	Key Objectives	Key Performance Indicators		
		Performance Indicator/Measure	Target	Reporting Requirements*
Part G: Caring for Country: Managing Resource Use.				
	Section 35: Rehabilitation			
	The objective is to restore degraded areas to a stable condition resembling as close as possible the natural ecosystem function.	35.1 Area of rehabilitated land within the planning area, including the rehabilitation of unnecessary tracks.	35.1 Increase in the area of disturbed land rehabilitated, including the rehabilitation of unnecessary tracks.	Every five years
	Section 37: Water Extraction			
The Millstream aquifer provides part of the 15GL of public water supply.	The objective is to ensure that management of the Millstream aquifer complies with the conditions specified in the Water Corporation licence, including maintenance of cultural and natural values.	37.1 Changes in the condition of riparian vegetation, in association with aquifer level declines and high rates of abstraction from the Millstream aquifer.	37.1 No decline in the condition of riparian vegetation, in association with aquifer level declines and high rates of abstraction from the Millstream aquifer.	Annually. Reporting will be to both the Conservation Commission and the Millstream Harding Consultative Committee.
Part H: Caring for Country: Involving the Community				
	Section 39 Community Education and Information			
An extensive range of educational and interpretation opportunities exist at Millstream to describe elements of the geology, flora and fauna, Indigenous cultural heritage, wetlands and their significance and the Department's management of the area. Opportunities to interpret the values of the planning area and to educate the community about their significance.	The objective is to promote community awareness, understanding and appreciation of the natural and cultural values of the planning area and engender support for effective management of the planning area.	39.1 The number of participants in education programs offered in the planning area.	39.1 An increase in participation, including recurrent participation, in education programs offered within the planning area.	Annually

Key Values	Key Objectives	Key Performance Indicators		
		Performance Indicator/Measure	Target	Reporting Requirements*
	Section 40: Community Involvement and Volunteers			
An opportunity to engage with Indigenous people and consider their aspirations in the management of the planning area and implement meaningful joint management with Indigenous people. Opportunities to work with the community and stakeholders to encourage greater involvement in the management of the planning area.	The objective is to develop, encourage and facilitate liaison with the community and involvement in implementing the management plan.	40.1 The number of registered volunteers and the level of volunteer hours contributed over the life of the plan.	40.1 An increase in the number of registered volunteers and the level of volunteer hours.	Annually

* Investigate the cause and report to the Conservation Commission for action

APPENDIX 2: PRIORITY FLORA

Family	Species	WA Conservation Code*	Habitat Description
Poaceae	*Paspalidium retiglume*	P2	Cracking clays.
Poaceaea	*Ischaemum albovillosum*	P2	Cracking clays, pebbly soils.
Cyperaceae	*Fimbristylis sieberiana*	P3	Mud in riverine areas. Also sandstone cliffs.
Euphorbiaceae	*Phyllanthus aridus*	P3	Sandstone, gravel, red sand and rocky outcrops.
Malvacea	*Owenia acidula*	P3	Floodplains and cracking clays.
Malvaceae	*Abutilon trudgenii*	P3	Low lying or riverine areas, brown sandy soils.
Malvaceae	*Hibiscus brachysiphonius*	P3	Cracking clays, creeklines and clay flats.
Malvaceae	*Sida* sp. Wittenoom	P3	Lower slopes in loamy soils. Disturbed roadsides.
Poaceae	*Eragrostis crateriformis*	P3	Low lying, riverine areas or gentle slopes. Clayey loam or clay.
Poaceae	*Themeda sp. Hamersley Station*	P3	Red clay plans on grass plains.
Arecaceae	*Livistona alfredii*	P4	Riverine deltas, floodplains and creaks

- See glossary for definition of conservation codes.

APPENDIX 3: SPECIALLY PROTECTED AND PRIORITY FAUNA WITHIN THE PLANNING AREA.

