THE UNIVERSITY OF
WESTERN AUSTRALIA

NGAPA KUNANGKUL:
LIVING WATER

REPORT ON THE ABORIGINAL CULTURAL VALUES OF GROUNDWATER IN THE LA GRANGE SUB-BASIN

Prepared by
The Centre for Anthropological Research,
University of Western Australia,
for
The Water and Rivers Commission
of Western Australia

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"Water is the life for us all. It's the main part. If we are gonna loose that I don't know where we are gonna stand. If that water go away, everything will die. That's the power of water. He connect with the land. *Pukarrikarra* (the dreaming) put 'em all together. One life."

John 'Dudu' Nangkiriyn, Bidyadanga, August, 1998

Fig.1 Traditional owners at Yaralya spring

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NOTE ON ORTHOGRAPHY

The orthography adopted in this report is the South Kimberley orthography recorded in *Guide to Writing Languages of the Kimberley*, Kimberley Language Resource Centre, Halls Creek, WA 1999:1,2,15.

Vowels

a	Like the **u** in b**u**t
aa	Like the **a** in f**a**ther.
i	Like the **i** in p**i**t, but also like the **ee** in f**ee**t.
ii, iyi	Like the **ea** in **ea**sily.
u	Like the **u** in p**u**t and the **oo** in foot
uu/uwu	Like the **oo** in p**oo**l.

Consonants

j	Like the **j** in **j**am.
k	Like the **g** in **g**oat, but also like the **k** in s**k**ite.
l	As in **l**ock.
ly	Like the **lli** in mi**lli**on. not like the **ly** in happily.
m	As in **m**eat.
n	As in **n**ut.
ng	As in si**ng**ing and bri**ng**.
ny	Like the **ni** in o**ni**on. Not like the **ny** in ma**ny**.
p	Like the b in **b**oat and **b**ig, but also the **p** in s**p**in.
r	As in **r**ed and o**r**ange.
rl	Like the **rl** when an American English speaker says girl or curl.
rn	Like the **rn** when an American English speaker says barn.
rr	Like the rolled Scottish '**r'** or the **r** in butter when spoken very fast.
rt	Like the **rd** or the **rt** sound when an American English speaker says cart or card, but the tongue curls back a little more.
t	Like the **d** in **d**og; sometimes like the **t** in s**t**un,
w	As in **w**ait.
y	As in **y**ellow.

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1 INTRODUCTION

In 1998 the Western Australian Government signed a Memorandum of Understanding (hereafter MOU) with Western Agricultural Industries (hereafter WAI) to investigate the feasibility of growing cotton and other commercial crops using groundwater from the La Grange sub-basin and surface water from the Fitzroy Valley. As part of this feasibility study the WA Government Waters and Rivers Commission (hereafter WRC) is required to develop water allocation plans for the La Grange sub-basin and the Kimberley region.

In his now classic ethnography of the Pintupi of Central Australia Fred Myers (1986:99) quotes a Yankuntjatjarra man: "the first law of Aboriginal morality: Always ask!" This simple injunction precisely illustrates how Aboriginal people within the present study area consider research into the proposed uses of groundwater should be undertaken. As Myers points out for the Pintupi, when such a request is made to use the resources of their country, denial of access is infrequent. However, the traditional owners are also obliged to carefully consider the request before granting approval.

In preparing the Allocation Plan for the use of groundwater in the La Grange sub-basin aquifer, the Waters and Rivers Commission has commissioned this research in order to ascertain the significance of groundwater to the Karajarri and other traditional owners (hereafter TOs[1]) of the affected area. It is the first time that the Western Australian Government or its agencies have asked the TOs in the west Kimberley region for their view of groundwater, over which they have traditional custodial rights.

This report presents the views of the Karajarri and other TOs concerning the cultural significance of groundwater, in the context of the proposed use of groundwater for large-scale irrigated agriculture in the area of study. It is thus part of Phase One of Waters and River Commission's programme to develop a water allocation plan for the La Grange sub basin. It is also part of Western Agricultural Industries' feasibility study, specified in the Memorandum of Understanding signed by WAI and the Western Australian government to investigate the potential for large-scale irrigated agriculture south of Broome.

1.1 SCOPE OF STUDY

The area of the La Grange Sub-basin can be seen on Map 1. However, the TOs extended the study area to include all water sources that they felt could be negatively impacted upon by the increased extraction of groundwater from the western side of the La Grange Sub-basin. The TOs emphasized that this was necessary for two reasons:

1 I use the term 'traditional owners' to collectively identify the Aboriginal people who have cultural connection to and responsibility for the area within the La grange aquifer. This term is employed by the Aboriginal people themselves and by the many Aboriginal organisations in the Kimberley.

1. The TOs of the various language groups share a cultural responsibility for looking after the water sources in their respective countries, and
2. The TOs hold a particular view (to be discussed below) of the interconnections between the traditional water sources.

Thus, from the west Kimberley coast, the area of study for this report extends approximately 200 kilometres inland towards the McLarty Hills. On a coastal north – south axis, the basin extends from Roebuck Plains to Salt Creek. Inland, the basin lies between the Edgar Ranges and Dragon Tree Soak.

The goals of this study into the Aboriginal cultural values of groundwater were outlined in the initial research brief as follows:

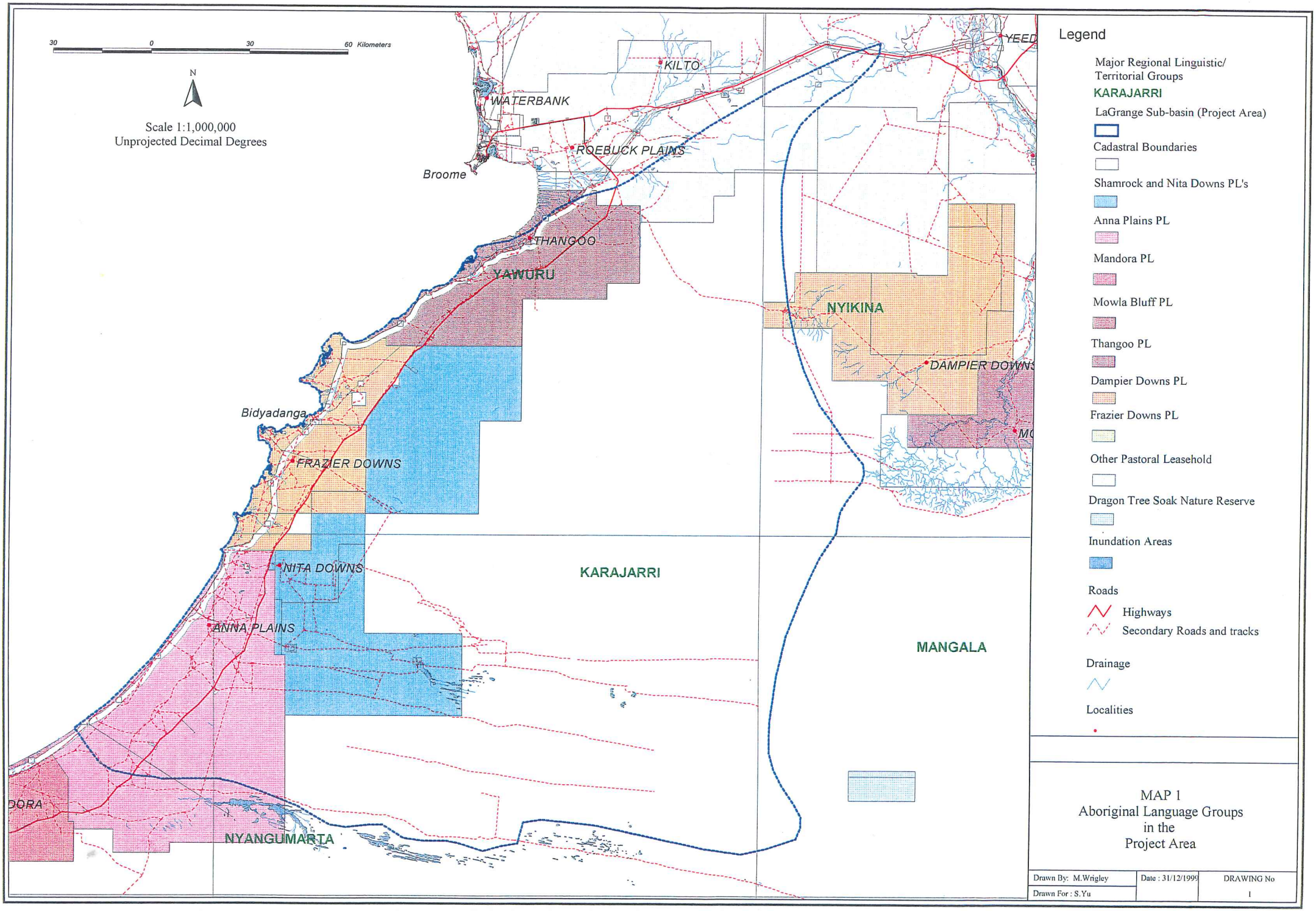
- To identify and document the Aboriginal cultural values of groundwater dependent ecological and hydrologic features within the study area.
- To provide an assessment of the significance of these environmental values with respect to the cultural values they possess.
- To identify any registered Aboriginal heritage sites in the study area that are linked to groundwater dependent ecological or hydrological features.
- To involve the Karajarri and other Aboriginal groups with traditional lands in the study area in the research process.
- To make specific recommendations regarding the avoidance of negative impacts on the groundwater dependent cultural values within the study area.
- To ensure that the resultant study report is approved by the Aboriginal community and groups involved.

1.2 THE TRADITIONAL OWNERS

The lands overlying the La Grange sub-basin aquifer and its surrounds include parts of the traditional countries of a number of Aboriginal language groups.

The area south of Roebuck Plains towards the southern end of Thangoo Station is in Yawuru people's territory. Their eastern neighbours are Nyikina speakers, whose country includes the Edgar Ranges. Near the old Dampier Downs homestead, Karajarri country meets the territories of both the Nyikina and the Yawuru peoples.

Most of traditional Karajarri country is included within the study area. Mangala territory is located on the extreme eastern boundary of the study area, while traditional Nyangumarta country includes the area south of Salt Creek. In the course of this project senior representatives of all of these groups were directly consulted. See Map1.


30 0 30 60 Kilometers
N
Scale 1:1,000,000
Unprojected Decimal Degrees
KILTO
WATERBANK
ROEBUCK PLAINS
Broome
THANGOO
YAWURU
NYIKINA
DAMPIER DOWNS
Bidyadanga
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Drawn By: M.Wrigley
Drawn For : S.Yu
Date : 31/12/1999
DRAWING No
1

2 METHODOLOGY

The Centre for Anthropological Research of the University of Western Australia was engaged to determine and assess the Aboriginal cultural values of groundwater dependent ecological and hydrologic features in the La Grange sub-basin.

Sarah Yu was appointed as the anthropologist to carry out the field research and write the final report. Since 1995 she has been working with Aboriginal groups in the West Kimberley on studies concerning their relationship to land and water, and has undertaken numerous field trips with TOs throughout the study area.

Geoffrey Bagshaw, a male anthropologist with recent experience of working with senior Karajarri men, was engaged to consider certain culturally restricted aspects of groundwater sources. This ensured that cultural protocols relating to gender-specific knowledge were observed and that relevant data were presented in an appropriate manner.

David Trigger, Director of the Centre, supervised the project, and his research assistant Adele Millard provided a preliminary desktop literature review.

The Waters and Rivers Commission also commissioned specific studies of regional wetlands and their environmental significance, and of the current use of groundwater in the area. Accordingly, the V & C Semeniuk Research Group was engaged to identify and assess groundwater-dependent wetlands in the study area. As an integral part of the research project the two research groups collaborated to produce their final results. Vic Semeniuk and his assistants also accompanied Sarah Yu and the relevant Aboriginal TOs to a number of well-known wetland sites in the study area, and were able to discuss the historical use of the water and hydrology of the sites with Aboriginal people in situ.

The present area of study contains numerous springs in both inland and coastal locations. Field trips were undertaken to record as many of the named springs as possible. As Sarah Yu and Geoffrey Bagshaw had previously travelled to Kurriji pa Yajula (Dragon Tree Soak) with several Karajarri and Mangala elders it was deemed unnecessary to make the arduous trip again. Geoffrey Bagshaw travelled to Jawanijawani (site no.41) in mid-December to record this site and discuss its importance with groups of Karajarri and Mangala TOs.

Chris Hassell, an ornithologist who has studied Kimberley migratory birds, visited a number of coastal springs in the Injitana area with Sarah Yu and a group of Karajarri TOs in order to compile a list of birds sighted.

During the course of the project Mervyn Mulardy, a young Karajarri man with training in land management, was appointed by the WRC as the Aboriginal Resource Person for La Grange groundwater planning. He provided invaluable assistance especially in the planning of the fieldwork, and in consultations with TOs.

2.1 LIMITING FACTORS

2.1.1 QUANTIFICATION OF RESULTS

In the proposal for this consultancy it was emphasized that it would be difficult to quantify Aboriginal cultural values of groundwater in Western terms (e.g. the volume of water required to sustain traditionally oriented lifestyles and their ecological base). Rather the Aboriginal cultural values of groundwater are qualitative, as will be discussed below.

The present study therefore aims to assess whether the use of groundwater will have a negative impact on the culturally-constituted values attaching to traditional water sources.

To do this the following issues were investigated with the TOs and their opinions documented:

- identification and definition of culturally recognized wetlands and their ecosystems within the La Grange sub-basin
- the cultural significance of water - as a force vital to the Aboriginal world view, and the interrelationship (both physical and metaphysical) between the identified water sources
- the Aboriginal view of the water table, referred to in Aboriginal English as 'the balance of water' or the 'water level', how it is maintained, and what are the signs that indicate that the 'balance' is out
- the interface between fresh and salt water, as it is revealed through out the sub-basin, in the coastal wetlands, in the 'Salt Creek' tidal inland mangrove system, in the inland spring country surrounded by the claypans, and in the fresh and salty soak waters often found side-by-side
- the relationship between seasonal changes, water sources and the exploitation of bush resources
- an Aboriginal view of the hydrogeological formations which generate sources of water
- interpersonal relationships and responsibilities between the Aboriginal TOs and the identified water sources in the area of the La Grange sub-basin.

