Sustainable Water Supplies for remote Communities of Indigenous people:

The first step: Water Conservation

Photo by Penny Tweedie

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Acronyms

ABS	Australian Bureau of Statistics
ADGW	Australian Drinking Water Guidelines
AGSO	Australian Geological Survey Organisation
ALEC	Arid Lands Environment Centre
ATSIC	Aboriginal and Torres Strait Islander Commission
CAT	Centre For Appropriate Technology
CDEP	Community Development Employment Program
CHINS	Community Housing and Infrastructure Needs Survey
CMAE	Centre for Management of Arid Environments
COAG	Council of Australian Governments
CRC	Cooperative Research Centre
ESO	Essential Service Officer
FRDC	Federal Race Discrimination Commission
HREOC	Human Rights and Equal Opportunity Commission
NHMRC	National Health and Medical Research Centre
NHT	National Heritage Trust
NT	Northern Territory
PAWA	Power and Water Authority, Northern Territory
TDS	Total Dissolved Solids
THS	Territory Health Services
TORC	Tjuwanpa Outstations Resource Centre
RADG	Remote Area Development Group
WHO	World Health Organisation

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Abstract

This report addresses the issue of sustainable water supplies for remote Indigenous communities living in arid environments. Primarily it has sought to investigate the role of water conservation in these communities. Water conservation is an important step because most remote Indigenous communities are reliant on limited groundwater supplies.

This report investigated 6 main areas that aid consumers to conserve to water. The report found that:

Current water efficient technologies are based on urban situations and therefore are not appropriate for remote Indigenous communities. The reasons for this are this technology has not been designed to cope; with high levels of TDS, variable and particularly extreme heat climatic conditions, variable and often quite high occupancy rates in households and low maintenance levels. Meaning that the lifetime of the technology is considerable shorter and that it is hard to maintain effectively. Water efficient technologies need to be designed to suit the conditions they are in. It should not be that remote Indigenous communities must change their lifestyle to reap the benefits of water conservation technologies. Technologies need to be designed considering the environmental, social and economic situations they are placed in.

Water conservation in remote Indigenous communities in the past has been based on technological changes. These are currently not suitable for remote indigenous communities. Water conservation needs to understand the cultural and lifestyle complexities of remote Indigenous communities. These can include; changing perspectives and needs, high mobility rates, changing household occupancies. Remote Indigenous communities will benefit from an understanding of their current water supply because communities will then be in a greater position to make changes to current water use patterns.

Limited maintenance programs increase the amount water losses. Maintenance programs in remote communities often consist of annual checks on essential services. On-going maintenance is hindered by lack of technological ownership, controlling government authorities and high mobility rates.

Management of groundwater is not apparent in remote Indigenous communities. Primarily because there is a lack of transparency in information transfer, resulting in groundwater experts storing the only knowledge of sustainable extractions rates and appropriate management practices. This knowledge needs to be more fluently translated to communities and those working with communities, so that they are in greater positions to be included in management decisions.

Water restrictions have had a limited use in remote Indigenous communities in arid environments. The use of them needs further investigations, particularly in the future as the number of high water use practices that are implemented (e.g. growing vegetable gardens and building swimming pools) is likely to increase.

Pricing mechanisms in remote Indigenous communities are heavily subsidized. Consequently, cost recovery remains low, increasing the financial burden on the central government to maintain services and develop/implement new infrastructure. Pricing the real costs of water remains a problem in communities because of high mobility, limited water metering in communities and due to health related factors. There is a need to further investigate a way of water pricing that ensures the real cost of water (e.g. environmental costs, infrastructure/supply costs) is incorporated into payments.

This report has found that most important step forward is to provide communities with knowledge of their water supply and to listen to their understandings of water use patterns within the community. With this in mind, the report provides a framework that can be used in helping implement water conservation strategies into communities. The proposed framework is based on knowledge sharing. The knowledge is shared between a number of stakeholders, ranging from Government institutions, community members, groundwater consultants and development organisations. The framework is broad, to allow for it to be directed and interpreted in a range of remote communities that have differing structures, lifestyles and cultures. Its aim is to provide knowledge to allow community members to decide on the direction of their water management. And, with this decide the importance of water conservation strategies in their community. It is hoped that in future, this framework will be tested and evaluated.

1.0 Introduction

Water is essential to life and next to oxygen is the most important substance to humans (Ashton and Haasbroek 2000). In Australian arid and semi-arid regions the need for water is intensified, due to the dry conditions. Despite the need for water in these environments, it is hard to come by; rainfall is low and highly erratic and evaporation is high. This means that all surface water supplies in Australian desert regions are ephemeral (English 1998, 255). Water supplied to the majority of communities in this area therefore, comes from below the surface, from groundwater aquifers. The demand on these groundwater resources is increasing significantly, due to growing populations living in desert communities and also (in some cases) increased fluxes of tourist visiting this region. At the same time there is a growing realisation that fauna and flora within the arid zone are also dependent on this supply of water (Cook et al, 2001). These demands on groundwater sources induce questions about sustainability of this resource and populations dependent on them. This report primarily addresses sustainability of water supplies for Indigenous populations and communities living in remote desert environments of Australia. Survival in these regions depends first and foremost on the supply of water and hence, the need to conserve and protect the groundwater resources is essential to permit the natural growth and development within each remote Indigenous community.

In order to address sustainability of water in communities, one must first understand the cultural and social issues that induce how water is used and how water supplies are currently managed. According to Radwan (1998), water systems must be understood in terms of the cultural settings within which they operate: “the formal and informal power structures which govern social relations and behaviour…. Interact to create the functioning village.” Water conservation strategies and projects, as this report will show cannot simply be taken from urban communities and placed into remote communities. Remote Indigenous communities’ needs, priorities and desires are vastly different from the typical urban community. The implementation of a water conservation strategy that does not appreciate the cultural perplexities and diversity in and within Aboriginal

communities is threatened with failure from the very beginning. The core reason for this is that strategies have, can and most likely will be implemented that do not address areas where high usage of water occurs. Hence, the importance of understanding these two aspects; culture and lifestyles of Indigenous Australians, lies in grasping a more holistic picture of the significance of water; how water is used, where water may be wasted and what forces will constrain the conservation of water, within specific remote communities.

This report was initiated through CRC Water Quality and Treatment Summer Scholarship Program. The project for this scholarship was based at Centre For Appropriate Technology in Alice Springs, NT. The project was designed to research water sustainability in remote Indigenous communities initially through desktop searches and was then developed to the incorporation of field-based experiences. The project brief was based on sustainable water supplies, however, there is an to the array of possibilities under this heading and it was decided by that author that the first step to sustainable water supplies is to conserve the water that is currently available for use.

The aim is therefore to investigate current areas of water conservation and make recommendations for future water conservation strategies and programs within Aboriginal communities. This report will be broken up into four main parts. The background information, which will provide a brief on the location, i.e. remote communities, it will look at remote communities' water supply and provide a brief on groundwater supplies. The report then goes on to look at current water conservation areas and provides a preliminary evaluation of the importance of these in Aboriginal communities. The third section provides an insight into specific communities. This section discusses 2 case study regions; Mutitjulu community and Tjuwanpa Resource Centre's outstations. The final section will provide an evaluation of the three areas and makes recommendations of where future water conservation should lie within communities. Due to the lack of work previously done in this area, there is a focus in this report that stresses and reinforces the urgency of communities to better understand their water supply and for institutions and organisation working in this field to better communicate knowledge to their clients.