Species	Common Name	Habitat Requirements	Threatening Processes (applies throughout their range)
Macroderma gigas	Ghost bat	Throughout northern Australia, although the Pilbara population is geographically isolated, separated from others by deserts. Found in a wide range of habitats, including rainforest and vine scrub in the tropics to woodlands and arid areas (Department of Environment and Heritage, 1995).	Mining, tourism and habitat decline. Also predation from foxes and cats and habitat loss from inappropriate fire regimes and livestock impacts (Department of Environment and Heritage, 1995).
Nyctophillus timoriensis	Greater long-eared bat	Forest, semi-arid woodlands and savannas.	Loss of habitat from clearing for agriculture, timber harvesting, grazing and altered fire regimes (Department of Environment, 1999)
Leggadina lakedownensis	Lakeland Downs mouse	Found in the Pilbara and Kimberley in areas of cracking clay and adjacent habitats and occasionally hill tops. Also found in hummock grasslands (Biota Environmental Sciences, 2005).	Loss of habitat from mining industry and possible competition with *Mus musculus* (Department of Environment and Heritage, 1995).
Pseudomys chapmani	Pebble mound mouse	Common or very common in suitable habitat in the Pilbara. Constructs extensive mounds of small stones covering an area of 0.5-9 square metres, generally on spurs and gentle slopes (Biota Environmental Sciences, 2005).	Unknown, possibly predation by cats (Department of Environment and Heritage, 1995)
Ardeotis australis	Australian bustard	Distributed over much of Western Australia, except for heavily wooded southern areas. Open or lightly grasslands, including Triodia sandplains. Often attracted to burnt areas (Biota Environmental Sciences, 2005).	Clearing for agriculture, invasion of pastoral lands by woody weeds, hunting and fox predation (Department of Environment and Heritage, 2000).
Burhinus gracillus	Bush stone curlew	Widespread in Australia and New Guinea. Prefers sparsely grassed or lightly timbered forests and woodlands (Biota Environmental Sciences, 2005).	Foxes and habitat clearing (Department of Environment and Heritage, 2000).
Falco peregrinus	Peregrine falcon	The peregrine falcon is uncommon but very widespread and prefers areas with rocky ledges, cliffs, watercourses or open woodland.	Illegal shooting.
Neochnia ruficauda subclarescens	Star finch	Found in north-western Australia. Inhabits grasslands or grassy woodlands near water.	Decline of riverine habitat through grazing. Trapping for aviculture. Also invasion of habitat by weeds and cyanide in mine tailings dams have been noted as local threats (Department of Environment and Heritage, 2000).
Phaps histronica	Flock bronzewing	Found in semi-arid tropics and subtropics in northern parts of Australia. Mainly found in plains, Triodia hummock	Decline of this species has coincided with the expansion of agriculture and pastoralism and destruction of habitat from

Species	Common Name	Habitat Requirements	Threatening Processes (applies throughout their range)
		grasslands, grassy woodlands, recently burnt areas, roadsides and agricultural land. They nest on bare ground and shelter in low vegetation and are often associated with permanent water.	overgrazing by stock and rabbits. Predation by foxes. Spread of woody weeds (Department of Environment and Heritage, 2000).
Morelia olivacea barroni	Pilbara olive python	Rocky areas, preferably near water. Shelters in rock crevices and feeds on birds, reptiles, and small to medium sized mammals (Biota Environmental Sciences, 2005).	
Notoscincus butleri		Endemic to Western Australia and restricted to the arid north-west of the Pilbara. Associated with spinifex-dominated areas near creeks and rivers (Biota Environmental Sciences, 2005).	
Ramphotyphlops ganei			
Leipotherapon aheneu	Fortescue grunter	Inhabits rock pools and slow flowing sections of streams and requires rock and plant cover.	
Nososticta pilbara		This species of dragonfly is found in streams and permanent river pools in the Millstream Chichester National Park (Department of Environment and Heritage, 2006).	