2.1.2 SIZE AND REMOTENESS OF STUDY AREA

Due to the enormous size of the study area and the remoteness of many identified Aboriginal water sites only a small percentage of water sources could be visited in the course of the research. Most permanent and ephemeral water sources located in the inland desert areas could not be accessed due to the difficulty, expense and time required to locate them and to the frailty of some of the principal TOs. To compensate, I have incorporated data from previous research and created a 'mud-map' from interviews with the TOs. The end result is a draft map that gives some indication of the extent and type of water sources within the

study area (see Map 2). Each site has been classified according to an Aboriginal taxonomy, and its accurate or approximate position indicated.

2.1.3 REGISTERED AND REGISTERING SITES

All water sites located and identified in the course of the research are considered significant by the TOs. However, at the present time when most all of the TOs are involved in native title claims, and the Aboriginal Heritage Act is under review, people decided not to register these sites. This can be done at a later stage if required. Meanwhile a copy of this report will be forwarded to the Aboriginal Affairs Department Heritage Unit.

2.2 WORK PROGRAMME AND ABORIGINAL INVOLVEMENT

For a detailed outline of the project work programme see Appendix 3.

2.2.1 ABORIGINAL PARTICIPATION

A series of initial meetings and interviews were held with all the TO groups in Broome, Derby, Looma and Bidyadanga to advise people of the project, determine significant issues to be investigated and to plan field work.

The following TOs were participants in the discussions and fieldwork during the project:

Karajarri :	John Dudu Nangkariyn, Stephen Possum, Donald Grey, Mervyn Mulardy Snr, Norman Munro, Alex McKay, John Hopiga Edna Hopiga, Flora Dean, Cissy Everett, Nyartiya Possum, Witadong Mulardy, Elsie White, Doris Edgar, Cecelia Bennett, Rene Hopiga,
Nyikina:	Darby Nangkariyn, John and Harry Watson
Mangala:	Peter Clancy, Harry Bullen
Yawuru:	Frank Sebastian, Felix Edgar, Peter Edgar, Elsie Edgar
Nyangumarta:	Wuda Davies, Darcy Hunter, Misha Peters, Rosie Munro, Susie Gilbert, Charlie Wright

A draft of this report was presented to local TOs in December for their approval before final submission.

Mervyn Mulardy Jnr participated in most of the discussions and all of the fieldwork in the course of the project.

2.2.2 FIELDWORK PROGRAM

A fieldwork period was chosen to accommodate the availability of the TOs and to meet the needs and availability of the Semeniuk research group. A ten-day field trip, commencing in October, explored springs, soak waters and *jila* in the Bidyadanga/Nita Downs/Anna Plains area.

I undertook a further 5 days of field research in late October to record sites of springs on the southern section of Frazier Downs and on the Anna Plains lease.

To assist in the identification of the bird life that access the coastal and inland springs, Chris Hassell, a Broome-based ornithologist, accompanied the TOs and myself to the springs in the Injitana area to compile an inventory and to assist in recording the Karajarri taxonomy for birds.

Geoffrey Bagshaw, an anthropologist who has worked with the Karajarri during the last four years, completed 3 days research in early December to advise on the significance of groundwater and water sources from the perspective of senior Karajarri men.

2.2.3 RESEARCH PROCESS

A desktop literature review was prepared of material relating to the significance of groundwater to Aboriginal people. Legal aspects of Aboriginal people's rights to groundwater were also reviewed.

Significant data from previous research conducted by Geoffrey Bagshaw and myself, with approval from the Kimberley Land Council and the TOs, were reviewed and included in the research findings**.**

After fieldwork was completed the data were compiled and collected for presentation in this report.

Fig.2 Sarah Yu with Stephen Possum and Mervyn Mulardy at Murtul (site no.4)

Fig.3 Chris Hassell sighting birds

Fig.4 Vic and Chris Semeniuk working with senior Nyangumarta and Karajarri men: Misha Peters, Mervyn Mulardy, Stephen Possum, John Hop

3 BACKGROUND

The present document was written in the period after the signing of a MOU between the Western Australian government and Western Agricultural Industries concerning the proposal to grow cotton and other commercial crops using groundwater from the La Grange sub-basin. Whilst the MOU is not a contractual agreement, it indicates the government's intention to support the establishment of irrigated agriculture in the region south of Broome.

Large scale irrigated agriculture is a new industry in the West Kimberley region, and WAI's proposal would impact upon the land in a way that has never been experienced in that region. In the south west of the State, changes to the landscape brought about by broad scale agriculture have affected the microclimate, and variously resulted in: changes to the water table, extensive salinization, contamination of the unconfined groundwater resources and—in some coastal areas—seawater intrusion (Allen 1997:48).

The TOs of the West Kimberley have seen reports of these effects on television and have had a number of discussions with WAI about possible impacts. Throughout the course of this project, which focuses on the cultural significance of groundwater, TOs were discussing the significance of groundwater in the light of their concerns about the changes the future may bring if broad scale agriculture is introduced on Nita Downs and Shamrock Stations.

As pointed out in my original submission to contract this work, the TOs are not *a priori* opposed to development in their country. They do, however, maintain that any such development must (i) be ecologically sustainable, (ii) recognize their own cultural values in respect to groundwater, and (iii) avoid destruction of culturally significant sites and areas.

3.1 HISTORICAL OVERVIEW OF GROUNDWATER USE SINCE 1864

The Karajarri assert that they and their ancestors have lived in the region of La Grange since time immemorial, that is, since *pukarrikarra* (the creative epoch in which the world was given form and meaning). They traditionally moved between camps along the coastal creeks, the inland bush and into the desert country. Knowledge of the location, size and condition of their water sources was essential for survival as they traversed the country from inland to coast.

The first Europeans came to the south Kimberley coast as pearlers, explorers and pastoralists in the 1860s. Some of the earliest contacts with the Aboriginal inhabitants focused on the Whites' need for fresh water for themselves and their livestock. According to the available information many of these contacts were violent, resulting from conflict over accessibility to and control of water sources and pasture lands[2].

[2] See Skates (1989), Willis (1997) and Burgess (1913).

For example, oral accounts and archival evidence agree that in 1884 Aboriginal people killed three explorers—Harding, Panter and Goldwyer. TOs say that they were killed for violating a sacred place (Jinjarlkuriny), which was a rainmaking *jila* (permanent water place). Retribution against the native people was swift and brutal with retaliatory raids continuing till at least one year later[3].

From the late 1880s pastoralists were quick to take up leases along the coast and along the Fitzroy River. The DeGrey-Kimberley stock route was formally gazetted in 1885. Many of the watering points along the stock routes were built over 'native' soaks and *jila* —Yardugarra, Jinjarlkuriny, Junkurljartiny to name a few. The resultant dilemma for Aboriginal people is recorded in the journals of the travelling inspectors who worked for the department of native affairs:

> It must be remembered that the whole of that line of coast has been leased: the natives have not one acre of land of their own. The Government Stock Route wells are being used by some of the stations and a native is not allowed to camp on any of them. This is a public scandal.[4]

Fig.5 Edna Hopiga at Yilwarrangurr government well

3 Ibid.

4 In a report from James Isdell, a travelling inspector of the Department of Native Affairs to the Chief protector of Aborigines, 18.2.1908, State Records Office, Battye Library, Perth. File No. - ACC255 332/1908.

In time, under the restrictions of the Aborigines Act (1905) which imposed a permit system to indenture Aboriginal workers to stations, the Karajarri and their neighbours worked with the pastoralists to assist in establishing wells and watering points on the leases for the cattle and sheep. Whilst the early pastoralists took over the country by force, many of their successors worked in close consultation with the local Aboriginal people, using their skills and knowledge of country. Many wells, for example, those on Frazier Downs, have official names that are derived from Karajarri place names. Chinkmataji Well is Jingkamartaji, Ambrooka Well is Yanpurrka, and Eugarangah Well is Yukurrungka. These wells may be either directly on top of old soaks or in the vicinity of these areas. However, up to the present, not all pastoralists have shown regard for Aboriginal interests. For example, it would appear that on Shamrock Station as recently as the 1990s a dam was constructed on top of an Aboriginal soak. Local Aboriginal people know about this and speak of it among themselves with concern.

For over 100 years there has been moderate use of the groundwater for livestock and small-scale agriculture at Shamrock, Shelamar and at La Grange. An essentially symbiotic relationship has been maintained between the pastoralists and the TOs who worked as stockmen, drovers, cooks and domestics on the stations. Information from contemporary Aboriginal people and pastoralists indicate that the parties co-existed.

Fig.6 The rainmaking *jila,* Jinjalrkurriny (site no.7). Historically and culturally a significant site whose water source was permanently damaged by the construction of a small dam as a watering point for sheep.

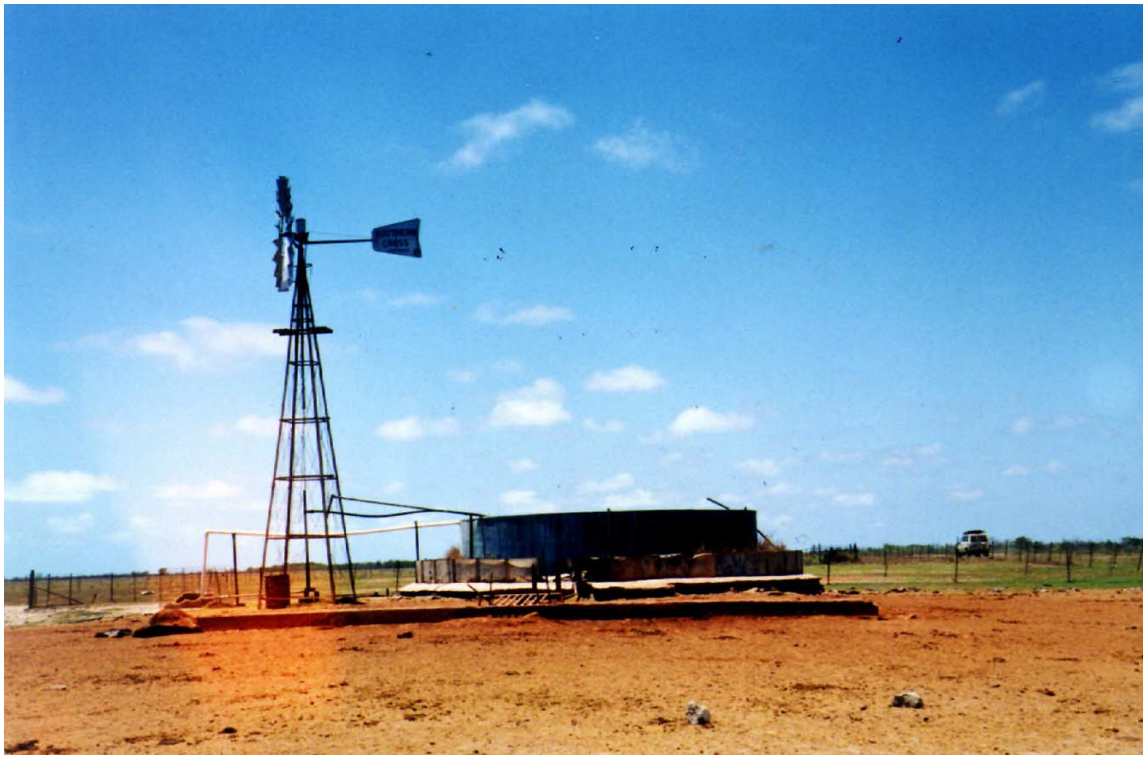

Fig.7 Kalyanjartiny (site no. 30), the site of the old station outcamp on Anna Plains Station, located near a traditional soak

Fig.8 Government well at Yanpurrka spring (site no.37)

3.2 RECENT PROPOSALS FOR GROUNDWATER USE

Recent conflict between leaseholders and TOs over water use in the study area have arisen because of the introduction of new techniques for water collection, such as birds-nest dams, and intentions to develop large-scale irrigation agriculture south of Broome.

For example, the construction of a turkey-nest dam at the south end of Shamrock was of great concern to the Karajarri, particularly when the area fenced around the dam at a 5km radius blocked off the main access to Parturr area, a significant site.

In recent times, the most significant development of this kind has been the Camballin irrigation agriculture project on Liveringa station on the Fitzroy River. It began with a local pastoralist pumping water from Yiralya creek in the 1950s for small-scale crops such as rice; this water was pumped from the bottom of the creek.

In the 1960s the Camballin project developed with the construction of the 17 mile dam and a man-made creek, and later a barrage on the Fitzroy River. Associated with this were the clearing and levelling of fields to grow a range of crops including sorghum and cotton. In the days before the introduction of the Western Australian Aboriginal Heritage Act (1972). Aboriginal people including the Nyikina TOs of this region, watched the destruction of their country and river system, as the Camballin project progressed from one problem to another. The damage is still apparent as the barrage rusts away, creating a dangerous waterway. The country downstream has been cut and eroded by new channels. The fields have been flattened and are now dust bowls, with little vegetation. The fauna in this riverine country has completely changed. Kangaroos that reportedly used to feed along the river flats are almost completely gone.