2.0 Background Information

2.1 Sustainability- International Context

'Our Common Future' published by World Commission on Environment and Development in 1987 (known as the Brundtland Commission) was a landmark report that dealt with environmental pressures facing humankind. The most important concept to emerge from the report was that of 'sustainable development' (Black 1998). 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs'. Following on from this in the 1992 Rio Conference came Agenda 21, the action plan for sustainable development, where sustainability was advocated as the focal point in development projects throughout the world. Australia is a signatory to the Agenda 21 agreement, but despite this there has been a poor record of achievement (Anderson 2000). In the perspective of international and national interactions, it is in Australia's best interest to move towards more sustainable use of its resources.

2.2 Sustainability- Australian Indigenous Context

Water is a vital key to sustainable development in Australia, crucial to its social, economic and environmental dimensions (Yencken and Porter 2001). In this report, water in remote communities is most commonly linked with the social dimensions of sustainability, i.e. ensuring communities have enough water to remain healthy and sustain a vibrant lifestyle which can support practices including culture, education, family life, etc. However social, economic and environmental dimensions of sustainability are intrinsically related, meaning that distinguishing one from the other is problematic. For example, a community with enough water to sustain health would also require a surrounding healthy and productive environment which in turn requires water as well. The scope for addressing all the issues attributing to sustainability of water for a community is theoretically outside the time limit given for the investigations. This report has therefore primarily focussed on the social needs of sustainable water for communities and only briefly highlights the other dimensions of sustainability.

2.21 Safe Water Supplies

The Australian Drinking Water Guidelines (ADGW), defines standards of acceptable drinking water quality which "based on current knowledge is safe to drink over a lifetime, that is, it constitutes no significant risk to health" (NHMRC 1996: 3). The Guidelines represent a framework of information that is intended to provide advice on assessing physical, chemical, radiological and microbiological characteristics of drinking water. From a public health perspective, the guidelines provide the minimum requirements for drinking water of good quality. These Guidelines have been used in Indigenous communities to help assess water quality and to draw deductions on any health illnesses that may relate to water quality supplied to a community.

2.22 Adequate Water Supplies

The ADGW do not define what is an “adequate” amount of water to provide healthy conditions for community. Hence, there is much uncertainty within Health Organisations and Development Organisations about this volume. Defined volumes of 20 litres per day (Gleick 1998: 44) right through to 1000 l/d (Yuen 2001) are suggested as adequate amounts. Engineers often take the figure 1000 l/d as the optimum figure when designing infrastructure and Health Authorities have supported this decision (Yuen 2001). This “gap” in understanding has lead to current perception that with increased water use there is increased health benefits to communities in Australia. Is the quantity of water the issue in relation to maximum health benefits?

Pruss and Mariotti (2000) showed that it is not actually the quantity of water that is required for health outcomes, rather the accessibility and location of the water (see Appendix A). If a tap is located inside the house, in contrast to several hundred metres away then community members are more likely to be healthier. Water that comes through a tap in a kitchen or a bathroom is easier to access and theoretically used on a more reliable basis; and does not have to be carted through dirt, dust and any other sites, that may potentially affect water quality.

2.3 Homelands Movement

Aboriginal people and their communities live in arid regions, primarily as a response to the Homelands movement initiated in the 1970s.

> "There were several objectives of the homelands movement according to aboriginal people, including:
>
> - Returning to traditional country in order to look after the land and its sites of cultural significance
> - Seeking a safer, healthier and culturally more satisfying lifestyle, free of the social stresses, alcohol abuse, petrol sniffing and domestic violence of some of the larger communities and towns
> - Re-establishing the importance and authority of the family
> - Teaching young people about their cultural heritage
> - Living a healthier lifestyle, with better food and opportunities for hunting
> - Keeping young people out of trouble." (McDermott et al 1998: 653)

Aboriginal people need and want to be on their traditional land; there is a cultural, spiritual and traditional desire to live off their land and to reconnect with their country. Their culture encapsulates ideas that people are a part of the land, not separate from it, unlike people of European descent who identify themselves as separate from the land and arguably see the land as a place primarily for resource collection (Dwyer 1998). The homelands movement allows Aboriginal people the chance to reconnect with their country and to preserve and renew the importance of the cultural and spiritual values that they share with their homeland.

In relation to this, Aboriginal people see themselves as belonging to an area of country and not specifically to one community. For example, the Walpiri people belong to the area in the Tanami desert, some 240 kilometres above Alice Springs and not simply to communities, such as Yuendumu or Nyirripi which are located in Walpiri country. Aboriginal people are highly mobile society and individuals move between communities,

outstations and urban regions. Individuals often make a choice on where to live for a number of different reasons; including martial status, life cycle, social unrest in a certain locality, cultural business, disagreements within community, the death of a relative, sporting events (particularly football), availability of resources, seasons/time of year, health/well being of themselves or family member/s. As previous literature suggests (Warchivker et al 2000; Taylor 1992; Young 1990; Smith 1980), mobility factors have implications for service and program planning in Aboriginal communities. Anecdotal evidence suggests that in communities smaller then 50 people, the population may rise to four or five times the usual population for a period of 2 to 3 months (Warchivker, 2000). This puts unpredictable demand on amenities, such as water supply.

The tragedy of the homelands movement is the fact that it does not necessarily mean that all Indigenous people were given back the rights to their land. Most land occupied by Indigenous people is in the centre and tropical north of Australia, in arid/semi-arid and monsoonal areas (see figure 1). In general, non-Indigenous people see this land as offering very little economical benefits, particularly in relation to agriculture and grazing and to a large extent this is the reason why these were the only areas land