APPENDIX 4: WEED SPECIES

Scientific Name	Common Name	Significance*	Local Significance	Current Control Status
Acacia farnesiana	Mimosa bush	High	Low	No control; not considered a problem at Millstream.
Acanthospermum hispidum	Starburr	Low	Not listed	
Acetosa vesicaria	Ruby dock	High	High	Local control; has potential to spread through the Millstream Chichester National Park from rail corridors.
Aerva javanica	Kapok bush	High	Moderate	Local control; removed in vicinity of Department depot.
Albizia lebek	Raintree, Albizia	TBA	Moderate	Eradication; a single tree in Fortescue River (*Yarnda Nyirranha*).
Alternanthera pungens	Khaki weed	Low	High	Eradication; affects recreation amenity due to spiny burrs.
Argemone ochroleuca	Mexican poppy	Mild	Low	Not controlled; restricted to sparse occurrence in river bed.
Arundo donax	Giant reed	Low		
Cascabela thevetia	Yellow oleander	Low		
Cenchrus ciliaris	Buffel grass	High	High	Local control; occasional control around facilities at the Department depot.
Cenchrus biflorus	Gallon's curse	Low	High	Eradication; seriously affects recreation amenity due to spiky burrs.
Ceratoptris thalictroides	Water fern	Not listed	High	Local control; fern blocks stream channels and reduces visual amenity.
Chenopodium murale	Green fat hen, Nettle-leaf goosefoot	Low	Not listed	
Chloris barbata	Purpletop Chloris	Low	Not listed	
Cyclospermum leptophyllum	Slender celery	TBA	Not listed	
Cynodon dactylon	Couch	Not listed	Not listed	
Echinochloa colona	Awnless Barnyard Grass	Mild	Not listed	
Ipomoea sp.	Morning glory ?	Mild	High	Eradication; dense thickets near the Millstream Delta.
Lepidium didymum	Lesser swinecress	Not listed	Not listed	
Malvastrum americanum	Spiked Malvastrum	Moderate	Not listed	
Malvastrum coromandelianum	Prickly Malvastrum	Not listed	Not listed	
Melochia pyramidata		Mild	Not listed	
Nymphaea odorata	Water lily	Mild	Moderate	Local control; cover pools and streams, reduce visual amenity.
Parkinsonia aculeata	Parkinsonia	Moderate	High	Eradication; many small infestations in river and wetlands.
Passiflora foetida	Wild passion fruit, stinking passion flower	High	Mild	Local control; occasional control.

Scientific Name	Common Name	Significance*	Local Significance	Current Control Status
Phoenix dactylifera	Date palm	High	High	Eradication; small number retained for visitor amenity.
Phyla nodiflora	Lippia, Carpet Weed	Moderate	Not listed	
Sida acuta	Spinyhead Sida	Mild	Not listed	DP P1 for Shire of Ashburton and for all that part of the State north of 26th parallel of latitude
Stylosanthes hamata	Verano stylo, Carribean styo		Mild	Is currently found in coastal areas but survives well in wetland areas. Hence monitoring of the planning area for invasion of this weed will be required.
Tamarix aphylla	Athel pine	Moderate		
Typha orientalis	Bulrush, cumbungi	High	Moderate	Local control; dense stands affect water flow and monitoring.
Washingtonia filifera	Cotton palm	Mild	High	Eradication; all local trees to be removed from springs and river.

- Significance is as listed in the Environmental Weeds Strategy for Western Australia, 1999 (CALM 1999). This State rating does not necessarily match with the significance rating given to the weed in the planning area.