Harry Watson, a Nyikina/Karajarri man, who grew up at Mt Anderson and worked on the Camballin project speaks of some of the disasters that occurred and how the Aboriginal people were never informed of the developments or their consequences:

> All of sudden they started to put in the 17 mile dam in the 60s. We didn't know what they were doing. One day they just brought in the trucks and starting making the dam and canals. They were growing wheat, feed for cattle, corns, sorghums that sort of stuff. Same time they were working on the barrage too. The land had already been cleared.
> [Once it was built] every year the levy banks used to get washed down from the floods, had to be built up after the erosion. You couldn't control the floods.
>
> Another time they had the idea of building a dam on the Fitzroy. They got so far but they ran out of time before the wet came. So they left it. Because the bank was fresh the flood took the sides out of it, and it was filling up on Camballin side. When the water builds up the bank just went 'Bang'. The bank on the north side of river was putting the water in a direct line, and the other end of our country was just washing away, making new creeks. The old creek water didn't follow same track any

> more. It just makes its own track. A new river, even bigger than the main river in the Fitzroy.
>
> At one time they trialed cotton. Nobody knew about the cotton. We were just wondering what was wrong, what was happening here. Couldn't work out why everything was dying on us. And then, somebody said, "Oh. They're growing cotton over there. Trial one".
>
> That's when we found out what was happening to the animals that were dying.
>
> People were camping at this place called Ngarpanagarra on Yiralya creek. Two mile down this used water was coming in, from the cotton fields with the chemicals in it. These people were drinking water and everything, not knowing what was going on this side.
>
> They were all dying. Pelicans, ibis and all the birds that eat fish. were dying like flies. Crocodiles were walking around like bones. Kangaroos - they all died. In two years, in the seventies, they were all gone All the kangaroos were gone.
>
> Who's going to fix all the erosion? Who's gonna fix up the mess? They should leave it as it is.[5]

The Camballin Project and the more distant Ord River scheme were two examples of water being used for irrigated agriculture that upset and disconcerted the traditional owners of the countries involved. In both cases, contemporary Aboriginal people of the Kimberley region claim there was no satisfactory negotiation, and that the long-term effects have either damaged or inundated their traditional lands, with consequent impacts upon the local ecologies.

These cases are well known to the TOs of the La Grange sub-basin. Whilst it is not presumed that the current WAI proposal for irrigated agriculture will result in similar ecological consequences, factors such as the scale of the proposal, the plan to have cotton as the primary crop, the control over the licensing of water and the probable State Agreement to establish the project have caused enormous concern to local TOs. The sorry history of relations between local Aboriginal people and governments and groundwater developers has led the TOs to be extremely cautious in facing the prospects of this new, large-scale proposal.

3.3 LITERATURE REVIEW

Ralph Piddington first researched the significance of Karajarri water sources in the 1930s. His article, which regrettably contains restricted cultural material, refers to the cultural significance of water sources, the existence of *bulaing* (water snakes) and their power to make rain, and details of myths associated with the generation of rain.[6] Other anthropologists who worked in or around this area, such as Elkin, refer to Piddington's research to make their own, similar analyses about the significance of water sources and their associated mythology. Elkin

5 Interview with Harry Watson, Broome, 29.10.99.

6 Information supplied by Geoff Bagshaw.

(1930) confirms the belief in *pulang* as snakes that live in water places such as Djaoini-djaoini (Jawanijawani, see site no.41 on Map 2). He also notes Aboriginal views about the ability of the water snakes to generate wild storms and argues that these snakes are evidence that the Karajarri believe in the rainbow serpent. Maddock (1982:114) refers to the Karajarri *bulaing* and suggests that it is a generic word used in the north of Australia, of the same derivation as *bolung*, a term for rainbow serpent used in Arnhem Land.

The significance of *jila*, (the term used to refer to permanent ground water sources) in cultural terms, has been discussed in a number of ethnographic studies of desert communities. Berndt (1942-1945) in his detailed ethnographic work with the desert groups at Ooldea in the north of South Australia speaks of the importance of waterholes, called *gabi*. They are believed to be conception and birth sites, containing spirit children, and were recorded as meeting and ceremony places. Berndt argues that such water sources typically demarcate boundaries between cultural groups, and as such provide geographic definition for people's country. Berndt also identifies *Wonambi* the water snake as a creator of waterholes, and the role of this mythic figure in male initiation ceremonies**.**

Myers (1982, 1986) speaks about the significance of water places among the Pintupi people of Central Australia and explains the concept of *ngurra as* place/country. He emphasizes that, in relation to management and use of resources, the first rule of etiquette among the Pintupi is always to ask if you are not in your own country.

Long (1971:264), who also wrote about the Pintupi in the 1950s, refers to the more reliable wells as *tjila* and gives a reasonably detailed physical description of them.

Tonkinson (1991) speaks of the significance of *jila* and other permanent water sources to the Mardu people around Jigalong in WA, and details how traditionally Mardu people utilized and lived around such water places.

Gould's (1969) study of the Pitjantjatjarra and neighbours in the Gibson desert refers to the links between living waters and serpent beings. He states that certain creation spirits are identified as *Wanampi* (water snake) in Pitjantjatjarra, and that the rainbow snake simultaneously links individuals with groups of people, totemic beings, water and land sites in the north of South Australia.

In the Kimberley region anthropologists such as Palmer (1980), Akerman (1980, 1982), Capelle (1982), Green (1987) and Arthur (1983) have noted the importance of water sources to the Aboriginal people with whom they have worked, and all refer to the existence of *bulany* or *kalpurtu* as the terms for mythical water snakes who inhabit *jila* or other permanent water sources.

Both individually and collectively these researchers identify water sources as being culturally significant spiritual places, to which individuals have close, personal relationships. They also identify patterns of traditional usage in the arid regions whereby people would retreat to the larger water sources in the hot, dry time and move out to live around less permanent water sources during the rest of the year. Their research relating to the significance of water sites is supported by other recent studies in WA and northern Australia.

Muecke (Benterrak, Muecke & Roe 1984) in his work with Paddy Roe, a Nyikina elder, writes about the relationship between Paddy and the springs located on Roebuck Plains, and the *yungurugu* (water snakes) that inhabit them. Paddy is recorded as saying:

> these springs here today that's all my spirit... cos I born here. I born 'mongst these *yungurugu*…. *Yungurugu* is the rainbow snake. He hold that water always. Never go dry must be something underneath. (p37)

He adds,

> that's why these springs permanent springs you know from *bugarrigarra* he bin like that water snakes never go 'way from this part of the country (p51)

Paddy sometimes refers to the springs as *jila*:

> at Mimiyagaman: all springs country all my country too .... never dry up all my *djila*. (p82-3)

Paddy also describes the characteristics of the *yungurugu*, and the consequences of disturbing them:

> that's the boss Mimiyagaman that grass there that's his ... beard.. belong to that *yungurugu* snake that his beard (p85) ... [and] if someone break the grass take away the leaves -- oh big rain (p86)

Finally he describes how closely he is attached to the springs in his country:

> you know anytime I go to sleep I want to come in dream I come here. I never go any other places (p88)

Pat Lowe (1990) provides a Walmajarri classification of water places in the Great Sandy Desert and describes *jila* as living water, inhabited by *kalpurtu*, magic water snakes. She also details some of the ways people must approach the *jila*.

Joe Brown, one of the TOs of the Great Sandy Desert, articulates the relationship between his people and *jila* in his letter addressed to Professor Marcia Langton when she was preparing her paper on indigenous water rights:

> Every *jila* (living waterhole) has its own songs, stories and skin group. A watersnake lives in the *jila*, he was human before he turned into the snake and went into water. Without the snake underneath the water will go away. Our old people know how to sing and talk to the snake. If you want rain or food you can sing to the snake and he'll bring it. If the *jila* is dry we know the proper way to dig them out and when we take the sand and clay out we know the right story to sing as we dig and how to do it properly. This has saved a lot of people's lives. It was our knowledge of *jila* that allowed *Kartiyas* [Whitefellas] to live in this country.

> Water is the basis for our songs and our culture. We have been looking after our waterholes and rivers for thousands of years. We have respect because we know that if you don't treat it right many things can happen. This is the lesson that we need to make other people learn. People see water just as a thing that can be drunk or used. They don't see it as a part of everything. They think they can control it. They think that they can own it. We know better. Many things fail because people don't understand this. (Langton,1999:14)

This view is confirmed by another Walmajarri elder and artist, David Downs, in his discussion of his paintings about Kurtal, an important rain-making centre and *jila* (Kentish & von Sturmer, 1995). Downs describes the link between the *jila* and *Ngarrangkarni* (Dreamtime), the transformation of a human figure into the mythic watersnake and how the *jila* is created with the power to determine weather conditions.

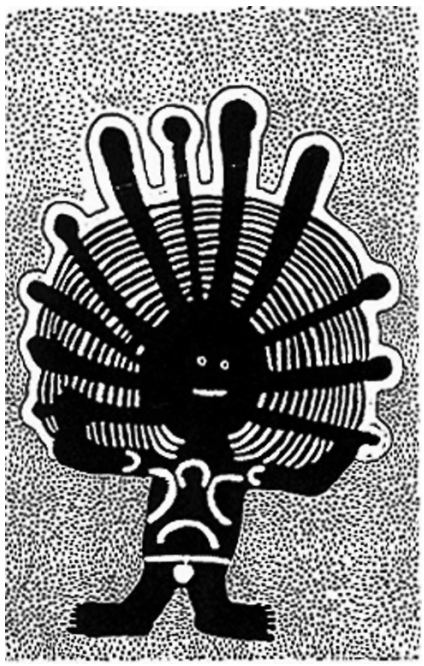

Fig.9 David Downs painting of *Kurtal as Cyclone and Living Water*, 1994

These cultural aspects of jila have also been reported in various statutory land claims in the Northern Territory. For example, in the Jila (Chilla Well) Warlpiri Land Claim, Chilla Well is said to be the name of a significant site referred to as The Springs, and is most important to the Aboriginal people as a totemic centre.

In their report for the Water Resources Council in 1989, O'Connor, Quartermaine and Bodney emphasize the need to consider water sources in the south west of Western Australia as protected Aboriginal heritage sites. Their research focuses on both archaeological and ethnographic aspects. In section 4 of their report O'Connor details the cultural significance of the *Waugal*. He concludes that:

> most of the major rivers which drain the Darling range, and a great many smaller creeks, springs, pools, swamps and lakes on the Swan Coastal

> Plain are associated with Waugal beliefs.(O'Connor, Quartermaine and Bodney, 1989:46)

From these literature sources it can be deduced that the concepts of *jila*, *pulany* (i.e. serpents living in water holes), rainmaking and *'living water'*, are found throughout much of Aboriginal Australia and most especially within the arid zone.

Semeniuk and Semeniuk (1995) describe and classify inland wetlands, according to a system that can be applied globally. Semeniuk (1983, 1993) has demonstrated that the mangrove systems of northwest Australia, like the springs, are groundwater fed. Veth (1989) and Cane (1984) further describe the archaeological deposits that can be found around well-used and well-known water sites in arid regions

Both the Western Australian Government, through agencies such as Minerals and Energy and the Water Resources Council/Commission, and the Federal government, through the Agriculture and Resource Management Council of Australia and New Zealand (1996), have commissioned a number of reports which discuss and make recommendations for the strategic planning of groundwater use and management. Recommendations in these reports consistently emphasize the need for ecologically sustainable usage of the groundwater.

There are numerous publications by government departments and agencies (e.g. Waterways (1995-99), Water facts (1998) and COAG publications (1997)) discussing the management of groundwater resources, both nationally and internationally. In response to growing community concerns over excessive groundwater use, these agencies stress the need for an integrated approach to the management of groundwater use, which focuses on ecological sustainability.

Fig.10 Walyata, the mangrove-lined Salt Creek

4 KARAJARRI CONCEPTS OF COUNTRY

In order to appreciate the cultural significance of groundwater to the TOs it is necessary to understand a number of key concepts pertaining to regional Aboriginal views about the physical environment and its material and spiritual dimensions. These concepts specifically relate to the formation and basis of the traditional view of life and to prescribed relationships between persons (whether as individuals or groups) and country. The same concepts directly underpin traditional laws and customs.

In this section I primarily focus on the Karajarri, as most of their traditional country lies within the study area. Whilst there are cultural differences between the various language groups in the study area, the significance of water is common to all. As the Mangala elder Peter Clancy puts it:

> Mangala, Nyikina, Yawuru, Nyangumarta, all got same story for *ngapa*. (in this context water sources)[7]

4.1 PUKARRIKARRA

Pukarrikarra is a regional term, employed by Karajarri, Yawuru, Nyikina, Mangala and Nyangumarta. (In Walmajarri the equivalent term is *ngarrangkarni*.)

Often glossed in English as 'Dreamtime', this term is indeed closely related to the word for dream — *pukarri*. However, rather than connoting insubstantiality or unreality, the terms *pukarri* and *pukarrikarra* specifically denote states or contexts of non-ordinary reality. In this regard *pukarrikarra* refers to the world-creative epoch and to the supernatural beings active therein. These beings are believed to be responsible not only for the formation of the world and its physical content, but also for the introduction of social laws and principles governing all subsequent human existence. *Pukarrikarra* are also credited with the introduction and differentiation of regional languages.

Some *pukarrikarra* are said to have travelled through the country, naming places and, in many instances, transforming themselves into environmental features (e.g. hills, stones, trees and water places). Certain of these are said to have introduced specific rituals. Yet other *pukarrikarra* beings are held to have become embodied in the landscape of particular areas.[8]

As Piddington (1933: 82) observes, *pukarri* is a socially binding factor in Karajarri society.

> In the first place it connotes that which has a binding force upon the society: to describe an institution or custom as *bugari* means that it

7 Interview with Peter Clancy Tapirri, Bidyadanga, 1.9.99.

8 See Bagshaw 1997:2-3

> has a special sanction which renders it inviolable. This is derived from the fact that all things which are 'bugari' were instituted by mythical beings in 'bugari' time, that is, in the distant past when the world was created. Thus, the most general meaning of the term when applied to a social institution or custom is that it has a sort of categorical imperative associated with it.

People often connect with *pukarrikarra* through their dreams, which are interpreted through the images they present. Thus, a man (or sometimes a woman) may dream the conception and conception place of his child, or he may dream prophetically about a turtle that has been washed up on the beach, or learn through a dream of relatives who have become ill. Such information is only transmitted to the 'right' people – i.e. to the people who belong to the country.

4.2 *NGURRARA*

Ngurrara can be translated into English as 'extent of one's country' and is often used in the expression *ngurrara ngajukura* - my country. Sometimes this term is contracted to *ngurra*, which is a more localized expression meaning camp or specific area.

However, *ngurrara* means much more than just the physical land to which one belongs. It encompasses a range of meanings that are taken for granted by Aboriginal people, which are not necessarily understood by non-Aboriginal people.

Ngurrara is given and determined from *pukarrikarra*. Thus *ngurrara*, on one level, is a physical expression of *pukarrikarra*, in which the features of the landscape were formed long ago. These features are not just surface phenomena, such as hills, trees, animals, creeks, bays and so on. They also include subterranean features and activities, for example groundwater and its flow, or rock formations and associated activity such as earth tremors.