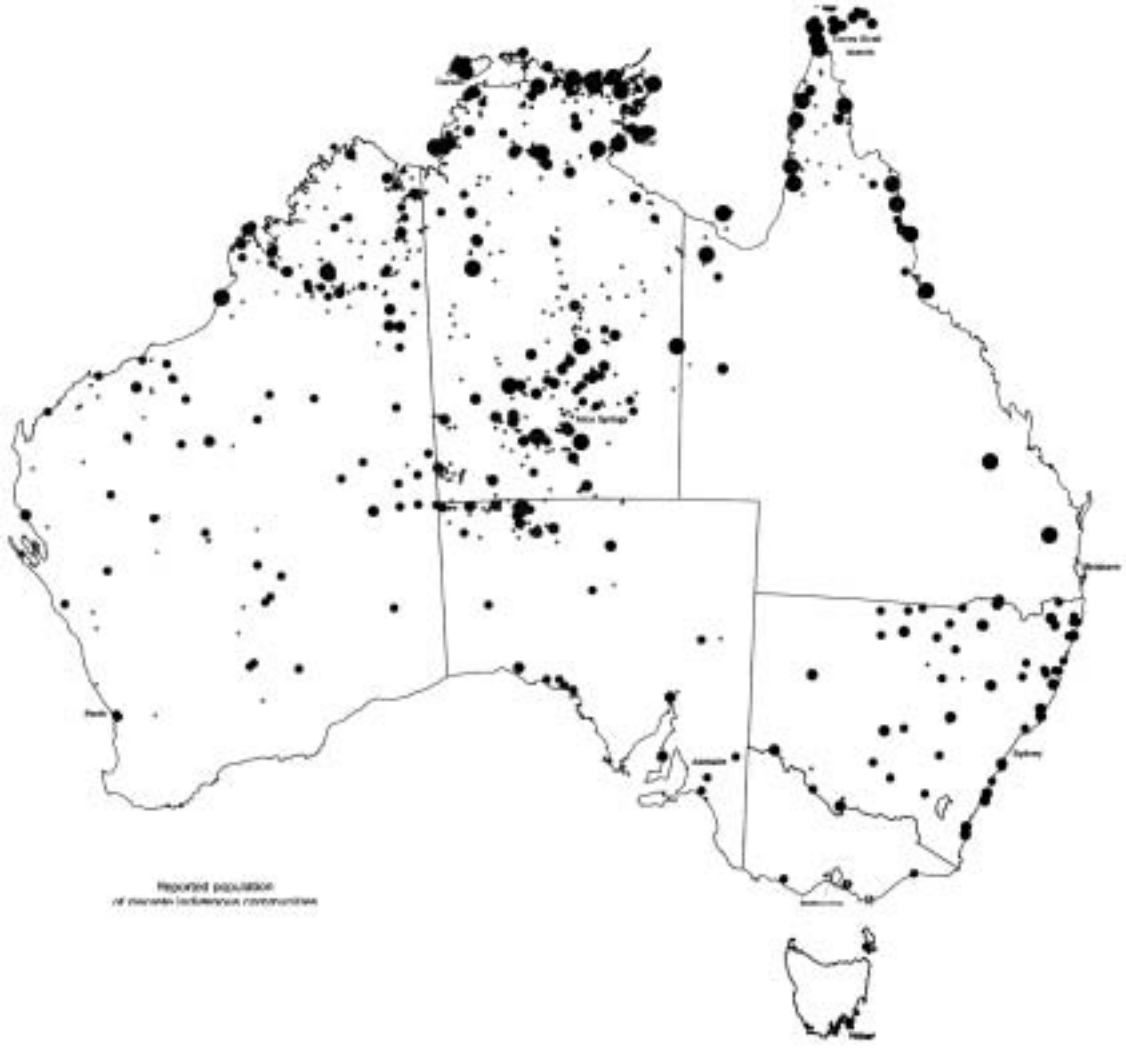


Figure 1: Indigenous Australians Community Distribution: The dots represent the land occupied by Indigenous Australians. The majority of this land is in desert regions and monsoonal regions of Australia.

2.4 Communities of Indigenous People

Red sand dunes and dusty plains in Central Australia hide the homelands of many Indigenous communities. Aboriginal lifestyles and cultures are unique to their specific environment/landscape and have been revoked from traditional thinking and ways that have been developed from experience that incorporates some 50,000 years ago of existence. The development of these communities modern technology has been influenced by western world; housing, power, water pipes and taps have been installed, but are kept minimal compared with Australia's city and towns and are often considered rudimentary; on average infrastructure is minimal and poorly maintained (Yuen 2001). As can be imagined, remote communities (see figure 2) are dry and dusty places, very isolated from the major centres and services. Many communities are without shops, schools and proper waste disposal systems. Most communities are only accessible by unsealed dirt roads and consequently can be difficult to get to, particularly because of severe climatic and environmental conditions. Temperature variations are extreme: summer temperatures can exceed 45 ºC and winter temperatures below –5 ºC are particularly common at night. Freak events of flooding are known to occur in some areas. This variation in community structure in comparison with urban centres will impact on the ways water is used.

Figure 2: Picture of a typical remote community of Indigenous people situated in an arid environment

There is no typical image for water supplies and usage in remote Indigenous communities. The levels of water in the supply and the usage patterns of communities are highly variable parameters. However, most communities in arid lands do not have a diverse range of water sources. Typically groundwater is the only source (see figure 3), with a very limited number of communities having access to supplementary supplies, such as rainwater tanks. As outlined earlier, due to dry, desert conditions, water to a degree will be limited in all communities. Some communities such as Kenmore Park, 400 kilometres southwest of Alice Springs are faced with the reality of their water supply terminating within the next two years. Other communities such as Kintore 600 kilometres west of Alice Springs escaped a potentially critical time for their water supply when the aquifer fortunately was replenished with water after massive flooding in 2000. Previously the Kintore aquifer had only very limited amount of water remaining in their aquifer (see figure 4: Kintore aquifer). This report has tried to realise that there is immense diversity among and between communities and their resource supply.

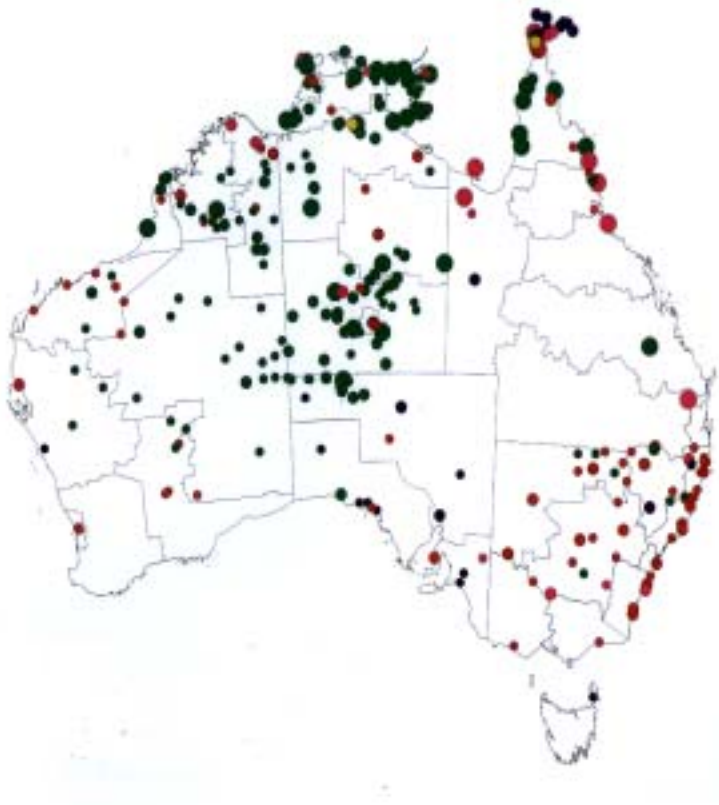


Figure 3: Indigenous Communities on Groundwater Supply: The green dots on this map show all those Indigenous Communities who have groundwater supplies, as their main water supply.