APPENDIX 5: GUIDING PRINCIPLES FOR FIRE MANAGEMENT IN SPINIFEX GRASSLANDS IN WESTERN AUSTRALIA

1. Climate and vegetation make landscapes dominated by spinifex grasslands highly prone to fire. For thousands of years, lightning and human ignitions have ensured that fire is an environmental factor that has influenced the structure and biodiversity of spinifex grasslands.
2. Species and communities vary in their adaptations to and reliance on fire. Knowledge of the ways in which species and communities respond to fire, and of the temporal and spatial scales of fires in relation to life histories of organisms or communities, underpins the use of fire.
3. Rainfall is the primary driver of the rate of fuel accumulation and subsequent flammability of spinifex grasslands and large, extensive wildfires are usually preceded by several seasons of above average rainfall.
4. The response of species and communities to fire will be influenced by the scale and patchiness of fire and by antecedent rainfall, which can drive systems towards a new transient state with respect to species composition and structure.
5. Fire management is required primarily to conserve biodiversity. In some circumstances, it may be necessary to manage fire to protect property, infrastructure and cultural values.
6. Fire management should be both precautionary and adaptive, considering the requirements of both fire sensitive and fire maintained communities and species in order to optimize biodiversity conservation outcomes.
7. Landscapes dominated by spinifex grasslands are vast, remote and difficult to access. Fire management resources are scarce, so active fire management including fire suppression and prescribed burning should focus on areas of high conservation value and on high value built and cultural assets. On much of the spinifex grasslands, passive management, including allowing unplanned (by the Department) fires to burn, is a realistic and acceptable management option.
8. Fire diversity can support biodiversity both at landscape and local scales. At the landscape scale, a fine grain mosaic of patches of vegetation representing a range of interlocking seral stages will provide diversity of habitats for organisms that are mobile and can move through the landscape. At the local scale, appropriate intervals between fire based on vital attributes of key species are necessary to ensure the persistence of sessile or less mobile organisms.
9. Avoid applying the same fire regime (frequency, interval, season and scale) over large areas for long periods and avoid seral and structural homogenization by not treating large areas with extreme regimes such as sustained frequent burning or infrequent burning.
10. The scale or grain size of the mosaic should a) enable natal dispersal, b) optimize boundary habitat (interface between 2 or more seral stages/fire boundaries), and c) optimize connectivity (ability of keystone species to migrate between seral stages.
11. A sequence of 2-3 years or more of above average rainfall will result in rapid growth of spinifex and flammable soft grasses, predisposing landscapes to large wildfires capable of burning through fire mosaics. While such events are infrequent, strategic low fuel buffers 500-1000 m wide may be required to contain wildfires under these conditions.
12. All available knowledge including scientific, local and Indigenous knowledge should be utilized to develop ecologically appropriate fire management.
13. Consultation and partnerships with neighbours, including Traditional Owners, is an effective way of managing fire for mutual benefit.
14. Fire management should be planned and implemented in an adaptive management framework. Use of tools including remote sensing and aircraft, will be essential for planning and implementing fire use and for mapping and monitoring fire mosaics and fire history.
15. As part of an adaptive management framework, biodiversity monitoring should focus on, in order of priority; a) threatened species and communities, b) fire sensitive species and communities and c) the remaining biota.
16. Where spinifex grasslands have been invaded by flammable weeds species such as buffel grass, which is capable of adversely altering the frequency and intensity of fire, prescribed burning should be used conservatively and strategically to break up the run of major wildfires.