As *pukarrikarra* created and named places, they endow them with meaning and significance. The associated narratives[9] and rituals recount their activities that link people to particular areas for all time. These narratives ascribe metaphysical meaning to all aspects of physical reality—the landscape, under the ground, the sky, the water. People are born with a predetermined connection to place and set of responsibilities to the country. Thus *ngurrara* refers not only to the physical horizons of one's country, both surface and subterranean, but also to the cultural knowledge and responsibilities, expressed in stories, songs and ritual, that bind people to place.[10]

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9 Following Geoffrey Bagshaw (personal communication) I use the term 'narrative' in preference to myth to refer to the stories and beliefs that are told by the Karajarri and other traditional owners about their country.

10 See also Myers (1982:92, 1986) for further discussion on the connection between myth and *ngurrara*.

4.3 *PULANY*

> There are lots of *jurru* [mythical water snakes] and *mila* [juvenile water snakes] in our country. They are breeding and sit down in all the *jila* and springs.[11]

Pulany[12] are water snakes or serpents who reside in, and /or have made the permanent water sources, called *jila* or *pajalpi*. Some *pulany* are also said to reside in the sea. *Pulany* may be referred to as *jurru*, as in the quote above, which is the generic word for all snakes, and young *pulany* are called *mila.* The term *pulany* is sometimes synonymously used for *jila*.[13] Among the Mangala the *jila* are said to have once been men who roamed in the *pukarrikarra*, and then transformed into *jila* by going into the ground to become *kalpurtu* (the Mangala term for *pulany* or water snake).[14]

The presence of *pulany* at springs is often indicated by the *panyjin* reeds, which grow in the springs. *Panyjin* are said to be the whiskers of the *pulany*, and it is considered dangerous, particularly for children, to swim near areas where the *panyjin* grow. During our research the TOs were often concerned for the safety of the scientists as they traversed the spring with their probes, particularly when they were in proximity to the *panyjin.*

Fig.11 *Panyjin* reeds at Yaralya (site no.3)

11 Interview with Peter Clancy Tapirri, Bidyadanga, 1.9.99

12 Not to be confused with the over-used term 'rainbow serpent'. It is unclear whether the Karajarri believe in one rainbow serpent who created all the water places. Whilst they believe that rainbows are created by water snakes, Karajarri believe that their country, as the above quote suggests contain many *pulany*.

13 Jim Marsh (1992) has translated the word for *jila* in Martuwangka languages as snake.

14 Interview with Peter Clancy Tapirri, Broome, 10.9.99.

All *pulany* have the capacity to smell strangers, that is, people who do not come from that particular country. They also have distinctive personalities. Some are very 'cheeky'— dangerous and unpredictable. Others are docile. Active *pulany* are believed to be able to move around under the ground, surfacing through escape holes called *tulkarru*. For example at Jawanijawani (site no. 41) the *pulany's tulkarru* is at Wilkarunganyjarl (site no. 60). Some water snakes are said to be surrounded by *mila* (young *pulany*), such as at Malupirti (site no.13), and most *pulany* interact with one another.

Evidence of an active *pulany* is the formation of clouds and the generation of storms, with lightning and rain. On most occasions when the TOs return to water sources that they have not visited for a while, and to which they bring strangers, cloud activity is said to be generated. As a result, rain may fall regardless of the time of year.

Fig.12 Storms on Nita Downs after visiting Malupirti (Munro springs)

It is said that *pulany* may follow people when they leave a water source:

> *Jila* chase people if they are upset. They might be angry or they don't want them [the people] to go away. Or sometimes the *mila* [baby *pulany*] get lost and don't know who to follow.[15]

[15] Interview with Mervyn Mularty senior, Bidyadanga, 1.9.99.

Angry *pulany* reveal themselves in violent storms, with lightning and wild winds, or they may generate cyclones. They can leave tracks on the ground, evidenced in holes that are blown out or trees that are knocked down or burnt. It is said that the tail of the serpent *pikaljina*, can kill a man. The TOs relate stories about the capacity of *pulany* to kill people, by drowning, battering or eating them. Most of all, they can be unpredictable and willful and therefore extremely dangerous. An example is Kurtal who lives east of the study area and may take the alternative forms of a cyclone and calm water. This is depicted by the Wangkajunga artist David Downs in his painting 'Kurtal as Cyclone and Living Water' (Kentish and von Sturmer, 1995). (See illustration on p14.)

The *pulany* at Jawanijawani, a spring in the south east of the basin, is held to be very 'cheeky', and people return to this place with some feelings of trepidation.

Many of the traditional owners relate first hand accounts of occurrences when *pulany* have been active. The senior Karajarri woman Cissy Everett, while washing her hands when she visited Injitana spring on the northern part of Frazier Downs, explained as follows:

> My mother was born here. They know this country. They have a snake in this water. People he know, he let them come. If he don't know them he make the clouds get up. He can smell *ngalkurru* [body smell]. That snake smell you, then he let you come. When I came here with my two boys, who have grown up in the dormitory[16], he didn't know them, The water got up and frightened them. It came like a tide. He made the water get up. I wash my hands and talk here to the water to let him know that we're here.

As a final comment on this subject, the senior Mangala elder Peter Clancy observes:

> They are the boss for us. They give us life. We live here on top, but they live under the ground. They can cause a lot of damage and big storms. They are linked in story but its not a public one. The story is there for us.[17]

4.4 *NGAPA KUNANGKUL*: LIVING WATER

In all human societies, water is associated with life. In inhospitable environments, such as the Great Sandy Desert, knowing where and how to get water is essential to survival.

'Living water' is an Aboriginal English expression that requires translation as it refers to both the physical properties of water sources and their cultural significance.

Living water sources in the study area, as in other parts of Aboriginal Australia, are permanent water sources. People used to live around them, particularly in

16 That is, the boys' dormitory at La Grange Mission.

17 Interview with Peter Clancy Tapirri, Bidyadanga, 1.9.99.

laja—the hot season. These waters are characterized as *kunangkul* — everlasting—and are a defining element of an individual's country. Historically, they were where people retreated to during *laja*, the hot season, when the less permanent waters such as *lirri* (soaks) dried up.

Living waters may be surface waters such as the springs (referred to as *pajalpi*) at Malupirti, or they may require digging, such as the *jila* at Jungkurljartiny. They are all said to be connected to the underlying water table, whether regional or local, which is referred to as *kurtany*, literally 'mother'. I have interpreted *kurtany* in this context to connote 'mother of underground water', that is, the groundwater itself. TOs refer to the water table in Aboriginal English as 'the balance of water'. They say that it is their responsibility to maintain the balance (i.e. to keep it at the same level).

Fig.13 *Living water*

Jila or springs *(pajalpi)* are said to be inhabited by various *pulany* who are powerful beings to be respected and approached in prescribed ways. Strangers should not approach a *jila* or spring without the presence of countrymen for that area. Countrymen speak to the *pulany*, informing it that they are 'relations' or kin, and asking it to welcome the strangers. The latter must all perform the act known as *kiyungari*, which is to take a mouthful of the spring water and spray it out in several directions. During the fieldwork for this project the scientific team was introduced to the springs in this way, as stockmen and other station workers are said to have been in the past.

Pajalpi usually have surface water, although it sometimes only found in small pools in water-saturated ground (e.g. at Murtul, site no. 4)**.** In the hot season the larger springs provide sanctuaries for wildlife. Ducks and other water birds congregate and migrant birds, such as the waders, swallows and swifts, arrive

from distant breeding grounds. In the study period we visited Yaralya (site no. 3) twice in the course of the research, and both times there were thousands of ducks living amongst the reeds. See Appendix 3 for more detail of the birds found on two springs on the morning of the 4th December, 1999, recorded by Chris Hassell.

Living waters are considered to be specific manifestations of *pukarrikarra*. Their names were given by *pukarrikarra*, as were their associated narratives, which link water places both geographically and temporally. For the TOs living waters are physical evidence of the continuity between the *pukarrikarra* and the present, and are so fundamental to the conceptualization of country that it is said:

> without our living water our country has no meaning[18].

As will be discussed below, *ngapa kunangkul* also have the power to generate rain for the whole country.

Fig.14 At Malupirti (Munro Springs, site no.13)

Fig.15 *Kilyurr* (ducks) at Yaralya (site no.3)

18 Interview with Donald Grey, Bidyadanga, 1.9.99.

4.5 *RAYI, YATANGKAL* AND *KUMPALIKUMPALI*

To fully appreciate the cultural significance of water sources other Karajarri conceptualizations concerning the creation of human beings should also be understood.

Among the Karajarri all individuals are intimately connected to certain sites, often water sources, in their country, from which, they say, they arose. Bagshaw (1997:3) in his study of Karajarri connection to country, explains as follows:

> Karajarri further believe that human beings (*ngarrungu*; i.e. Karajarri people) are themselves instantiations of localized *pukarrikarra* essence (*rayi*). Such site-specific essences are held to generate spirit-children (*yatangkal*), each of which is considered to represent the animating life-force (*pilyurr*) of an unborn Karajarri individual. Typically, a *yatangkal* first appears to its prospective human genitor in a dream (*pukarri*) and thereafter enters its human mother. Yatangkal and their human incarnations are deemed intimately associated with particular natural species. Called *kumpalikumpali* (a term, which also means 'namesake'), these species are also held to arise from, or otherwise closely linked to sites of localized *pukarrikarra* essence.
> ....
> Insofar as Karajarri conceptualize themselves as instantiations of localized totemic essence each individual is directly linked to his/her place of spiritual origin (such places are known as *pirtimaru* [*pirti* = hole, *maru* = head]. Indeed at the most fundamental level, each person is held to be an aspect of (i.e. consubstantial with) that particular locality. It is this mode of identification to which the expression 'my country' (*ngurrara ngajukura)* primarily refers (Bagshaw, 1997:3).

When some Karajarri elders were explaining their ontological beliefs during my fieldwork, they further expounded on the concept of *rayi*:

> *Rayi*, they just come up by themselves [i.e. they are self-existing]. *Rayi* is *wankayi*. It is always alive. We die but they are still alive. *Rayi* always *wankayi*. They are *kunangkul* - here forever.[19]

4.6 THE SEASONAL CYCLE

For the TOs, time is measured in a cycle of changing seasonal patterns, which roughly correlate to a European year. The Karajarri believe that the cycle of seasonal change is *pukarrikarrajangka* ('put down by *pukarrikarra*') and that the seasonal replenishment of water sources from rain is promoted by the activities of the *pulany* who make the *jila*.

In the Karajarri and Yawuru seasonal calendar there are four major seasons which are interspersed by two short transitional seasons.

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19 Interview with Edna Hopiga, Bidyadanga 7.12.99.

Marul	The season after the rain when the country begins to dry out, roughly April and May.
Wiralpuru	The time when the cold south-east winds (*wiralpuru)* begin to blow, between April-May.
Parrkana	Cold time, approximately from June- August/September. The time when all the goanna and snakes are sleeping. It is good for salmon and fish that live in cloudy water.
Wilpuru	A short warming period before the hot season begins, approximately in September. The warm westerly winds start to blow, and the reef fish and shell fish begin to get fat.
Laja	The hot season, and the build-up before the rain. It is when the goanna and other lizards and snakes begin to wake up, and is the time for stingrays.
Mankala	The rain season, when many bush fruits are harvested and there is plenty of *mayi* (edible plant food) and *kuwi* (all types of meat). It is the time of cyclones and heavy rain.

This cycle is similar among the Mangala, Nyikina and Nyangumarta.

Fig.16 Stephen Possum and Mervyn Mulardy Snr at Juwurr-karjartu soak (site no. 10)

5 *NGAPA* : WATER SOURCES AND THEIR SIGNIFICANCE

5.1 KARAJARRI TAXONOMY OF WATER SOURCES

For Karajarri and other traditional owners there are two main categories of water sources—'on top' water and 'bottom' water—which are both found or produced in various manifestations. There are also a variety of man-made (both Aboriginal and non-Aboriginal) water sources.

'On-top' water:

There are many sources of 'on-top' water. It is the water for drinking and digging up—obtained by both traditional practices and contemporary technology such as bores and windmills. 'On-top' water is dependent on rainwater for replenishment. The following are types of 'on-top' water.

lirri Soaks, in which water is dug up for drinking. Some soaks are permanent, others dry up in *laja*, the hot time. To access the water the soak has to be dug out, often a few metres deep. In the deep holes small ledges are constructed to allow people to access the water.

jila Permanent water sources. In some cases *jila* have visible surface water, for example at Pikarangu (Joanna Springs), but many require digging, which is done in a prescribed way, to access the water.[20] A *jila* may be marked only by a small depression in the ground. There may be scrubby ti-tree vegetation surrounding the water source. *Jila* occur in clayey soil from which white mud (*kalji*) is found and used in ceremonies to represent the rain clouds.

Fig.17&18 Kurrjalpartu jila in the Great Sandy Desert recently dug out.

[20] For details about these practices see the film *Jila: Painted waters of the Great Sandy Desert*, Mangkaja Arts Resource Agency and the Kimberley Land Council, 1998, Fitzroy Crossing.

Jila are important as rain making centres, occupied by *pulany*, (powerful snakes, of destructive potential who must be approached with respect and care, to avoid angering them). There are prescribed ways in which these *jila* should be approached, and dug out, particularly when rain making ceremonies are held.

pajalpi The ecosystem surrounding springs. These are permanent water sources and are found on the fringes of mudflats along the coast, or inland areas

wawajangka Fresh water seepages found in mudflats in the intertidal zone and only accessible at low tides. For example at *Jikilyja* (site no.9) in La Grange Bay.

various ephemeral surface waters - claypans (*pirapi*), rockholes (*wirrkuja* or *turrpu ngapa kura*, literally 'rockhole with water in it'). They are filled by rainwater and usually dry up either after the rain or as the hot time approaches. They provide water for short periods of time after rains.