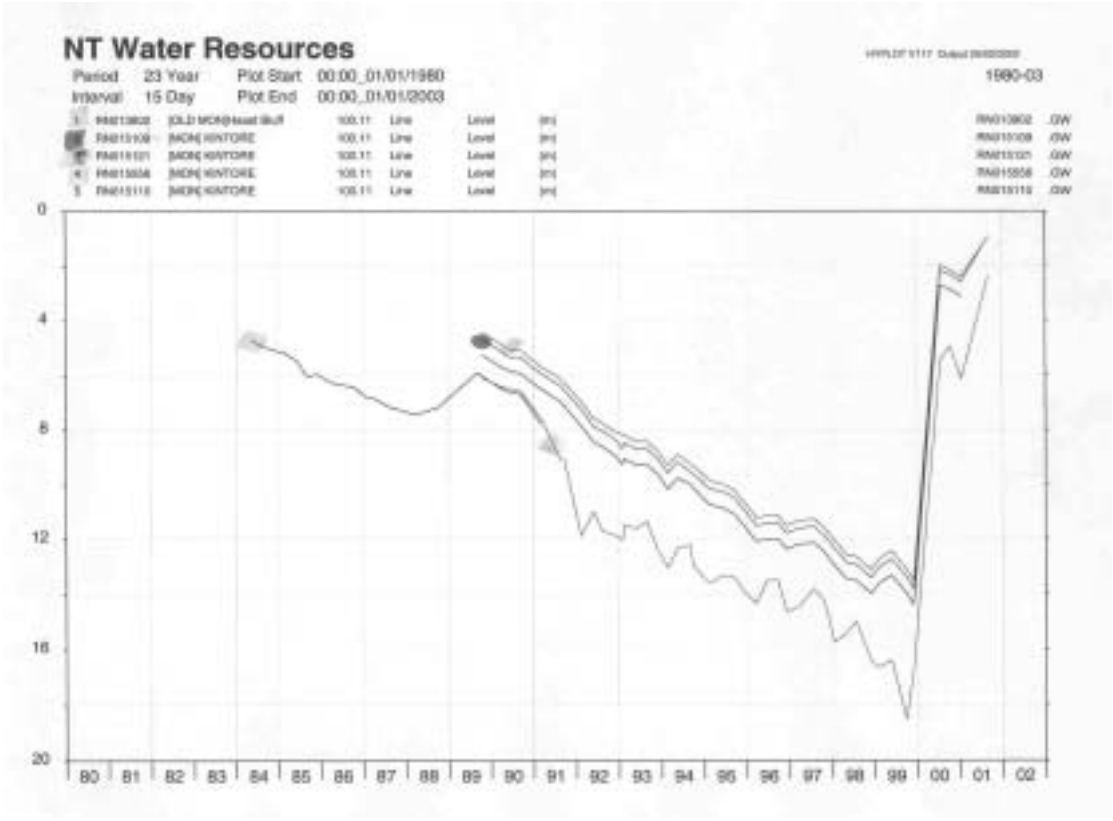


Figure 4: Data on groundwater monitoring bores of Kintore Community: This graph shows data on 4 monitoring bores for the aquifer that supplies the Kintore Community. The monitoring bores are an average of approx. 25m in depth. The graph shows a rapid rate of decrease water inside the aquifer (between 15-19metres decrease). However due to floods the following year the aquifer was completely replenished.

It is important to note at this stage that most communities only have one water meter. Outstations also have one water meter or a number of outstations may have one water metre between them to measuring water usage. Thus, one water meter can only provide a total of how much water is used in a community, an outstation or a number of outstations that are supplied by the same bore. Essentially this limits the amount of information available on how and where water is being used and hence, if water is being wasted. Urban community water conservation programs have been instituted around knowledge of where individual households are wasting their water and programs and technologies have been introduced to reduce the wastage of water in these areas.

> "To examine whether current water use practices are sustainable, it is important to determine the quantity and purpose of water use". (Foley and Daniell 2001: 1)

Foley and Daniell's proposal would be effective in remote Indigenous communities as well, as their different demands and uses of water would inform strategic analysis and help in the implementation of effective target programs. It is unfortunate that this information is not available and conceivably may limit the amount of work that can be achieved in this report. Despite this, investigations for this report has been based on evidence provided through interviews on general consumption patterns or ideas on water supply and these ideas are considered an important part of the process. Thus, while exact figures of water use patterns cannot be sought (e.g. litres used in households, litres used in showers, etc), it is arguably just as important to grasp an understanding of where communities feel their water is being used inefficiently.

2.5 Sustainable use of Groundwater

Groundwater is extracted from an aquifer through the means of the bore (see figure 5). Sinking a bore requires knowledge on where is the most appropriate location for the bore, considering a list of surrounding environmental properties, including; soil, vegetation, etc; as well a social properties such as; sacred sites and the impact on the amenity value of landscape (Renner, personal communication, 2002). After this planning, determination of the level of groundwater and (in most cases), the sustainable extraction rates are then investigated.

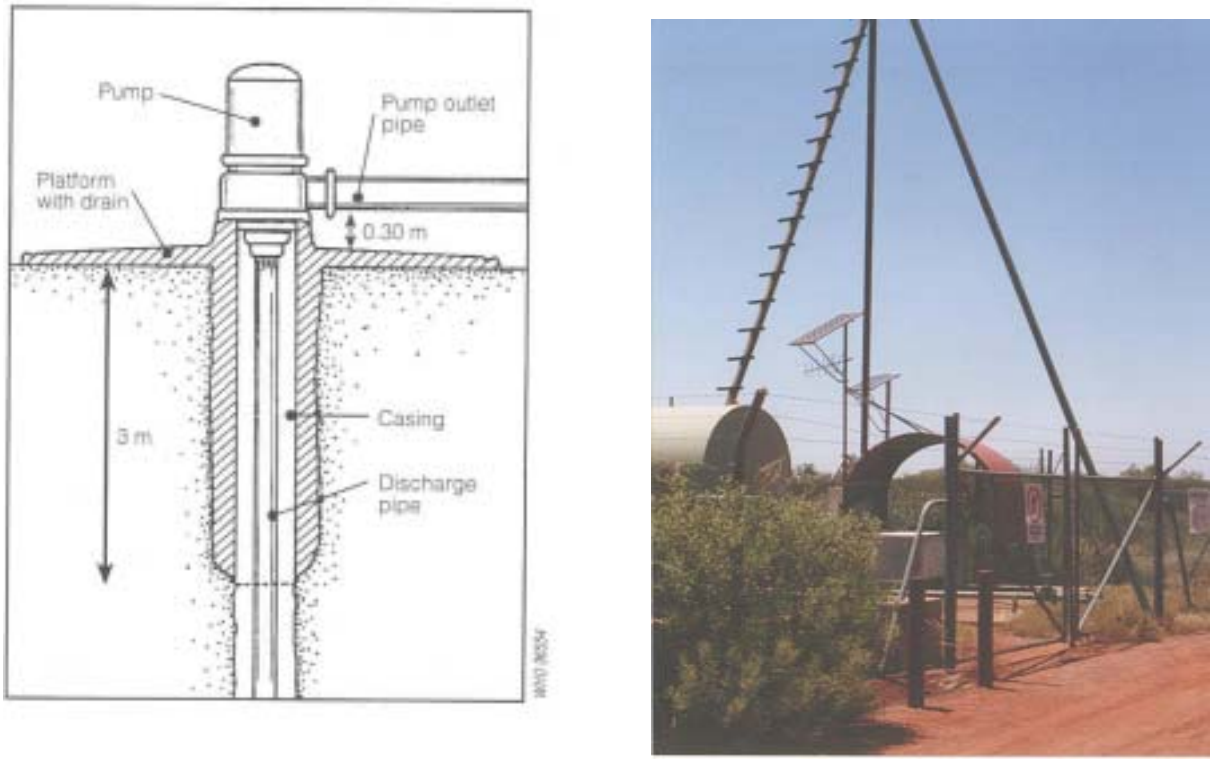


Figure 5: Groundwater Bore Diagram (WHO 1997: 95) and Picture

The sustainable yield of an aquifer depends most importantly on the amount of recharge the aquifer receives. However due to induced recharge or unstable equilibriums in recharge and discharge, the sustainable yield of an aquifer does not necessarily equal the amount of recharge to the aquifer (Bredehoeft 1997 and Schoeller 1959 as cited in Wischusen 1998). Therefore the sustainable yield of an aquifer has been defined by Schoeller (1959 as cited in Wischusen 1998) as the amount extracted that does not exceed the normal flow of the aquifer and similarly, defined by Smith (1999) as the rate of extraction that is not in excess of the effective recharge rate. In arid environments, recharge to aquifers is often irregular and unpredictable, and can result in over development of an aquifer. It was therefore recommended by Lerner et al 1990 and Foster 1998 (as cited Wischusen 1998) that groundwater extraction in arid areas be staged, allowing the response of the aquifer to be monitored. Due to the limited definitions on sustainable yields of groundwater, the idea is often hard to conceptualise.