APPENDIX 6: VISITOR MANAGEMENT SETTINGS CRITERIA

	Class 1 – Wilderness Area (as recognised in *Policy Statement No. 62 – Identification And Management of Wilderness and Surrounding Areas*)		Class 2 – Natural	Class 3 - Natural -Recreation	Class 4 – Recreation	Class 5 – Highly Modified	
	Class 1a - Wilderness	Class 1b – 'Surrounding Areas'				A	B
Principle purposes	Maintaining and restoring the integrity of ecological processes and natural landscapes, maintaining and restoring biodiversity, and maintaining opportunities for solitude by maintaining or restoring the highest degree of apparent and biophysical naturalness and remoteness from permanent modern structures (*refer to Policy Statement No. 62 – Identification And Management of Wilderness and Surrounding Areas*)	'Surrounding areas' provide a buffer to wilderness areas and will be managed to support wilderness values. Conservation of significant natural and cultural values, with low level recreation	Conservation of significant natural and cultural values, with low level recreation	Conservation of significant natural and cultural values, with low to medium level recreation	Provides for moderate intensity recreation in a mostly natural landscape.	High-level recreation, education and interpretation. Group activities specifically catered for at many sites.	
Description	Natural areas with an NWI rating of >12 or greater. Wilderness areas are large, remote areas (8000 ha in temperate areas, 20 000 in arid, semi-arid and tropical areas of the State), with minimal evidence of modern human activity (*refer to Policy Statement No.62 – Identification And Management of Wilderness and Surrounding Areas*).	Provides a buffer to wilderness areas that will assist in maintaining wilderness values in adjacent areas.	Remote areas with conservation significance. Some evidence of previous development in process of rehabilitation, or existing human activity related to management tracks/trails, designated 4WD tracks and walking tracks	Modified environment but dominated by natural vegetation and landscapes conservation significance. Signs of past use evident	Areas with 'natural' landscape values. Exotic vegetation may be present but rarely dominant, recreation facilities present.	Includes concentrated areas of modified environment with natural background. Human activity conspicuous. High likelihood of non-natural, regular background noise. High level of site hardening and provision of facilities evident, frequent staff presence. Emphasis on interpretation and education at many sites.	
Access (access standards and type of transport used by visitors,	Vehicles: use of any form of mechanised transport is not permitted within wilderness, except for emergency or essential management operations, or reasons of cultural importance. Walk: constructed walking tracks,	Vehicles: use of mechanised transport within areas surrounding wilderness will be permitted on designated access routes and in other areas for emergency or essential management reasons only.	Vehicles: 4WD only Walk: AS Walking Track class 4-6; tracks generally formed (class 6 tracks not formed)	Vehicles: 4WD, sometimes 2WD seasonal Walk: AS Walking Track class 3-5; tracks formed;	Vehicles: 2WD unsealed Walk: AS Walking Track class 3 & 4; tracks generally formed;	Vehicles: 2WD sealed Walk: AS Walking Track class 1 & 2; tracks well constructed; universal access provided where appropriate and practical	

	Class 1 – Wilderness Area (as recognised in *Policy Statement No. 62 – Identification And Management of Wilderness and Surrounding Areas*)		Class 2 – Natural	Class 3 - Natural -Recreation	Class 4 – Recreation	Class 5 – Highly Modified	
	Class 1a - Wilderness	Class 1b – 'Surrounding Areas'				A	B
resource users and protected area managers)	signs, track markers and toilets will not be permitted in wilderness, and walking access is via natural routes. AS Walking Track standard 6 only. Existing vehicle tracks and built walking tracks within wilderness, other than those required for emergency and essential management purposes, will be closed. Aircraft: landing of non-fixed wing aircraft is permitted for emergency and essential research purposes only. Flying under 2000 feet for fixed wing aircraft and 1500 feet for helicopters above wilderness is discouraged, except for emergency or essential research purposes. Existing vehicle tracks and built walking tracks within wilderness, other than those required for emergency and essential management purposes, will be closed.	Walk: AS Walking Track class 5-6; tracks generally formed (class 6 tracks not formed)	Boats: non-motorised boats only Cycle: No cycle trails Horses: no horses permitted Airstrip: no airstrips permitted	Boats: boats, motorised and non-motorised, on designated routes/areas Cycle: type 4 cycle trail Horses: designated bridle trails possible Airstrip: natural earth	Boats: motorised and non-motorised, on designated routes/areas Cycle: types 2 & 3 cycle trails Horses: designated bridle trails possible Airstrip: unsealed	Boats: Areas may be open to all types of boats Cycle: type 1 cycle trails Horses: designated bridle trails possible Airstrip: sealed	
Site modification (Extent, type and design of infrastructure, facilities, amenities and	No site modification and no facilities or structures except for reasons of visitor safety, resource protection and/or management operations. Any rehabilitation or repair of worn trails or sites is unobtrusive, with no long-term or permanent marking or hardening of trails or	Services and infrastructure adjacent to wilderness that may impact on landscape values and/or otherwise degrade the quality of such areas should be avoided where possible. Overnight Stays: campsites not defined	Minimal modification at sites Overnight Stays: 'No Facilities'; campsites not defined	Minor modifications at specific sites Overnight Stays: 'Medium' and 'Low' level of development; campsites generally defined	Modification of sites clearly evident Overnight Stays: 'Medium' level of development; campsites generally defined	Modification of site evident Overnight Stays: 'High' and 'Medium' level of development; may include built accommodation	Modification of site evident with permanent, commercial infrastructure such as shops, café's, accommodation present