Fig.19 *Pajalpi* (spring) at Injitana (site no.1)

Fig.20 Pirapi (lake in claypan) at Munro Springs (site no.15)

Fig.21 Wawajangka (fresh water seepage) at Jikilja (site no.9)

Fig.22 Stephen Possum at Jingkamartaji *lirri* (soak – site no.25)

'Bottom' water:

This source of water is usually underneath the ground and not disturbed. According to the TOs 'bottom-water' is not used for drinking, and whilst ultimately providing the subsistence basis of all life from under the ground, they say it is too brackish for supporting vegetation when on the surface.

jarrurru Described as a 'big stream' which travels under the ground. When it comes to the surface, in the form of artesian free-flowing bores, it is brackish and the surrounding vegetation dies. Such a free-flowing bore can be found south of Sandfire Roadhouse on the Great Northern Highway, which was drilled during a seismic survey.

Man-made water sources

palutany Fresh rain water sitting in the hollows of trees, especially bloodwood trees (*langkarn*). Small holes are drilled into the tree and plugged up with sticks. When people require a drink they remove the sticks and the water flows out.

palnga Used for the collection of rain water between water sources. A hollow log, cut in half is set in the ground. A section of antbed is carved out and placed on one end to channel in the water.

wells Sunk for the pastoral industry. More often than not they have been located on top of, or next to existing native wells, and can still be seen along the old stock routes. They are often referred to as 'government' wells, having been established for the industry by the government on the public stock routes, and were often semi-permanent camping areas for bush Aboriginal groups. Jinkurljartiny (Whistle Creek) has a government well and is referred to as a 'big reserve' for the old people. In the past these wells had drums sunk in them, or were cemented, so that the water was accessible by a windlass or small pump. If still in use, they now have mechanized pumps or windmills.

bores Introduced with drilling technology. Historically useful in opening up back country, away from permanent water sources, for the pastoral industry. Most of the TOs, having worked many years in the industry as drovers, stockmen and windmill men, map stations by the location of bores and other water sources.

5.2 SITES VISITED AND THEIR HYDROGEOLOGY

During the field trips we visited 38 water sites, focusing on the coastal and inland springs. There are many other sites that should be visited but time and accessibility constraints made this impossible in the short duration of the project.

See Appendix 4 for a list of sites visited in this project or recorded in other fieldwork that I have conducted in the study area during the last 6 years.

N

30 0 30 60 Kilometers

COLOUR LEGEND

- *Lirri - soak*
- *Pajalpi - spring*
- *Jila - permanent water source*
- *Pirapi - fresh water lake in claypan.*
- *Wawajangka - freshwater seepage in the intertidal zone.*
- *Wirrkuja - Rockhole*

SYMBOLS LEGEND

- *Full Circle - POSITION ACCURATE*
- *Star - POSITION APPROXIMATE*
- *Circle - POSITION DOUBTFUL*

KILTO
WATERBANK
ROEBUCK PLAINS
BROOME
THANGOO
SHAMROCK
DAMPIER DOWNS
BIDYADANGA
FRAZIER DOWNS
Walankarrjarri
EDGAR RANGES
NITA DOWNS
ANNA PLAINS
LINYIRRKARTINY
MANDORA
Walyarta
SALT CREEK

Legend

- LaGrange Sub-basin (Project Area)
- Cadastral Boundaries
- Shamrock and Nita Downs PL's
- Anna Plains PL
- Mandora PL
- Mowla Bluff PL
- Thangoo PL
- Dampier Downs PL
- Frazier Downs PL
- Other Pastoral Leasehold
- Dragon Tree Soak Nature Reserve
- Inundation Areas
- Roads
  - Highways
  - Secondary Roads and tracks
- Drainage
- Localities

MAP 2
Aboriginal Wetlands Visited and/or Reviewed for the Groundwater Project

Scale 1:1,000,000
Unprojected Decimal Degrees

Drawn By: R. Menzies	Date : 01.06.00	DRAWING No
Drawn For : S.Yu		1

The table has categorized the water sites according to the Karajarri taxonomy outlined in section 5.1, and, when certain, Semeniuk's classification of groundwater sources, i.e. as a pan, oasis or spring.

See Map 2 for an overview of traditional water sources in the study area. Note that soak waters along the coast have not been included as there were too many to situate on this map.

5.3 SEASONAL MOVEMENT BETWEEN WATER SOURCES

Karajarri country covers the coastal region from Thangoo Station to Anna Plains station and inland to the Great Sandy Desert. Inland groups of Karajarri traditionally travelled (whether for social, economic or ritual purposes) between the coast and the hinterland (*pirra*) in seasonal patterns, following the supply of water and the availability of bush and sea resources. Yawuru and northern Nyangumarta followed similar patterns of seasonal movements. The Nyikina, having access to riverine pools, would retreat to those that were permanent in the hotter months. The Mangala, as desert dwellers, would retreat to the main *jila* or larger soaks. In this context it was essential to differentiate between permanent and impermanent water sources.

During *mankala* — the rain time — and after the wet, groups would travel out on *makurr* (well worn routes) to *lirri* that had been replenished by the rain and which are scattered throughout the country. This pattern of movement would continue right through to the end of *parrkana*, (the cold time) and into *wilpuru* when it begins to get hot again. There are well-known soaks, *jila* and springs which would never dry up, and in *laja*, when the country gets hot, people would congregate in these areas until the rains came again. These latter areas are often referred to in Aboriginal English as 'reserves'.

The coastal and inland springs are said to have been inviting places, rich with dependent wildlife, such as cockatoos and other birds, kangaroos and wallabies, that were exploited by the TOs. The varied insect life is also a source of food. Karajarri eat various *pirna* (witchetty grubs, i.e. larvae of moths) and cicadas (e.g. *karratu*) that are found in the acacias and succulent bushes (e.g. *winki)*. The shady canopies of the *warrapa* (large paperbarks) and *ngalinmara* (corkbark trees, a species of Sesbania) provided relief in the heat of the day. Many TOs recount stories of relaxing around springs during *laja*. It was a time to catch up with family and to begin planning for ceremonies. In this latter connection it is worth noting that a number of the springs and *jila* on Frazier Downs have law places associated with them

5.4 RELATIONSHIP BETWEEN *LIVING WATERS* AND *NGURRARA (COUNTRY)*

For the Karajarri people there is a seasonal cycle of water use and replenishment, a cycle which they necessarily respect and interpret for their survival. Acknowledgment of, and respect for this cycle effectively ensures that the water table, referred to as 'the balance of water' or water level, is maintained in the permanent water sources across their country.

These water sources, known as *jila* or *pajalpi* (springs) are referred to as being *kunangkul*, or in English 'everlasting'. They are also called *kurtany*, literally the 'mother of all water'. *Ngapa kunangkul* (living waters) come from, or 'were put there by' the *pukarrikarra* ('*pukarrikarrajangka'*) and are said to 'look after' all the other less permanent water sources, such as *lirri* (soaks). It is essential that the *living waters*, like the milk from a mother's breast, never dry up, as they create a balance in the supply of water across the country. According to the Karajarri view, when the *living waters* fill up, the rest of the water sources across the country will be replenished. The level of the water in permanent water sources is thus interpreted as an indicator of the health of the country and its people, as all forms of life — animals, trees, plants, insects and people — are dependent for their survival on the water.

> The big water, the mother of water, *kurtany*, keeps the water level. It keeps it [the water] alive. Same like the mother of a human being. That's the mother of the water level. The water is from the *pukarrikarra*—it's underneath. The water underneath doesn't live free - it travels underneath, from the high country to the sea.[21]

There are many indicators that herald the change to wet season when the *pulany* are most active. The rain birds *kitirr* (fork-tailed swift, *Apus pacificus)* and *wiyurr* (barn swallow, *Hirundo rustica*) arrive. For these birds that live on the wing, it is said that the springs and *jila* provide *kitirr* and *wiyurr* with their food—firstly, insects like mosquitoes and later *wiyawiya*, the 'helicopter dragon fly'. The birds are said to 'pull in the rain', and are associated with different forms of lightning. *Wiyurr* brings the *kapalawurr* lightning, which is like sheet lightning and does not touch the ground. *Kitirr* brings *jitama*, the strong lightning that strikes the ground and can kill people.

A basic aspect of the cycle of seasonal change, outlined in Section 4.6, focuses on the activities of the *pulany* in the *jila and* springs. More specifically seasonal changes are interpreted as responses to the activities of the *jila* and the *pulany*.

In the *laja* (hot time), before the rains, it is said that the heat goes into the *jila*. From *jila* the *pulany* are believed to generate clouds as they respond to the heat. This response is also evident in the formation of *karlkurriny*, or willy-willies, which go straight up when it is hot. Karajarri say that the *karlkurriny* is going up to make the clouds[22] to make the thunderstorms. Once the thunderstorm clouds have formed there is 'too much wind'—*wiriliwirili* ('like raking the clouds up')—which causes a 'big dust'. It is from these clouds, dust and wind that the rain will form. The rain will then fill again the *lirri* and replenish the springs and *jila*, and the *kurtany* (the groundwater) becomes bountiful. There is increase among all species and the country is alive again. The trees, the animals, the plants and the people will live off this water until the next rain season. Even in the salt water, fish, such as mullet and bream, can be seen drinking fresh rainwater during

21 Interview with John Dudu Nangkariyn, Linyjarrkartiny 29th August, 1998.

22 Clouds, especially those in the vicinity of water sources or locations where serpents reside, indicate that the serpent is active, getting uneasy, angry or 'stirred up'. For example, when strangers come to the country unwelcomed, clouds will form above the water place.

mankala (the rain season). They come to the surface with their mouths open drinking the fresh water and become fat at this time.

In this way it is said that the *kurtany*, through the generation of rain by the *jila*, makes everything strong and healthy. *Pukarrikarra* 'put that down'—i.e. the water—to replenish the country and the people.

At other times of the year, for example during the winter months, the *pulany* will blow out *wilany*, little boomerang shaped clouds, that are made 'by the *jila*'. *Wilany* indicate that the *pulany* is moving underneath, sniffing the air. *Mujungu* (winter rain) will come after this.

This is why *jila* and springs, the permanent waters, are referred to in Aboriginal English as *living waters*. They are respected as powerful animate beings who provide not only permanent water for the Karajarri, but generate the life-giving water, in the form of rain, for the whole country. They are also literally a source of life for human beings who, in the form of *yatangkal* (spirit person) arise from *rayi* in such places (see section 5.5). The *living waters* are created by *pukarrikarra*, usually through the metamorphosis of supernatural beings who have gone into the ground and become *pulany*. For example, at Narrkunja, Luma, the blue tongue lizard transformed into a *jila* which has the power to make *jitima* (forked lightning)[23]**.** In short, the present-day physical reality of *living waters* is explicitly interpreted as evidence of *pukarrikarra.*

For many *jila* and springs there are secret (i.e. only accessible to initiated men) powerful stories. According to Harry Watson, for example,

> There are inside stories for living waters, known all over the country. They've all got connections. The Law is big. It is not passive, it's active. We can't speak about this. It's not public. Water, culture and land. That's our *ngurrara* [country]. You can't divide them, doesn't matter which language you speak.[24]

5.5 RELATIONSHIPS BETWEEN WATER SOURCES AND *NGARRANGU (PEOPLE)*

As suggested in the above sections, the permanent water sources in the study area are literally the source of life for the TOs. Other researchers have addressed this aspect of *ngapa kunangkul* in some detail.[25] As already mentioned, for many Karajarri, their *yatangkal* (conception spirits) come from water sources. More specifically, their spirits come out of the *rayi* that exist in these places (referred to as *pirtimaru*[26]) and return to them when individuals pass away.

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23 Interview with Mervyn Mulardy Senior, Bidyadanga, 1.9.99.

24 Interview with Harry Watson, 29.10.99, Groundwater Committee meeting, Broome.

25 See Berndt (1942-45), Tonkinson (1991), Lowe (1990) and Langton (1999).

26 *Pirtimaru* literally means *pirti* = hole, *maru* = head, i.e. sites from which people and all living things arise. (Bagshaw, 1997:3).

Given the acknowledged power of the *pulany*, who are believed to live in the springs and *jila*, it is not surprising that the Karajarri and other TOs have developed ways to manage and interact with the *pulany*, so as to look after the country and its people.

Under their Law, TOs are directly responsible for looking after water sources, for ensuring that people follow the correct protocols and for maintaining knowledge through song and narrative so that future generations will be able to continue to look after the country in the appropriate manner. It is interesting to note in this connection that when the desert people began to return to visit their homelands in the 1970s it was said that:

> the *jila* were crying out for people to come back and look after the country[27].

Respect for the *jila* and springs is clearly evident when Karajarri people visit these places. Among other things they introduce themselves to the *jila*, speaking quietly and reassuringly to the effect that they are countrymen, descendants of their ancestors. Strangers must be introduced and then directed to take a mouthful of water and blow it into the *jila* or spring. This practice is called *kiyungari*. If the correct procedure is not followed it is believed that the *pulany* will smell the stranger *ngalkurru* (body smell), and rise up to show his displeasure.

Because of the innate unpredictability attributed to the *pulany*, people never camp in the immediate vicinity of *jila* or other living waters. They always camp at some remove to avoid danger to themselves and most particularly to their offspring.

Fig.23 Edna Hopiga spitting the water out (*kiyungari*) to greet the *pulany* at at Malupirti

27 Interview with Harry Watson, Bidyadanga, 28.10.99.

5.5.1 RAINMAKING CENTRES

One of the most important traditional means by which the 'balance of water' is maintained throughout *Ngurrara* (country) is though rainmaking ceremonies**.** Whilst the *pulany* in springs have the power to generate rain at any times whenever they are disturbed, it is to *jila* that men go to generate —and thus control—rain, by persuading the *pulany* to 'get up'[28].

There are rain-making *jila* throughout the study area such as Jinjarlkurriny, Manala, and Narrkunja. It is said that from these *jila* the knowledge of songs and dances relating to rain-making, arise, like people, from *rayi*, and are given to countrymen in dreams. It is precisely through these songs and dance that those who have the power to make rain actively intervene to ensure that the balance of water is replenished.