In response to the COAG (1996) agreement on provision of water to the environment, the National Land and Water Resources Audit (NHT) has defined the sustainable yield of an aquifer as “the level of extraction measured over a specified planning timeframe that should not be exceeded to protect the higher value social, environmental, economic uses associated with the aquifer.” (Cook et al, 2001). This report provides credible evidence that desert communities may be extracting groundwater unsustainably and hence, to protect the “higher value social uses”. Elsewhere, such as the Top End of Australia, groundwater systems are managed in the expectation that up to half the available storage can be used per year (Pidsley, 1991). One area of concern for some aquifers in the arid region of the NT is that only small amounts of recharge relative to aquifer storage have been observed. Other areas such as the Kintore community’s aquifer (described in 2.3) are known to completely replenish after heavy depletion. The spatial temporal variability of rainfall in arid regions may mean that an element of uncertainty as to when and if groundwater resource may be replenished is innate to all groundwater systems (Wishusen, 2001).

In central Australia, most rainfall penetrates only the top few metres of the unsaturated zone from where it is systematically removed by vegetation and by soil evaporation. Rarely, a large rainfall penetrates beneath the root zone to recharge aquifers (see figure 6). Two recharge mechanisms are apparent: localised recharge due to infiltration through the sandy beds of ephemeral streams emanating from the base of rocky outcrops; and distributed recharge vertically downwards through sand dunes and calcrete (English 1998). In summary, groundwater management and sustainability rates of communities require on-going research and calculations, and the use of these resources will constantly require an element of caution due to the over estimation in sustainability predictions.

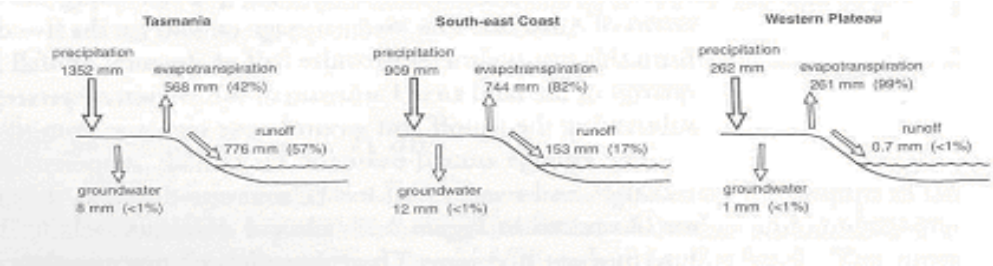


Figure 6: Groundwater Recharge – a comparison of the different areas of Australia (Smith 1998)

2.6 Population Growth

Australian indigenous population make up 1% of the Australian population, but they make up 1/5 of population living in remote and rural areas of Australia (ABS 1999). Indigenous communities are documented in population charts as one of the fastest growing populations within Australia. This growth will increasingly place pressure on the resources available, as a growing community will mean more resources will need to be allocated, including water. If the availability of water is limited due to natural population growth, a vast number of repercussions may surface. Examples of problems that could arise or be exacerbated in the face of water supplies being used unsustainably include:

- Social problems, such as increase in poverty, decrease in livelihoods (Walker 1994);

- Health problems, such as increase in malnutrition and increases in the cases of amoebic dysentery (diarrhoeas), trachoma, scabies (Shaw 1999: 77);

- Economic problems such as increase in welfare dependency, reduced areas for development or sustaining of enterprises (Walker 1994);

- Environmental problems such as loss of flora and fauna (AGSO 1997)

Water conservation is therefore essential to ensure that the growth in population and the development of community is not restricted through a lack of water resources.

Figure 7 and 8 show a comparison between Indigenous populations and the entire Australian population. These population pyramids show that the Australian population is balancing out, in that the number of older people is relatively equivalent to number of young people. In contrast, the Indigenous population pyramid shows that the number of young people is much larger then the population of elders. This is a sign that Indigenous populations are increasing at an extremely fast rate and much faster then that of entire Australian populations. Hence, a growth in population in most Indigenous communities or outstations is likely to occur (Taylor 2000).

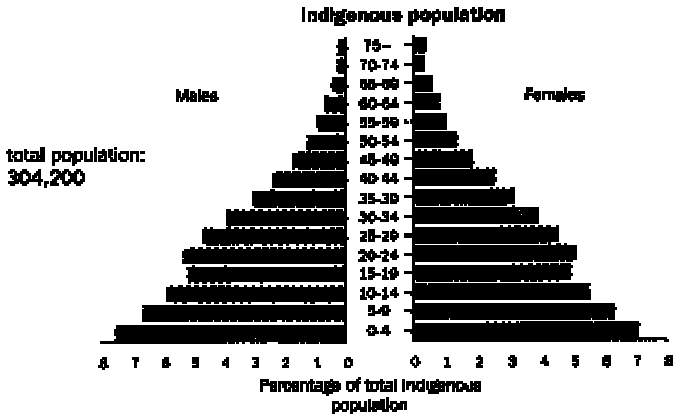


Figure 7: Population Pyramid for Indigenous Australians, 1994

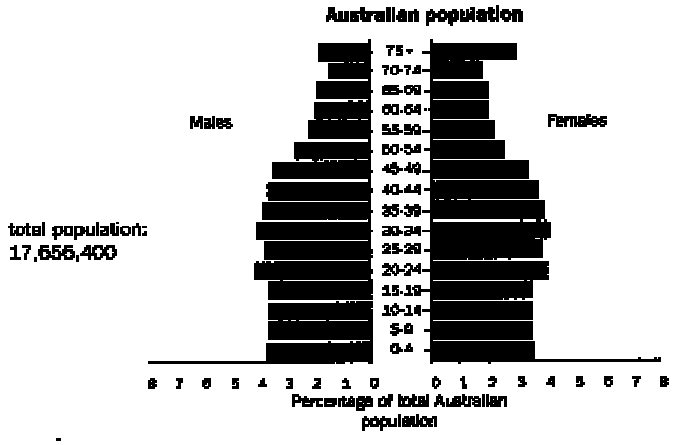


Figure 8: Population Pyramid for all Australians, 1994

3.0 Current Areas of Water Conservation

The potential design areas for water conservation are defined below. They have been separated into 6 main areas; Water Efficient Technology, Water Conservation Education, Maintenance, Knowledge and Management, Water Restrictions and Pricing Mechanisms. There has been a minimal amount of work done on water use patterns and conservation measures in remote Indigenous Communities. This research has looked at some source areas of water conservation and then tried to capture the appropriateness of them, as strategies for implementation in the context of remote communities.

3.1 Water Efficient Technology

Water Efficient Technologies are currently not suitable for remote Indigenous Communities

Technologies which reduce water usage have been used throughout the world, as a way to conserve water. Examples of water efficient technology include; water efficient shower heads (see figure 10), aerated tapes (see figure 9), flow restrictors (see figure 11), grey water re-use systems, type of toilets: composting toilet (see figure 12); dual flush toilet, pit toilet and other examples.