	Class 1 – Wilderness Area (as recognised in *Policy Statement No. 62 – Identification And Management of Wilderness and Surrounding Areas*)		Class 2 – Natural	Class 3 - Natural -Recreation	Class 4 – Recreation	Class 5 – Highly Modified	
	Class 1a - Wilderness	Class 1b – 'Surrounding Areas'				A	B
the style of accommodation provided)	sites. Overnight Stays: campsites not defined but includes 'Wild' or 'Remote' camping Day Use: day use sites not defined Walk: walking tracks are not defined	Day Use: day use sites not defined	Day Use: Car parking not defined Facilities: No facilities provided	Day Use: Car parking generally defined Facilities: Basic facilities may be provided such as shade shelters, BBQs, toilets	Day Use: Car parking generally defined Facilities: Facilities generally provided such as shade shelters, gas BBQs, tables, toilets	Day Use: Car parking has defined bays Facilities: High level of facilities including shade shelters, gas BBQs, tables, toilets, visitor information, rubbish collection; visitor centres may be present	
Social interaction (Density of users and degree of social interaction and opportunities for solitude)	Interaction between users is minimal, with usually less than two other groups encountered during a day, and no other groups within sight or sound at campsites. Maximum group size of about six to eight people.		Little interaction between users, with small numbers of brief encounters with individuals or small groups only except at campsites.	High likelihood of contact with individuals and small groups along access routes and at campsites.	High level of contact with others at campsites and along access routes. Campsite design allows for group camping.	Constant interaction expected. Group and family activities important part of visitor experience. Interaction with others unavoidable. Natural setting important but in the security of a safe and managed environment.	
Degree of self reliance (level of support services)	Visitors must be totally self-reliant as support services are inappropriate and are not provided (except where necessary to protect wilderness values). Commercial tourism and recreation operators not permitted in wilderness.		Visitors must be totally self-reliant. Support services infrequent or unreliable.	Visitors must still be largely self-reliant. Basic support services provided in specific locations.	Self-reliance requirements are generally low where facilities are provided, but outdoor skills will be important in areas away from roads and tracks.	Minimal self-reliance. High level of support facilities usually present or in close proximity.	
Style of visitor management	On-site visitor management is very low with controls primarily off	Activities, including services and infrastructure, adjacent to	Infrequent ranger presence.	Some management presence including visits	May be frequent ranger presence	Frequent staff presence, on-site manager	