If it is a bad season and there is no rain, the TOs go to the *jila* to make rain. Under the direction of a *yiliwirri* —a senior man who holds knowledge relating to the water source and who holds the knowledge to make rain— people perform rituals at the *jila* to induce rain. Particular songs, and body designs are employed as people dig the *jila*, in a prescribed way, throwing the mud out to attract the rain. Some of these designs represent the *wilany* clouds and others represent the birds *kitirr* and *wiyurr* (see below). On completion of the ceremony, there is celebration and the *yiliwirri* places an eagle feather in his headband. Where he walks, the water, rain, is believed to follow the feather and fill up the soaks. A *yiliwirri* thereafter has the power, it is believed, to placate the *pulany* or make them 'get up'. This is held to be demonstrated in his ability to make winter rain, large thunderstorms and lightning, and to direct storms or large cyclones away from or towards particular areas.[29]

5.5.2 LOOKING AFTER COUNTRY

> We have to look after this water. If the water go, everything will be finished. Life gone. Spirit gone. People gone. The country will have no meaning.[30]

Karajarri characterize their environmental responsibilities as *palanapayana tukjana ngurra* - 'everybody looking after country properly', an expression best translated as appropriate land management. People are born with this responsibility which arises with their *yatangkal* (conception spirit). By virtue of spiritual conception, people are born with this binding and inviolable responsibility. They must follow correct protocols and ritual practice, which, although functioning in a metaphysical realm, can create changes in the physical realm.

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28 This can be also done in other areas where *pulany* reside, such as the sea.

29 Interview with Peter Clancy Tapirri, Bidyadanga 1.9.99.

30 Interview with John Dudu Nangkariyn, Bidyadanga 8.10.99.

Fig.24 Digging for water at Wilkarrunganyjarl (site no.60)

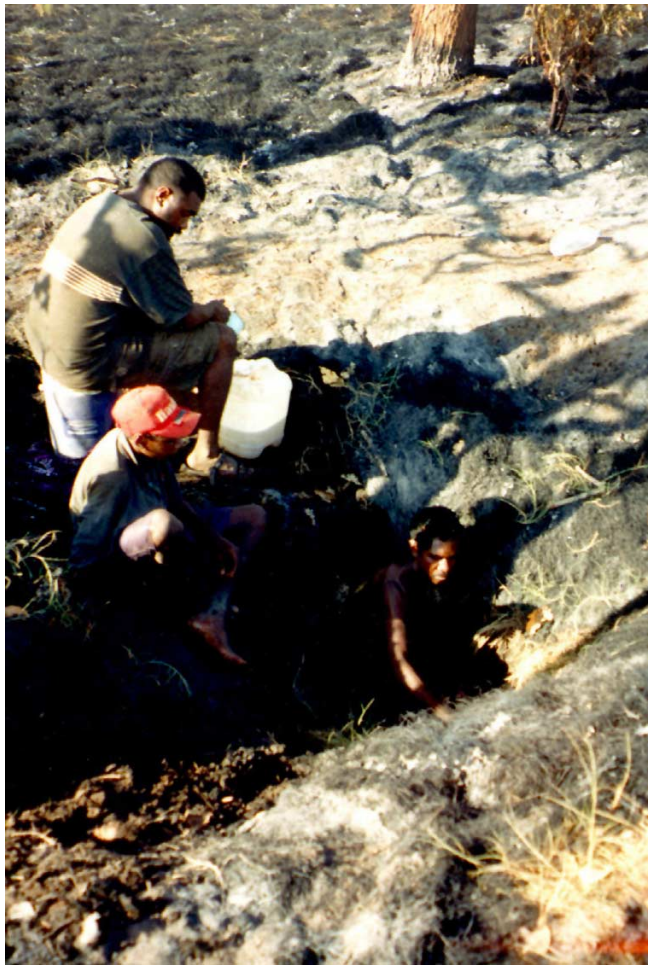

Fig.25 John Dudu Nangiriyn—pirrka — at Jinjarlkurriny (site no.7)

Fig.26 Burning the ground at Wilkarrunganyjarl site no.60)

When deemed necessary, the TOs will interact with the *pulany*, through *pirrka* (senior Lawmen)[31] or *yiliwili* (rain-makers).

Pirrka, manage the *jila* for all their countrymen. Donald Grey explained the source of this power:

> *Jila* belong to that man, that *pirrka*. It holds [binds] that *pirrka*. That's his religion. The *jila* [*pulany* in the *jila*] comes up to the *pirrka*, then it goes down. This is the source of his *yirnta* [ceremonial power] from his *ngurrara* [country]. This man is the boss, he control everything that belongs to that area. He holds it for all [the people]. He keeps that *jila* business. That never finish. If he lose that *jila* he lose everything.[32]

5.5.3 *KITIRR* AND *WIYURR*

In section 4 the arrival of *kitirr* and *wiyurr* birds was linked to the onset of the rain season and its particular manifestations, such as lightning. Among the TOs *kitirr* and *wiyurr* are assigned to different *inara*, i.e. to one of two social categories, each consisting of alternate generation levels among Aboriginal people of the region[33]. Thus, a person's sisters, brothers, cousins, grandparents and grandchildren belong to one *inara*, while parents, parent siblings, children, nieces and nephews belong to the other. Section affiliations[34] are assigned to each alternate generation category or *inara —kitirr* is *karimpa/parrjari*; while *wiyurr* is *panaka/purrungu*.[35]

By attracting *kitirr* and *wiyurr* — that is, species specifically associated with the activities of the *pulany* located in *living waters*—these waters can thus be said to reflect aspects of the traditional social organization involving kinship and marriage arrangements.

> Two birds (*kitirr* and *wiyurr*) show the law for marriage from the *jila*.[36]

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31 For example, Bagshaw (1997:6) says that 'John Dudu Nangkiriny is referred to as *pirrka* – the 'root' of Karajarri religious law and practice'.

32 Interview with Donald Grey, Bidyadanga, 1.1.99.

33 Kaberry (1939:175,196,207) refers to *gidor* and *wi:r* as the two endogamous moiety totems, whose social relevance apparently lies in the fact that they are associated with the quarters from which rain comes: *gidor* from the north east and *wi:r* from the north west. When rainmaking ceremonies occurred each moiety had a specific role to play, with the *wi:r* men and women occupying the west side of the water, and *gidor* the east side.

34 Among the TOs, all individuals are assigned 'skins, or what are known among anthropologists as section categories, derived usually from the mother. In the study region there are 4 skin categories—*panaka, purrungu, karimpa* and *parrjarri.*

35 The use of the *inara* concept, whilst known to the senior TOs in the region is emphasized by the Mangala who are traditionally permanent desert dwellers, and to whom the arrival of rain birds is a dramatic environmental and cultural event. In their rainmaking ceremonies designs representing the rainbirds are painted on the men.

36 Interview with Stephen Possum, 1.9.99. Marriage laws, like all law, are also said to come from *pukarrikarra* and *inara* are part of this body of knowledge

6 CONCLUSIONS

In presenting the cultural significance of *living waters* and their place in Karajarri cosmogony, the previous section gives some indication as to why the TOs of the La Grange sub-basin are concerned about damage to or drying up of their *springs and jila.* Damage to *living waters* threatens not only the water source itself but the very fabric of their society.

6.1 ABORIGINAL MODELS FOR THE GROUNDWATER IN THE LA GRANGE SUB-BASIN

In a manner broadly consistent with Barrett's[37] model of the movement and replenishment of the groundwater in the La Grange aquifer, the TOs maintain that groundwater runs under the ground from the higher inland desert to the coast. Specifically, they identify two layers of groundwater – top, as in the Broome sandstone, and bottom, as in the Jarlemai siltstone. The coastal springs, they agree, are directly fed by the underground water that comes from the high country.

There are, however, some significant differences between Barrett's model and the TOs' perspective. Firstly, the TOs maintain that the water travels through the ground mostly in streams, rather than just as a sheet flow, and that their water sources intersect with these streams. In this way the inland and coastal soak waters are linked to permanent water sources (i.e. 'living waters') such as springs and waterholes (*jila)* that are spread throughout the country.

Secondly, the TOs say that the movement of underground water is complex, and if transects were made across the La Grange sub-basin on a north-south axis, this complexity would be revealed. For example, in many places salt water and fresh water are found very close together. At Wartalwartalkujarra (see Map 2, site no. 110), there is a fresh water source and a salty/ brackish well nearby. At Jingkamartaji (site no. 25) soak, two wells had been dug on either side. One was fresh the other salty. According to Semeniuk and the TOs, the groundwater flows down towards Walyata (Salt Creek). Also, many of the station wells (for example, Yiwarrankarr (site no.26) on Frazier Downs Station), which reach the regional water table, are known for their saltiness, even though there are freshwater soaks nearby. Barrett's model does not appear to explain these variations.

Thirdly, Barrett's model does not account for the presence of inland springs (e.g. at Mulupirti (Munro Springs – site no.13), Kurriji pa Yajula (Dragon Tree Soak (site no. 43/44) and Jawanijawani (site no.41). Nor does it account for the fresh-water dependent mangrove-lined water courses at Walyata (Salt Creek), the

37 See Barrett's model in WAI (1999).

presence of mangroves inside springs (e.g. at Jukutukuran[38]), or explain the often fingerlike seepages of freshwater occurring in many coastal localities..

Specific detail is required on the movement of groundwater through the basin. With the expertise of the Semeniuk group the TOs want to construct a series of N-S transects, identify localized variability in the hydrogeology of traditional wetlands, and further explore the interface between salt and fresh underground water.

Fig.27 Mangroves growing in Warrangkakarra spring (site no.18)

6.2 WATER PLACES AND THEIR CONNECTION TO THE REGIONAL WATER TABLE

During the research project the TOs and myself examined 16 sites with the Semeniuk team. Using the Karajarri taxonomy of water sources there were 8 *pajalpi* (springs), 1*wawajangka* (springs in the tidal flats), 3 *lirri* (soaks), 1 *jila*, 1 dam (spring), 1 *purlu* (claypan—dry) and 1 *pirapi* (lake, usually on a claypan) among the sites investigated.

On the basis of their own model of groundwater in the region, as well as their experience in working with Semeniuk researchers, the Aboriginal people consulted in this research wish to emphasize their view that all the springs and *wawajangka* (coastal seepages in the intertidal zone) were fed by the regional groundwater (i.e. from the Broome sandstone).

However, the TOs would like to see further research into this matter in regard to their non-surface water sources, such as *lirri* (soaks) and *jila* (permanent living water).

38 The researchers have not located this site but TOs have described its physical appearance to include mangroves. Other inland springs on the south of Walyata – Warrankakarra, had mangroves growing in them.

6.3 WATER SOURCES AS HERITAGE SITES

As detailed below, all water sources, or *yanginy* (wetlands), listed in this report may be legitimately classified as Aboriginal heritage sites.

Firstly, these locations are typically occupation sites with associated surface scatters of stone and shell artefacts. At a number of places visited—without specifically searching for archaeological evidence—we found evidence of *pinka* (large baler shells) used to scoop and carry water for drinking, *wiluru* (like an oil stone) used for sharpening spear heads, axes, and flakes, and *kurtanyanu* and *jungari* (grinding stones). At coastal soaks, springs and *jila*, there were always shell middens of oysters, cockles and other shell fish. Significantly, most of the latter sites were in use until recent times.

Secondly, all water sites are culturally significant to the TOs of this region. They are all named places, toponyms derived from *pukarrikarra* beings. Many have mythological narratives associated with them, some public, others restricted to initiated men. All sites have concentrations of *rayi* (spiritual essence) within. Most of the permanent water sources, that is *jila* and *pajalpi*, are also inhabited by powerful water snakes known as *pulany*, who have the powers to produce rain, regenerate or damage the country and take people's lives. These permanent water sources are called *ngapa kunangkul* (living water), and are an embodiment of *pukarrikarra*. They are said to support all other less-permanent water sources (e.g. soaks) within the country.

Thirdly there is a myriad of personal connections between the TOs and the water sources. For many of the TOs their *yatangkal* arise from *ngapa* (water) sites. Historically, they were living areas where the senior TOs grew up, and as a consequence many water sources have particular events associated with them. For example, Yanpurrka is where Norman Munro's mother is buried. Jinkamartaji is Stephen Possum's place or birth. And, Putuputungka is where the three white explorers—Panter, Harding and Goldwyer—were killed in 1864**.** Inevitably, such personal and historical connections combine to create a profound link between the TOs and these water sources.

Fig.28. Mervyn Mulardy Snr with a *wiluru* (sharpening stone) and Stephen Possum with grinding stone at Jingkamartaji (site no.25)

6.4 WETLANDS AND THEIR FAUNA AND FLORA

The springs and other ephemeral surface water sources, such as the lakes formed in claypans after rainfall, support a variety of birds (see Appendix 4) marsupials, insects such as *karratu* (a type of cicada) and reptiles, especially in *laja* (hot season) before the wet. Many of the migratory birds which arrive at this time can be found on the coastal springs. As indicated in Sections 4.6 and 5.3, the Karajarri and other TOs continue to exploit these resources seasonally.

In short, coastal and inland springs support lush vegetation that contrasts with the surrounding *pirra* (pindan scublands) and *puntu* (mudflats), and their maintenance is essential to Karajarri environmental and cultural requirements.

Fig.29 & 30 Lush vegetation found in both inland and coastal springs

6.5 WATER PLACES AND NATIVE TITLE

Responsibility for, ownership of, and the right to speak for the groundwater as part of one's *Ngurrara* (country) is part of its cultural significance to the TOs. These attachments to country are being addressed by the Native Title Act (1993).

Native title rights to groundwater have not yet been firmly established in law. For example, in the Miriuwung-Gajerrong case**,** although Justice Lee found that the Native title holders have:

- exclusive rights to the land, which includes minerals (and by extension groundwater),
- rights to trade in the resources of the land,
- a right to receive a portion of any resources taken from the land,

this decision is under appeal.

The study area is subject to several native title claims – Rubibi #8 and Nyikina/Mangala to the north; Ngurrara to the east; Nyangumarta to the south, and the central area by Karajarri #2, #3 and #4 in the central zone. In each of these claims the TOs will be asserting rights to groundwater, the right to trade resources, which they will argue includes groundwater, and the right to receive a portion of the any resources taken from the land. As all native title claims are likely to go through the Federal court, determining the legal status of these traditional rights may take a number of years. Karajarri claims will be heard before the Federal court in mid-July 2000.