Figure 9: Aerated Tap

Figure 10: Water Efficient Showerhead

Figure 11: Flow Restrictor

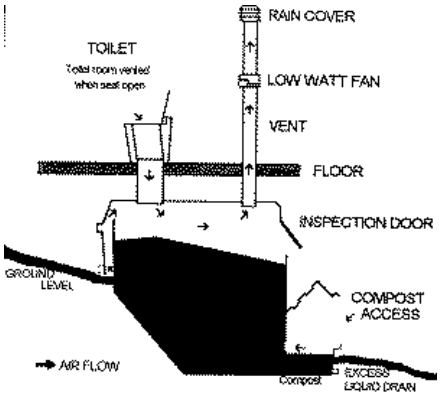


Figure 12: Clivus Miltrum dry composting toilet

The pre-dominant problem with this type of technology is the fact that they have been designed in most cases to reduce water in urban households that are supplied with surface water. There has been very little work to assess their viability and potential in remote

communities. Evidence suggests that water efficient shower heads and aerated taps would be problematic in remote communities, particularly those prone to scaling from high calcium levels in their water (Remote Area Development Group, 2000). Currently, normal shower heads placed in these communities have problems with scaling, which decrease the diameter of holes in showerheads. Water efficient showerheads have smaller holes then that of a normal showerhead and have the potential to block up very quickly, resulting in increased maintenance for remote communities. The NHMRC guideline for Total Dissolved Solids (TDS) is 500-1000 mg/L (NHRMC 1998), however these levels can cause scale formation. Frequently communities have TDS levels higher then the ADWG recommendation. An extreme example is Tjuntjuntjarra which has a TDS level of 50,000mg/L, by comparison seawater is approximately 34,000 mg/L. High level of hardness or dissolved salt in remote communities' water supplies can constrain the effectiveness of water efficient technology currently available.

One suggested solution to the effects of scaling is to install removable showerheads or taps, which can be cleaned out when significant levels of calcium cause blockages (Botica, personal communication, 2002). The frequency in which blockages would occur and the limited maintenance programs with community may mean that this solution has the potential to be a burden to a community and is not an appropriate long-term solution.

Urban designed water efficient technology will also fail in the context of remote communities because many systems are designed using technologies and techniques which work in urban structures, where economies of scale increase the feasibility and resources are more plentiful (FRDC 1994). As the economies of scale decrease, the vulnerabilities of water efficient technologies adversely affect remote and isolated situations, who have limited resources, maintenance programs and access to services to sustain the technology.

Water efficient technology designed on urban standards will require a vigilant maintenance program that is currently not available in most remote Indigenous Communities. Due to the hardness of the groundwater, severe climatic conditions and different social patterns, most water efficient technology implemented in these communities will have a lifespan much shorter than that which would accompany the use

within urban households. In communities, maintenance (as shown in section 3.3) may be limited to yearly operational checks. Water efficient technologies are likely only to be a maintenance burden on these communities, such as flooding or cutting off the water supply through break down in technology. Furthermore, these maintenance issues have the potential to induce a number of other related problems; such as health related problems.

Additionally water efficient technology will fail because the technology is usually installed when community members are not there. When the people return the contractors/builders have left and there is no one to tell the community how the equipment works and how it should be maintained. Essentially this leads to the problem of ownership, where communities do not feel obliged to look after technology because they do not know how to use it and/or maintain it. This technology is seen as "white fella technology" or that which "white fellas" operate and maintain and therefore not the community's responsibility, but rather the responsibility of the installers. The need to address this problem in a wider sense is important for all technology implementation, however it is critically important to water conservation, for if the technology fails and there is an absence of maintenance then this can ultimately result in water being wasted.

Growing perceptions of higher (urban) standards from people living in communities inhibit the implementation of technology. For example, pit toilets and composting toilets are seen as a backwards step for the development of communities. Community members often demand the installation of flush toilets as a way forward (Blight, personal communication, 2001). This predominant perception of pit toilets and composting toilets as a "primitive" technology will limit the use of these in communities because of the widely held view that it is an improved development. This perception is widespread, despite the fact that pit toilets are good at conserving water and there has been successful use of pit toilets in community development projects situated in Top End of Australia (Marshall 2000). Flush toilets have often resulted in a huge maintenance problem for communities (see figures 13); blockages, leaking cisterns, and the limited resources and knowledge provided to maintain and look after these, has meant that installation of flush toilets, debatably may not be an appropriate technology for remote Indigenous communities.

Figure 13: Dual Flush Toilet that was installed into a remote Indigenous Community

There is a need for research to assess where appropriate water efficient technology can be incorporated in to communities. A technology will be appropriate when it:

- Requires little maintenance and it outlives the environmental and social pressures associated with desert regions
- Is accepted and understood within the community
- Is economically feasible, in the short and long term

In essence any water efficient technology installed into communities should be socially, economically and environmentally appropriate and should not just be "a short-term, quick fix" to the problem. Linton Espie (personal communication, 2002), a lecturer of the Education and Training at CAT further suggested that the best technology is that which is simple. Technologies to increase water efficiency can have a place in remote Indigenous Communities but it must be designed specifically for these communities.

3.2 Water Conservation Education

Water Conservation Education in remote Indigenous communities only deals with technological changes

Water conservation education (in urban communities) has addressed three main areas of information provided to the consumer. It firstly aims to give the consumer information about the water supply, how much is available, where the water comes from and where it goes to. This increase in knowledge is aimed at making the consumer more thoughtful the next time they turn the tap on and to provide a deeper understanding of the importance of conserving water. The next two areas provide information about changes, essentially lifestyle changes that can be made and technological changes that can be implemented into your household.

Lifestyle changes mostly relate to changes that can be made to your current behaviour. These include taking shorter showers, turning the tap off when you brush your teeth, watering the lawn at night, washing the car on the lawn, etc. In the urban context these behavioural changes have been known to decrease water usage within many households by a large percentage. Conversely, in the remote community context, these types of changes may not be productive to implement. Behavioural changes highlight the need to better understand how lifestyles in remote communities differ from urban communities and also highlight, the need to gather information on where water may be used inefficiently.

Technological changes such as the implementation of water efficient technology was discussed in the previous section. Findings show that implementation of this type of technology into remote communities will be problematic. Additionally technological changes also highlight the importance of maintenance. The importance of maintenance has been discussed as a separate issue in this report. However, effective maintenance should rely on effective education, to instil an understanding within the community about certain technologies and how best to use and look after them.

Despite, the uncertainties (addressed above) of water conservation education in remote communities, Remote Area Development Group (RADG) produced an educational kit in 1999 for remote communities, called “Saving Water for Healthy Communities” (see figure 14). RADG (2001) carried out an assessment of this kit and found the following constraints:

- It was designed for use in all remote communities and therefore does not address the different needs and dynamics of differing separate communities;
- Problems existed in the ability to include the kit in the community school;
- The kit included mathematics that was advanced and not suitable for many of the participants that attended the workshops (Ryan et al 2001).

These constraints led to the decision that best way to convey water conservation techniques is not through calculation of actual savings; it is through hands-on training and talking through questions in a workshop style. Being able to implement water conservation techniques is not dependent on a person being able to read or have numeracy skills, as was often the case with this educational kit workbook.

Figure 14: RADG’s “Saving Water” Educational Kit: The educational kit consists of a workbook and a video.