	Class 1 – Wilderness Area (as recognised in *Policy Statement No. 62 – Identification And Management of Wilderness and Surrounding Areas*)		Class 2 – Natural	Class 3 - Natural -Recreation	Class 4 – Recreation	Class 5 – Highly Modified	
	Class 1a - Wilderness	Class 1b – 'Surrounding Areas'				A	B
(level of on-site management, site constraints and regulations)	site. All interpretation is off-site; no trail information in brochures. Boundary signage only. Very infrequent ranger presence. Constraints on visitors may apply to areas subject to resource use. Surrounding areas to be managed to complement wilderness and provide a buffer. Wherever possible, ground disturbing activities required for fire management will be conducted outside of wilderness. This includes construction and maintenance of access roads, firebreaks, fuel-reduced buffers and water points. Prescribed burning within wilderness may be carried out for the protection and maintenance of natural values and processes as determined through the preparation of area and regional management plans and interim management guidelines.	wilderness that may impact on landscape values and/or otherwise degrade the quality of these areas should be avoided where possible (such activities not permitted within wilderness).	Information principally off-site (e.g. brochures, guides, maps); minimal signs Low maintenance	by ranger staff and signs. Information may be provided on-site Permit system may be used to control access; emphasis on establishing appropriate visitor expectations and behaviour	Interpretive material, brochures and track guides available Moderate on-site management requirements, including signs and barriers; facilities may be common but clustered	Could be interpretative and education focus High degree of on-site management including use of physical barriers and on-site staff; vehicle and pedestrian movement heavily controlled	
Interpretation facilities and services	Signposting not provided on site, although some information provided off-site (e.g. websites, books, DEC offices).	Signposting often not provided but may be at start of pedestrian tracks and/or may be noted on wilderness interpretive signposting (located in 'surrounding area').	Signposting may be provided at trailheads; track markers and signs may occur for public health or safety reasons (e.g. at track junctions) Some guided tours may be permitted (see below)	Signposting may be provided where necessary Interpretive material off-site or at trailheads; guided tours permitted	Well signposted at trailheads and along track; Interpretive shelters, displays and leaflets, guided tours may be provided Primary themes may be expressed at recreation	Well signposted at trailheads and along track Interpretive shelters, displays and leaflets, guided tours may be provided; visitor centre may be present Primary themes may be expressed at recreation sites Extensive range of opportunities	

	Class 1 – Wilderness Area (as recognised in *Policy Statement No. 62 – Identification And Management of Wilderness and Surrounding Areas*)		Class 2 – Natural	Class 3 - Natural -Recreation	Class 4 – Recreation	Class 5 – Highly Modified	
	Class 1a - Wilderness	Class 1b – 'Surrounding Areas'				A	B
					sites Extensive range of opportunities		
Commercial uses	Commercial recreation and tourism operations are not permitted within wilderness (see section 4.3 of *Policy Statement No. 62 – Identification And Management of Wilderness and Surrounding Areas*).	All tourism management operations will be carried out in a manner consistent with maintaining the qualities of wilderness. CTOs permitted, but may need to consider restricted licences to maintain adjacent wilderness qualities (E class).	CTO licences permitted, but may consider regulating numbers to maintain visitor experiences consistent with setting (E class). Focus on nature-based/cultural activities.	CTO licences permitted with focus on nature-based/cultural activities.	CTO licences permitted, nature-based/cultural and adventure activities.	CTO licences permitted, nature-based/cultural and adventure activities.	
Probable recreation experiences	Opportunities for isolation, independence, closeness to nature, tranquillity and self-reliance through the application of outdoor skills in an environment that offers a high degree of challenge. Educational and/or recreation expeditions will be permitted within wilderness providing they are consistent with the maintenance of the qualities of the area and operate according to the Department's code of ethics (see Attachment 2 of *Policy Statement No. 62 – Identification And Management of Wilderness and Surrounding Areas*).	Activities adjacent to wilderness that may impact on landscape values and/or otherwise degrade the quality of such areas should be avoided where possible, and all recreation and tourism management operations will be carried out in a manner consistent with maintaining the qualities of wilderness.	Opportunities for solitude, independence, closeness to nature, tranquillity and self-reliance in an environment that offers a high degree of challenge. Although the activity may not be based on the use of a motorised vehicle, the influence of vehicles and the safety afforded by them may be significant.	Opportunities for challenging interaction with nature using outdoor skills. Opportunities may have human elements but still high probability that visitors can experience isolation from human influences.	Opportunities to interact with nature while still having access to facilities. Interaction with others expected.	Opportunities for nature appreciation and social interaction in a safe environment. Interaction with others unavoidable. Facilities support group activities.	

*Wilderness areas are classified under section 62(1) (a) of the CALM Act to establish management zones to which specific management prescriptions or regulations apply.
Sources: *Department of Conservation and Land Management, Policy Statement No. 62 – Identification and Management of Wilderness and Surrounding Areas, The Recreation Opportunity Spectrum (Clark and Stankey 1979*).