If the WAI project proceeds to the implementation phase, as specified in the MOU, native title issues will clearly have to be addressed. As the TOs assert traditional proprietorial rights in respect of groundwater, there may well be an obvious conflict of interest between the developers and the TOs in the event that the developers are granted licenses to sell the groundwater to third parties as per the MOU. Negotiations will be necessary to address the cultural values of groundwater for Aboriginal people.

6.6 CONCERNS OF THE TRADITIONAL OWNERS

In the light of these points, it should be appreciated that when undertaking this study of the cultural significance of groundwater it has been difficult to separate the study of the significance of water from the awareness among the Aboriginal people of the plans to use the groundwater for growing cotton.

The TOs of this area are concerned about the effects of taking too much underground water. They are aware that the damming of rivers in the eastern States, such as the Murray-Darling, the over exploitation of groundwater and catchment areas has caused the water systems to be starved of water. With respect to the large scale use of groundwater for irrigated agriculture in the study area, the TOs fear that the underground 'rivers' or 'streams' will be irrevocably deprived of water, and that their water sources will as a consequence dry up or become salty.

As we have seen, there is an important interface between salt and fresh water throughout the study area between Roebuck Plains and Walyata (Salt Creek). The TOs are vitally concerned that if the underground fresh water supply to the springs and other water sources is significantly reduced, their wetlands will then become inundated by salty water.

The TOs are further concerned about the effects of large amounts of fresh water being pumped everyday, believing that such activity may well 'pull down'[39] the groundwater from the *jila*, springs, soaks and other 'on-top' waters, thereby rendering them salty or dry. Since such effects would interfere with the 'balance of water' (i.e. the level of the water-table), and, the rate of flow of the groundwater, they also believe that large scale pumping would irreversibly change the cycle of flow and replenishment of the underground aquifer.

As articulated by John Dudu Nangkariyn, the most basic and pressing question asked by Karajarri and other TOs is:

> What happens if this goes? What's going to happen underneath? What happens to the roots underneath? To the *pukarrikarra* underneath? He put everything on top—*ngarrangu* (people) and every living thing, but *pukarrikarra* is underneath. So we worry about underneath. We feel that a big wind is gonna come, soon as the underneath go wrong. This is the place here that belongs to Aboriginal people. We are only talking about Karajarri country, but this is one Law, from the *pukarrikarra* that goes right through. One Law for Aboriginal people in the Kimberley.[40]

In summary, from the TOs point of view, any negative impact on the traditional water sources caused by the extraction of groundwater would be unacceptable.

39 The metaphor used to describe this effect by the TOs is 'like straining fencing wire' when erecting a fence.

40 John Dudu Nangkiriny, Linyjarrkartiny 29th August, 1998

Fig.31 Stephen Possum and Donald Grey near Mintalgarra spring on coastal mudflats

Fig.32 Yanpurrka spring on the coastal mudflats on Frazier Downs Station

8 RECOMMENDATIONS

The brief for this research project specifically requires recommendations regarding the avoidance of negative impacts on the cultural values associated with groundwater from an Aboriginal perspective. The following recommendations address this matter.

RECOMMENDATION 1

Funding should be provided to enable the relevant Aboriginal people to participate collaboratively in further research on groundwater in the La Grange sub-basin. Appropriate hydrogeological studies should involve substantial participation such that Aboriginal models concerning the groundwater—its replenishment and its flow—can be addressed through scientific evaluation. *(See sections 6.1/6.2)*

RECOMMENDATION 2

Waters and Rivers Commission should continue to adopt a bi-cultural approach to the management of groundwater in the La Grange aquifer.

RECOMMENDATION 3

A local groundwater management committee should be established for the La Grange aquifer and the relevant TOs should have significant representation on the committee.[41]

RECOMMENDATION 4

Funds should be provided to enable further investigation of the ecosystems of wetlands in the La Grange sub-basin through a holistic approach that incorporates cultural, ecological and economic values.[42]

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41 During the research project the TOs often discussed the government processes by which groundwater is licensed and allocated. The TOs stressed that they should play an integral part in the allocation process on the following grounds:

- the traditionally inscribed cultural significance of groundwater, integral to traditional conceptualizations of country and being.
- the right to access groundwater is a traditional territorial right
- the TOs have a holistic view of the connections between the sources of water, the wetland environs and an acceptable level of exploitation of groundwater.

42 Knowledge of the ecological systems of groundwater dependent wetlands in the La Grange aquifer is limited. In particular, the groundwater dependent eco-systems of the inland springs, the Salt Creek area and in the inter-tidal zone.

RECOMMENDATION 5

Establish a register of traditional wetlands in the La Grange aquifer, and adopt culturally appropriate processes to maintain and manage the register.

RECOMMENDATION 6

Register the wetlands of the La Grange sub-basin and its surrounds on the Register of the National Estate, and provide adequate funding to document the ecological and cultural significance of each site.

RECOMMENDATION 7

Establish a multi-agency approach for the provision of funding and resources to enable TO communities to:

- Undertake their own planning processes for land and water resources
- Develop appropriate cultural and environmental techniques for water and land management
- Investigate options for the future uses of land and water that incorporate traditional cultural and ecological values.[43]

Fig.33 TOs at Jawanijawini (site no.41)

43 The TOs wish to take an active role in the management of their traditional countries, and consider the management of groundwater to be a significant aspect of this.

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APPENDIX 1

GLOSSARY OF KARAJARRI TERMS RELATING TO WATER

inara	a social division within Karajarri social organization which distinguishes between alternate generational levels. Thus ego, his real and classificatory sisters, brothers, cousins, grandchildren and grandparents and marriageable partners and their siblings form one inara, and his mothers, fathers, aunties and uncles, great grandparents and grandchildren form the other inara. This social division coincides with the kinship system which identifies people as either panaka, purrungu, parrjari or karimpa. One inara is thus panaka-purrungu. The other is karimpa-parrjarri.
irngkurr	thick, dark clouds
jalin	ice from sky—hail
jalalu	burnt country
japiny	sweet. fresh, as applied to water
japurr	fog
japurrjangka ngapa	dew
jarrurru	this is described as a 'big stream' which travels deep under the ground. It comes to the surface under pressure and is free-flowing. It is brackish.
jarnpa	water found in a spring or lake
jayu	weeds/reeds/algae in fresh water. It is dangerous to drink such water
jila	permanent water holes, sometimes with surface water visible. They are important as rain making centres, occupied by pulany.
jirrpal	clouds forming like mountains, indicating a storm starting in the east
jitarrmajartu	storm
jitama	powerful lightning that strikes the ground. Associated with the kitirr inara. It is said that a maparn can extract- jirtima from the jila. 'like you take out a heart from a body'.
jungari	grinding stone – hand-held
kalji	white clay/mud
kalu	mud
kapalawurr	a form of lightning. At the end of a storm, the lightning sheets across the sky rather than striking the ground. Not as powerful as jitama. It associated with the wiyurr *inara*.
karlkurriny	willy-willy
kari	salt
karratu	a type of cicada
kilyurr	duck
kitirr	fork-tailed swift, *Apus pacificus* migrant bird from Asia which arrives just before the wet season. Represents karimpa/parrjarri inara.
kiyungari	refers to the practice of spitting out the water, as when strangers are introduced to the pulany at jila and pajalpi
kujukuju	cyclone
kunangkul	everlasting, such as the living waters that originate from pukarrikarra.
kurtanyanu	grinding stone - bottom
kurtany	mother
lali	white
laja	hot time
langarn	bloodwood trees
lirri	soaks, in which water is dug up for drinking. Some soaks are permanent, others dry up in the hot time. The water has to be dug out, often a few metres deep. They are replenished by rain water
malikarr	cold south-east wind
mankala	rain season
mangkulkarra	bush country (pindan scrublands)/spinifex country

marala	dinosaur (NB: this word is not public in Bardi area)
marrkala	face of the storm—the front of a large rainstorm/ dust storm.
marramarra	mirage
marul	season after the rain
mila	little water snakes (pulany)
mirrinykujarra	rainbow snake
mitirn	rainbow
mujungu	winter rain
murrka	salty
ngalinmarra	cork bark tree (*Sesbania*) found around springs. Also called mita.
ngapa	water; rain; water source
ngarrangu	Aboriginal people or countryman
ngarnka	beard, whiskers of a pulany
ngalkurru	body smell
ngurrara	one's own country
pajalpi	spring country with surface water. They provide permanent water sources, and can be found both inland and along the coast mudflats.
palnga	a traditional construction made with a hollow log and ant-bed to collect water when it is raining
palutany	fresh rain water sitting in the hollows of trees, especially bloodwood trees (*langkarn*)
panjin	reeds that grow in the springs, and are said to be the whiskers of the pulany
parrkana	cold time
pilyurr	animating life force
pinka	baler shell used for collecting water
pirapi	fresh water found in a claypan; a lake that becomes salty with evaporation
pirna	witchetty grubs , i.e. larvae of moths
pirra	pindan scrublands. 'Bush' or 'bush-side'. Used to refer to the inland area of Karajarri country.
pirrka	senior law man: lit. 'roots of tree'
pitaljina	tail of water snake
pulany	snake or serpent, rainbow serpent, who lives in the permanent water places - jila and pajalpi
punturr	hot south-east wind
purlu	claypan
rayi	spiritual essence, arising from a particular site, that creates human spirits, marru (songs and dance) and other living things.
ringu	clouds
uja	seaweed
tulkarru	exit hole in the ground, said to be blown out by a pulany
wankayi	alive
wawajangka	fresh water springs found in mudflats in the intertidal zone and only accessible at low tides
wilany	little boomerang clouds that appear in a pair above the jila to indicate rain time, also used as motifs in body designs during rain-making ceremonies
wilpuru	season about late July, races time
wiliya	willy willy
wiluru	sharpening stone for knives
winki	succulents (*Halosarcia sp)* growing around spring areas
wiralpuru	cold southeast wind blowing—season
wiriliwirli	cloud formation; 'raking the clouds together'
wirrkuja	rockhole
wiyurr	barn swallow, *Hirundo rustica*, migrant bird from Asia which arrives just before the wet season. Represents panaka/purrungu inara.
yanginy	wet land
yarrany	cold front
yatangkal	an individual's pukarri, in English called totem
yiliwirri	rain-maker, who wears the eagle feather in his headband
yirnta	magic ceremony site; ceremonial powers

APPENDIX 2

TIMELINE OF RESEARCH

Date/time	Task
3.8.99	meeting -WRC(RS)& KLC (BG)
4.8.99	meeting - Bidyadanga TOs/WRC/WAI/Vic Semeniuk
5.8.99	meeting - Derby-WRC/Vic/Clancy & Watson
6.8.99	am: meeting- Groundwater C'ttee pm: discussion with Vic Semeniuk
1.9.99	fieldtrip - meeting with Karajarri TOs
2.9.99	prepare research details
3-4.9.99	write up notes/prepare files
6.9.99	write up notes/read references
7.9.99	prepare for trip talk to Clancy & Joe Green
8.9.99	to Bidyadanga
9.9.99	to Walyata
10.9.99	discussion with Clancy - return trip to Looma
13.9.99	invoice & receipts. Talk to Watson
14.9.99	type up notes & mapping sites/reading
15.9.99 – 21.9.99	reading/note taking/ speak to Bagshaw
22.9.99	meeting at Bidyadanga
23.9.99	meeting with Yawuru elders/ write up notes
24.9.99	meeting with P Sullivan/write up notes
28.9.99	desk top research
8.10.99	prepare for fieldtrip/intro session with Mervyn
12.10.99	Prepare for fieldtrip,drive to Bidyadanga
13.10.99	travel to Injitana area with TOs & Semeniuk
14.10.99	travel to Injitana area with TOs & Semeniuk
15.10.99	travel to Jinjarlkurriny/Putuputungka/Jikilja
16.10.99	travel to Juwurr soaks
17.10.99	return to Broome - clean & change vehicles
18.10.99	prepare for field trip
19.10.99	return to Bidyadanga. Travel to Munro Springs
20.10.99	Munro Springs. Return to Broome.
21.10.99	Drive to Walyata area with Nyangumarta TOs
22.10.99	Walyata.
23.10.99	Yalayala springs. Return to Bidyadanga.
24.10.99	Return to Broome. Clean cars
27.10.99	WRC meeting - Bidyadanga
28.10.99	meetings - Roy Stone/Bruce Gorring/Mark Horstman
29.10.99	WRC Groundwater Committee meeting - Broome
1.11.99	To Bidyadanga - organise fieldwork, consultations
2.11.99	Springs on Frazier Downs - south side
3.11.99	Springs on Anna Plains
4.11.99	Springs on Frazier Downs - south side/return Broome
6.11.99	Return to Bidyadanga
7.11.99	Coastal areas (Frazier Downs) - Return to Broome
8.11.99-11.11.99	Type up notes, etc
12.11.99	Visit Father McKelson/type notes
15.11.99-30.11.99	Writing report/maps/photos etc
1.12.99 -9.12.99	To Bidyadanga - follow-up research with Bagshaw
12.12.99 - 16.12.99	Bidyadanga – check report with TOs and Bagshaw
18.12.99-23.12.99	To Perth –review with D Trigger
27.12.99 - 31.12.99	Finalize report.

APPENDIX 3

LIST OF BIRDS SIGHTED ON SPRINGS

Chris Hassell

Expert Interpretive Guiding ~ Ornithological Survey & Fieldwork ~ Freelance Training and Research

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The attached table shows the birds recorded in and around the Bidyadanga Community between 0430hrs and 9000hrs on the fourth of December 1999. Most emphasis was put on surveying the fresh water springs.
This was a short survey to identify the common birds using the area. The area appears to have a rich and varied avifauna.