It is apparent that the educational kit focussed on technological changes that as discussed previously (section 3.1), have not been assessed for their appropriateness within communities. The types of technology addressed in the kit included water efficient showerheads and taps, composting toilets, AAA rated washing machines and evapotranspiration systems (i.e. greywater re-use). The focus of this kit, particularly the video, suggested technological changes that have not been designed for remote

Indigenous communities and may limit the kit's effect on conserving water in the target communities.

Water conservation education in remote Indigenous communities needs to move beyond information about technological changes. An approach which incorporates the provision of knowledge on water supplies and their limitations would be beneficial. Knowledge of water uses and abuses implies education, both formal and informal. People must use the water supply and waste facilities in order to obtain the health benefits inherent in them; the physical presence of a water pipe does not in itself guarantee hygiene (Webb and Iskandarani 1998). This means that it is crucial for households to know how to protect and store water safely, how to maintain personal and domestic cleanliness, how to dispose of excreta and how to eliminate or minimise unsanitary environmental conditions. It is also important that communities have understanding of their current water patterns; source of water supply, where water is being used. Communities will then be in a greater position of force to make their own decisions about changes to their water usage.

3.3 Maintenance

Remote Indigenous communities' limited maintenance programs results in water wastage

Hardware that controls the distribution of water, if not maintained, can cause considerable losses in amounts of water. It is one of biggest accountants for unknown loss of water. If a leaky pipe is not seen and fixed immediately then there is the possibility that 10,000 litres of water can be wasted for every week that it remains in a state of disrepair (Anda and Ryan 1998). Similarly if a tap is leaking or left running large amounts of water can also be wasted. Interviews (Marshal 2002; Nash 2002; Decet 2002) held with authorities that provide services and developments to remote communities suggested that maintenance systems are a huge problem in these communities. Similarly other anecdotal stories (Maher and Espie, personal communication, 2002) suggest that maintenance remains largely unaddressed in most remote communities.

There are two distinctive reasons that have been identified as to why maintenance is such a large issue within communities. Firstly, there are no or little resources allocated to maintain technology and infrastructure provided to communities. The money that is provided has to be prioritised by community members and the community council. This may mean that some maintenance issues will be left unaddressed or unidentified because they are a low priority compared to other issues.

Secondly, many systems have been installed without significant community involvement and as such the community has limited ownership and may be reluctant to devote valuable time and resources to it. These factors have resulted in technologies being implemented that are often inappropriately designed for the local conditions and have a far shorter lifespan than similar systems in an urban environment. Various factors such as overcrowding, high mobility, lack of quality control during construction, access to maintenance and repair crew, access to other resources and saline and hard water all result in water supply systems rapidly deteriorating.

Essential service delivery, which can include water supplies to remote Aboriginal communities, involves quite an array of state and federal authorities as well as regional and community-based organisations (Anderson 2000). The hierarchy of this involvement tends to mean the state level bureaucracies are in control by virtue of their responsibility for implementing services which meet prescribed standards or guidelines (i.e. ADGW). Therefore, bureaucrats or functionaries located in the state capital some distance from many Aboriginal communities largely determine and control what, how, where and when services will be provided. For reason such as, little community input, little community ownership, etc, this does not work out very well and despite the concerns for standards observance some of the products fail. Furthermore, most essential service delivery operates on a yearly basis. This means that a system may break down within a month after the essential service visit, but remains unattended until the following year. Essential service delivery is vital to maintain services and technologies in communities but current systems are somewhat lacking and anecdotal evidence supports the ideas that much water is wasted due to lack of maintenance within these communities.

Many benefits sought by communities are only available as a result of technical intervention (e.g. implementation of water tap inside house increases health benefits). If the technology cannot be sustained or maintained and replaced in a timely fashion, the benefits disappear. Increased maintenance of water systems, such a leaking pipes, toilets and taps would help reduce water being wasted in many communities. Maintenance can be increased through increased resources, installing ownership of technology and increase knowledge of technological systems within community members and those working within communities. In essence, maintenance needs to move beyond that which the essential service officer's deliver, that is, above annual programs of maintenance.

3.4 Management and Knowledge Communication

Effective management of water supplies is not apparent in remote Indigenous communities

Water is a renewable resource and the key to its future is sustainable management (Smith 1998: 83). This involves consideration of supply (how much water is available) and demand. In arid conditions, as previously discussed, recharge to aquifers can be irregular and limited to small amounts, therefore water as a renewable resource in these arid environments should not be taken for granted. Management essentially needs to be an on-going process and community members need to be involved in the process.

Currently there is very little evidence to show that communities particpate in the process of managing their groundwater supplies. Monitoring of groundwater, in the majority of cases is carried out by Government Departments (such as, Department of Infrastructure, Lands, Planning and Environment in the NT), who derive data on bore water levels and maps/satellite images that help identify suitable sites for drilling bores. These Departments also have filed reports and references of groundwater sustainability and assessments for remote communities and outstations.

However it is unlikely that Aboriginal people living in remote areas know how to access this information. There is a need for a more consultative approach to the management of

groundwater supplies, where knowledge of water supplies is held both by the providers and shared with the consumers. This is the most likely way that remote Indigenous communities will be able to make decisions about their water supply and future use.

Water gives life to Indigenous communities in arid environments and is essential to the region's social, economic and environmental security. Developing sound water resource management programs will be crucial to the region's poverty reduction, economic growth, food security and maintenance of natural systems.

3.5 Water Restrictions

Water Restrictions (in times of drought) are currently not used in remote Indigenous Communities

Water restrictions are used in many urban environments in response of drought or dry times. At these times, limited water is available for use and must be used with an element of caution. Such restrictions in urban centres can include; not watering the lawn/garden during daylight hours or total ban of sprinklers for a period of time. In Perth 1994, the watering of lawn during night time restriction was put in during a drought session, however the success of this restrictions was such that the restriction has been kept in use ever since. Restrictions aid the consumer in understanding that water resources can be limited at times and can often result in an increased appreciate of the resource by the consumer (Pagsanjan, personal communication, 2002).

Water restrictions because of drought have not been well documented in remote arid communities. Northern Territory does not use restrictions at all as a method for conserving water. It is not clearly understood as to what impact restrictions in times of drought or dry times will have on remote Indigenous communities. More defining of what could be restricted (areas of water usage) need to be sought from an understanding of the community's design and structure. Installing a restriction on watering gardens might not be effective in conserving water in some remote communities, who have very little surrounding vegetation and most certainly do not have green lawns and vegetable gardens.

Conversely, anecdotal evidence suggests an increasing desire for Indigenous communities to implement higher water use practices, including growing vegetable gardens and trees, green grassy football ovals and to obtain air conditioners for the houses. Health authorities encourage the growth of vegetation, as it helps in reduce dust and dirt around communities (Dallas et al 1998). A number of communities have also shown interest in installing swimming pools in their country. These are areas which will undoubtedly place pressure on an already short supply of water and may move governments to employ the use of restrictions on water use, in these areas where water is not a necessity to health/life. However, as there is an increase in putting infrastructure in occurs, so does the spiralling costs increase and the need for more allocations of resources. It may therefore be, that in the future a restriction is placed on the number of settlements that occur in arid environments.

3.6 Pricing Mechanisms

Increased water prices would have little effect on water usage in remote Indigenous Communities

Pricing mechanisms can be used to conserve water, as increased costs of water institute the consumer to think about reducing water in certain areas. Traditionally water pricing in Australia has been very much below the real cost of the resource. In cities and towns, the immediate results of this underpricing, was wasting of the resource and poor services to users. The need to protect water resources, the increasing cost of supply and distribution systems, and the demand for adequate supply of water for domestic use and agriculture use are some of the reasons why many of Australia's major cities and towns are currently changing their conventional water prices. These pricing reforms have meant that water is treated as a commodity rather then a public good or right. In other words, the overall cost of operating, maintaining and (perhaps) expanding the water-supply system are reflected better in these new pricing systems.