APPENDIX 7: VEHICLE ACCESS STRATEGY

Road/Track – Millstream Chichester National Park	Managing Authority	Existing and Proposed Management and Comments
Roebourne-Wittenoom Road	Shire of Ashburton	Open – 2WD unsealed[10] to Barowanna Hill, with short sealed section in Python Pool precinct. Proposed sealing from Barowanna Hill to the park boundary as part of the Karratha-Tom Price Road (see below).
Karratha-Tom Price Road	Main Roads Western Australia	Proposed sealed road passing through the park, via Barowanna Hill. The proposed route is 35 kilometres from the Millstream Homestead precinct and 20 kilometres from the Python Pool Precinct.
Millstream-Yarraloola Road	Shire of Ashburton	Open – 2WD sealed between park entry station and intersection with Roebourne-Wittenoom Road.
Kanjienji-Millstream Road	DEC	Open – 2WD unsealed. Progressively seal.
Dawson Creek Road (to Crossing Pool [*Murlunmunjurna*])	DEC	Open – 2WD unsealed.
Snappy Gum Drive	DEC	Open – 2WD unsealed
Cliff Lookout road	DEC	Open – 2WD unsealed.
Deep Reach Pool (*Nhangghangunha)* day use site access road	DEC	Open – 2WD sealed.
Deep Reach Pool (*Nhangghangunha)* camping area access	DEC	Close – due to closure of Deep Reach Pool (*Nhangghangunha)* camping area. Management access.
Pilbara Iron access road	Pilbara Iron	Permit required – 2WD unsealed.
Water Corporation access road	Water Corporation and DEC	Permit required – 4WD unsealed.
Track between Snappy Gum Drive and Roebourne-Wittenoom Road	DEC	Open – unsealed, standard to be determined.
Track east of Water Corporation Road	DEC	Open – unsealed, standard to be determined.
George River Track	DEC	Permit required – 4WD unsealed.

[10] The 2WD unsealed roads listed in this table are not all-weather accessible. Many unsealed roads in the planning area are closed following rain and are inaccessible to both 2WDs and 4WDs.

APPENDIX 8: DEPARTMENTAL STANDARDS FOR WALKING TRACKS

Class of walk track	Description of walk track
Class 1	A broad, hard-surfaced track suitable for wheelchair use, with a width of 1200 mm or more. An easy walk with the opportunity of large numbers of visitors, including those with reduced mobility to undertake walks that are provided with a high level of interpretation and facilities. Users need no previous experience.
Class 2	A track with a modified or hardened surface that is well maintained with no intrusions and a width of 900 mm or more. These tracks allow for large numbers of visitors to walk easily in natural environments that are provided with a moderate to high level of interpretation and facilities. Users need no previous experience.
Class 3	A track with a modified surface, sections may be hardened and a variable width but generally less than 1200 mm. The surface is kept mostly clear of obstacles and intrusions and provides visitors with the opportunity to walk in slightly modified natural environments, requiring a moderate level of fitness and where the provision of interpretation and facilities is not common. Users need no bushwalking experience and a minimum level of specialised skills. Natural hazards such as steep slopes, unstable surfaces and minor water crossings
Class 4	A generally distinct track without major modification to the ground. Encounters with fallen debris and other obstacles are likely. This type of track gives visitors the opportunity to explore and discover relatively undisturbed natural environments along defined and distinct tracks with minimal, (if any) facilities. Users require a moderate level of specialised skills such as navigation and first aid and need to be self reliant.
Class 5	This type of track consists of limited modification to the natural surface and alignment may be indistinct in places. Minimal cleaning and debris along the track. This type of track gives visitors the opportunity to explore and discover relatively undisturbed natural environments along defined and distinct tracks with minimal, (if any) facilities. Users require a high level of specialised skills such as navigation and first aid and need to be self reliant.
Class 6	This consists of no modification to the natural environment. This allows for highly experienced walkers to explore remote and challenging natural areas without reliance on managed tracks. Users require previous experience in the outdoors and a high level of specialised skills such as navigation and first aid and need to be self-reliant.

Source: Standards Australia (2001)