Chris Hassell

14 December 1999

Chris Hassell

Expert Interpretive Guiding ~ Ornithological Survey & Fieldwork ~
Freelance Training and Research

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English Name	Latin Name	Local name	Recorded at Bidyadanga Community	Recorded in Eucalypt/Pindan Woodland	Recorded on Samphire Flats	Recorded at and around Springs
Plumed Whistling-Duck	Dendrocygna eytoni					X
Wandering Whistling-Duck	Dendrocygna arcuata					X
Pacific Black Duck	Anas supercilliosa					X
Grey Teal	Anas gracillis					X
Pink-eared Duck	Malacorhynchus membranaceus					X
Hardhead	Aythya australis					X
Australasian Grebe	Tachybaptus novaehollandiae					X
Little Black Cormorant	Phalacrocorax sulcirostris					X
White-faced Heron	Egretta novaehollandiae					X
Little Egret	Egretta garzetta					X
Great Egret	Egretta alba					X
Intermediate Egret	Ardea intermedia					X

English Name	Latin Name	Local Name	Recorded at Bidyadanga Community	Recorded in Eucalypt/Pindan Woodland	Recorded on Samphire Flats	Recorded at and around Springs
Glossy Ibis	Plegadis falcinellus					X
Australian White Ibis	Threskiornis molucca					X
Straw-necked Ibis	Threskiornis spinicollis					X
Royal Spoonbill	Platalea regia					X
Black-necked Stork	Ephippiorhynchus asiaticus					X
Black Kite	Milvus Migrans		X		X	
Whistling Kite	Haliastur sphenurus					X
Collared Sparrowhawk	Accipiter cirrhocephalus					X
Brown Falcon	Falco berigora			X		
Nankeen Kestrel	Falco cenchroides					
Brolga	Grus rubicunda				X	
Purple Swamphen	Porphyrio porphyrio				X	X
Australian Bustard	Ardeotis australis					X
Little Curlew	Numenius minutus		X			X
Marsh Sandpiper	Tringa stagnatilis					X
Common Greenshank	Tringa nebularia					X
Red-necked Stint	Calidris ruficollis					X
Sharp-tailed Sandpiper	Calidris acuminata					X
Curlew Sandpiper	Calidris ferruginea					X

English Name	Latin Name	Local Name	Recorded at Bidyadanga Community	Recorded in Eucalypt/pindan Woodland	Recorded on Samphire Flats	Recorded at and around Springs
Red-capped Plover	Charadrius ruficapillus					X
Oriental Plover	Charadrius veredus					X
Black-fronted Dotterel	Elseyornis melanops					X
Red-kneed Dotterel	Erythrogonys cinctus					X
Masked Lapwing	Vanellus miles					X
Gull-billed Tern	Sterna nilotica					X
Whiskered Tern	Chlidonias hybridus					X
Crested Pigeon	Ocyphaps lophotes					X
Bar-shouldered Dove	Geopelia humeralis					X
Little Corella	Cacatua sanguinea		X	X		X
Red-winged Parrot	Aprosmictus erythropterus					X
Brush cuckoo	Cacomantis Variolosus					X
Pheasant Coucal	Centropus phasianinus		X			X
Fork-tailed swift	Apus pacificus					X
Sacred Kingfisher	Todiramphus sanctus			X		
Rainbow Bee-eater	Merops ornatus		X			
Dollarbird	Eurystomus orientalis		X			
Variegated fairy-wren	Malurus lamberti		X			X
Striated Pardalote	Pardalotus striatus		X			

English Name	Latin Name	Local Name	Recorded at Bidyadanga Community	Recorded in Eucalypt/Pindan Woodland	Recorded on Samphire Flats	Recorded at and around Springs
Mangrove Gerygone	Gerygone levigaster					X
Little Friarbird	Philemon citreogularis			X		
Brown Honeyeater	Lichmera indistincta		X			X
Rufous-throated Honeyeater	Conopophila rufogularis		X			X
Grey-crowned Babbler	Pomatostomus temporalis					X
Rufous Whistler	Pachycephala rufiventris		X			X
Grey Shrike-thrush	Colluricincla harmonica				X	X
Magpie-lark	Grallina cyanoleuca		X			X
Black-faced Cuckoo-shrike	Coracina novaehollandiae			X		X
White-breasted Woodswallow	Artemus leucorynchus		X			X
Pied Butcherbird	Cracticus nigrogularis		X	X	X	X
Torresian Crow	Corvus orru					X
Great Bowerbird	Chlamydera nuchalis					X
Singing Bushlark	Miafra javanica					
Richard's Pipit	Anthus novaeseelandiae				X	
Zebra Finch	Taeniopygia guttata				X	X

English Name	Latin Name	Local Name	Recorded at Bidyadanga Community	Recorded in Eucalypt/Pindan Woodland	Recorded on Samphire Flats	Recorded at and around Springs
Tree Martin	Hirundo nigricans					X
Brown Songlark	Cincloramphus cruralis				X	
Totals			**14**	**6**	**8**	**56**

Total Species

68

APPENDIX 4: Sites recorded and/or reviewed in the project area

Site no.	Place name	European name	Karajarri classification	Semeniuk classification	Site location appraisal
0.1	Jambadangaba	No 4 well	lirri		approximate
0.2	Bilinalan		lirri		approximate
0.3	Balmagun	No3 well	lirri		approximate
0.4	Walambunyari	Thangooingunjal	lirri		approximate
0.5	Miliriny		jila		accurate
0.6	Marrar		lirri		approximate
1	Yardugarra		jila		accurate
3	Warakutinyari		wawajangka		accurate
4	Warrwany		wirrkuja		approximate
6	Walangkajarri		lirri		approximate
12	Pilinypilinyja		lirri		approximate
14	Pilawarinyari		lirri		approximate
15	Punturrpunturr	Port Smith Caravan Park	lirri		accurate
16	Kajarlngapa		lirri		approximate
17	Milarinyarri		lirri		accurate
28	Murrumurru		lirri		accurate
36	Kurrurrungka		lirri		accurate
37	Murtul	3rd spring	pajalpi	spring	accurate
39	Yaralya	2nd spring	pajalpi	spring	accurate
41	Injitana	Injitana Swamp	pajalpi	spring	accurate
45	Kurtungaral		pajalpi	spring	accurate
47	? Kurtungaral	? dam	pajalpi	spring	accurate
48	Jikilja		wawajangka	spring	accurate
52	Lalurrjartu		lirri		accurate
57	Putuputungka		lirri	spring	accurate
58	Jinjarlkurriny		jila	pan	accurate
73	Rula		lirri		accurate
75	Muwarangka		lirri		accurate
80	Wangalngurru		lirri		accurate
85	Yamulakarr		lirri		approximate
94	Wangkurru		lirri		accurate
99	Kuwimpirna	Frazier Downs	lirri		accurate
102	Inta		lirri		accurate
107	Jungkurljartiny		lirri		accurate
111	Lamaniny		pajalpi	spring	accurate
112	Wirritmal	Widdingmarl well	pajalpi	spring	accurate
113	Winjawali		pajalpi		accurate
115	Jingkamartaji	Chinkamuddage Well	lirri		accurate
116	Partakuna		pajalpi	spring	accurate
117	Yirkana	Eegannah Well	pajalpi	spring	accurate

APPENDIX 4: Sites recorded and/or reviewed in the project area

Site no.	Place name	European name	Karajarri classification	Semeniuk classification	Site location appraisal
118	Yilwarangari	Eelwaringah well	lirri		accurate
125	Wapuna		lirri		accurate
128	Yanpurrka	Ambrookah Well	pajalpi	spring	accurate
133	Mangkuna	Mungoonoo Well	pajalpi	spring	accurate
134	Walalkarra	Red Tank	pajalpi	spring	accurate
135	Warrapa	Waroohpah well	pajalpi	spring	accurate
139	Ngarringarringurru		lirri		accurate
142	Jinmankurrr	Mangrove Point	lirri		accurate
143	Wanjanangana		lirri		accurate
144	Manari		pajalpi	spring	accurate
145	Ngaminya		lirri	well	approximate
146	Kalayanjartiny	Calandin well	lirri	well	accurate
147	Pulka - 2		lirri		accurate
150	Puwarta		pajalpi	well	accurate
152	Nyamparri		lirri		approximate
155	Kartingka		lirri		approximate
156	Jangujartiny		lirri		approximate
157	Yawinya	Anna Plains homestead	lirri		accurate
159	Yalakurtu	Yellow Gap Bore	lirri		accurate
161	Karratumartji		lirri		approximate
162	Janti	Sandy Well	lirri		accurate
164	Ngurrinya		lirri		accurate
166	Jukutany		lirri		approximate
167	Marumartaji		lirri		approximate
168	Yakunya		lirri		approximate
169	Kujirti		lirri		approximate
170	Waluminirri		lirri		approximate
172	Lingkirr		lirri		approximate
172.1	Malanpurr		lirri		accurate
172.2	Yamalitu		lirri		approximate
172.3	Ngalingmarapukan		pajalpi		accurate
174	Warrangkakarra	Stockyards complex	pajalpi	spring	accurate
175	Jantitu	Grants	pajalpi	spring	accurate
176	Utangujarrajantitu	Saunders	pajalpi	spring	accurate
177	Yalayala	Eil Eil Springs	pajalpi	spring	accurate
178	Kartungpirti		pajalpi		accurate
179	Jinawaku	Grenache Well US	lirri		accurate
181	Titarrangu	Boremiya	lirri		approximate
182	Palkurrutu		lirri		approximate
183	Urtu marrangu		lirri	? pan	accurate

APPENDIX 4: Sites recorded and/or reviewed in the project area

Site no.	Place name	European name	Karajarri classification	Semeniuk classification	Site location appraisal
184	Pinjipukany		pajalpi		doubtful
185	Putarramal		pajalpi		doubtful
186	Wirangaral		pajalpi		doubtful
187	Wilkarunganjarl		lirri		accurate
188	Jawinijawini		pajalpi		accurate
189	Wunturrmataji		pajalpi		doubtful
190	Puntumartaji		pajalpi		doubtful
191	Munta		lirri		approximate
192	Panjinmartaji		pajalpi		approximate
194	puntu	lake	puntu	pan	accurate
198	Malupirti	Munro spring	pajalpi	spring	accurate
199	Japurr		lirri		approximate
200	Lipirntangu		lirri		doubtful
201	Wartalwartalkujarra		lirri		accurate
202	Pinkarratu		lirri		doubtful
203	Wirril		lirri		doubtful
205	Tirrkamartaji		lirri		approximate
206	Nurrkurlmartaji		lirri		accurate
207	Munakara soak		lirri		accurate
209	Wangkuwany		lirri		approximate
213	Kalukuna		lirri		doubtful
214	Pampitanganyjarl		lirri		doubtful
215	Partipirti		lirri		doubtful
216	Kantijurtiny		lirri		doubtful
217	Japirrangan		jila		doubtful
218	Wilirrjartiny		lirri		doubtful
219	Yirawalyi		lirri		doubtful
220	Parturr		lirri		accurate
222	Juwurr-kakara		lirri	pan	accurate
223	Juwurr - kara		lirri	alluvial channel	accurate
225	Wapirranya		wirrkuja		doubtful
227	Wanamalyanu/Mijimilmaya	Bohemia Stn	lirri		accurate
231	Ilila		lirri		accurate
232	Wangkurtimartaji		lirri		accurate
233	Jukutukurrany		pajalpi		doubtful
234	Kalyatanyan		lirri		doubtful
235	Manala		jila		doubtful
236	Mamanung		lirri		accurate
239	Kurunan		pajalpi		doubtful
240	Pirrpirrkara		lirri		doubtful

APPENDIX 4: Sites recorded and/or reviewed in the project area

Site no.	Place name	European name	Karajarri classification	Semeniuk classification	Site location appraisal
241	Ngarrapangarrany		lirri		doubtful
242	Partikurra		lirri		doubtful
243	Yajukan		lirri		doubtful
244	Pirriminany		lirri		doubtful
245	Pirriminany		lirri		doubtful
246	Mantikarrakarpu	Dampier Downs	pajalpi		accurate
247	Niyamaninyarri		wirrkuja		doubtful
248	Kalwany		lirri		doubtful
249	Yirakin		pajalpi		doubtful
250	Mitankunany		wirrkuja		doubtful
251	Walmatany		wirrkuja		doubtful
252	Jitapu		wirrkuja		doubtful
253	Winjanyalinyarra		wirrkuja		doubtful
254	Yanparlimany		wirrkuja		doubtful
255	Wayilpil		wirrkuja		doubtful
256	Partanyurtany		wirrkuja		doubtful
259	Irlpi		wirrkuja		approximate
261	Jilarjartiny		lirri		approximate
262	Lilkinyi		lirri		doubtful
263	Ulupu		lirri		doubtful
264	Narrkanja		jila		doubtful
265	Pulnya		lirri		doubtful
266	Purranungu		lirri		doubtful
267	Jirrkany		lirri		doubtful
268	Jalinymata		lirri		doubtful
269	Pantarrakujartiny		lirri		doubtful
270	Walal		lirri		doubtful
271	Tinkimartaji		lirri		doubtful
272	Jalparayi		lirri		doubtful
273	Mantarrkarra		lirri		doubtful
274	Murnaku		lirri		doubtful
275	Walkalaji		lirri		doubtful
276	Yajuramany		lirri		doubtful
277	Jurti		lirri		doubtful
278	Purrparr		lirri		doubtful
279	Yuliyarra		lirri		doubtful
280	Kumpujarra		lirri		doubtful
281	Yarrili		lirri		doubtful
282	Kalpu		jila		doubtful
283	Yarri		lirri		doubtful

APPENDIX 4: Sites recorded and/or reviewed in the project area

Site no.	Place name	European name	Karajarri classification	Semeniuk classification	Site location appraisal
284	Mantangarru		lirri		doubtful
285	Nyalapukul		lirri		doubtful
286	Pantalanju		lirri		doubtful
287	Yinjunarra		lirri		doubtful
288	Karnkurlkara		lirri		doubtful
292	Wangkujartiny		lirri		doubtful
293	Kalpipirra		lirri		doubtful
294	Karpi		lirri		doubtful
295	Tapaltapal	Dragon Tree Soak	pajalpi	spring	accurate
296	Yajula	Dragon Tree Soak	pajalpi	spring	accurate
297	Kurriji	Dragon Tree Soak	pajalpi	spring	accurate
298	Nilikara		lirri		doubtful
299	Latitingu		pajalpi		doubtful
300	Junyurrturr		lirri		doubtful
301	Kilkuyarra		lirri		doubtful
302	Karnapirra		pajalpi		doubtful
303	Tiwatiwa		pajalpi		doubtful
304	Junyi		pajalpi		doubtful
305	Milyalara		lirri		doubtful