Water use is highly subsidized in remote communities since water prices are set below the operational and maintenance costs. The water pricing that occurs in most remote communities consists for the fuel that supplies generators used in pumping groundwater

to the community or outstation from the bore (Blight and Schubert, personal communication, 2002). Consequently, cost recovery remains low, increasing the financial burden on the central government to provide capital for maintaining existing systems and developing new infrastructure (i.e. a State or Territory Water Authority or ATSIC).

Increased water prices in remote Indigenous communities is currently not practicable and/or a realistic solution to enhance water conservation ethics within communities. Three reasons are given for this:

- Water as addressed above is heavily subsidised, and whilst communities do pay amounts, these are largely unrelated to actual volumes of water being used.
- Limited measurements of volumes of water being used and make-up of households (i.e. high mobility factors) mean that it would be hard to prescribe a direct bill to households. Pricing based on uses requires a means of measuring usage – normally through water meters.
- Water is required for minimum health standards and an increase in prices may affect the health of those who are limited resources available.

Increased prices may therefore have unintended impacts. The implementation of increased pricing to water requires more knowledge of the water systems in each individual community.

4.0 Case Studies

4.1 Mutitjulu Community

While Aboriginal people have occupied and visited the site of Uluru for millennia, it is only since the 1970s that a contemporary Anangu settlement can be said to have existed in the vicinity (Taylor 2001: 2). The title for the National Park Uluru-Kata Tjuta was handed to traditional owners by special statue in 1985 (Taylor 2001). Following on from this the Mutitjulu community was formally established in 1986. The Mutitjulu community is located in the Uluru-Kata Tjuta National Park and provides housing and infrastructure for approximately 500 of Anangu (Central Desert Aboriginal people).Being in a National Park places Mutitjulu in a unique position for resource management and enterprise potential.

Over the last sixteen years, since the title deeds of Uluru-Kata Tjuta National Park were transferred to Anangu people, the population usually resident at Mutitjulu have almost trebled. Currently new housing is being built at Mutitjulu, to not only replace existing houses but also to provide housing for the growing population. Taylor (2001) projected that the Mutitjulu population will grow to a level of between 850-890 over the next 20 years (see figure 15). Therefore, based on these projections there is a rational basis for the research of planning options for the community and intrinsic to this would be planning of sustainable water.

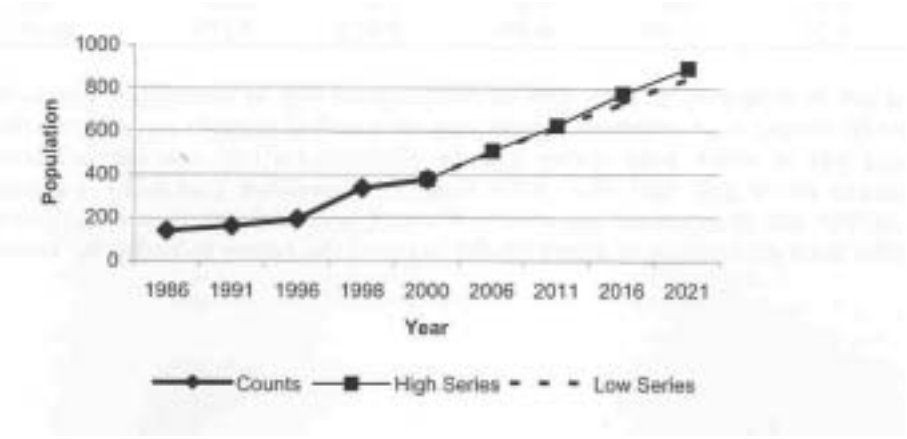


Figure 15: Predicted Population increase of Mutitjulu, 1986-2021 (Taylor 2001)

It should be noted that social gatherings in Mutitjulu can draw large groups of people (over 1,000) from all the over central Australian region for periods of up to a week or longer (Taylor 2001). Such peaks in population numbers raise questions about which is the most appropriate population to use for planning of essential services (Taylor 1998). These peaks in population have an effect on family groups within the house and increase the number of people within the house. It is fair to say, that the occupants of a house may change at a relatively rapid rate.

Community members have expressed interest in establishing ventures that would require more water to sustain. There are a growing number of air conditioning units being installed into community houses. The interest in establishing a grass recreation oval within the community was expressed in 1998. There was a plan to water the grass with grey water re-use, however calculations showed that size of the population in Mutitjulu could not produce enough grey water to keep the grass green. Despite this plan not being successful, it helps to highlight the growing needs within Mutitjulu community.

EA through Uluru-Kata Tjuta National Park maintain the water supply of the Mutitjulu community. Water in this area is not only important to sustain the community, but also important for the tourism industry and to sustain the vegetation and wildlife dependent upon this resource. The water provided for these users comes from the southern aquifer which is situated underneath Uluru and covers some distance of the surrounding area.

A number of studies have been completed to investigate the sustainable yield of the Southern Aquifer that supplies water to the Mutitjulu community. The earliest findings of sustainability rates were compiled by Wischusen (1999) (see appendix B). Furthermore a study done by Wischusen (1999) researched and detected sustainable recharge rates and sought to identify an appropriate management plan to address water sustainability within the park. In 2000, a tender was put out to seek applications for the design of a Water Conservation Strategy for Uluru-Kata Tjuta National Park (Bain 2000). However, the tender has not been initiated to date. This evidence suggests that Parks Australia are still trying to understand the limitations of water supply and that previous research has had a limited effect on achieving a management strategy for water.

This lack of information transfer, due to the complexities in understanding sustainable extraction rates of ground water and design management programs, has meant that ground water supplies for the Mutitjulu community are currently under managed and the potential of the resource being over utilised to maintain that social values within the Park is high. Hence, there is little confirmation that the Mutitjulu community has the required knowledge to make informed decisions about their water supplies. With a growth in population and growth in tourist numbers visiting the region, groundwater resources have the potential to be over utilised and hence, management of this resource is a vital component to future developments.

Primarily the Essential Service Officer from Uluru-Kata Tjuta National Park controls all water supply maintenance programs (see figure 16). This position entitles regular checks on groundwater bores; to ensure the pumps are working. Yearly checks to each household are also carried out, in which time leaking taps and pipes are changed. Essential Service Officer, Robert Renner (personal communication, 2002) considers that infrastructure is well taken care of within the Park and that leaking pipes and taps are dealt with reliably.

Figure 16: Talking with Essential Service Officer of Mutitjulu

There is also no cost to water supplies for the community. This can result in over-use of the resource and no or little appreciation for the limitations of the resource. While there was not time to gather this information to support this claim, it is suggested in future that this idea be closely looked into.

4.2 Tjuwanpa Outstations Resource Centre

The Tjuwanpa Outstations Resource Centre (TORC), some 150km west of Alice Springs, services and maintains approximately 40 outstations in the surrounding area. The outstations can be found within an area of ten thousand square kilometres stretching 80km west of Alice Springs right to the Mereenie gas fields north of Watarrka National Park. TORC was built-in 1984 to support and foster the outstation movement of the Western Arrernte people. TORC looks after the interests of about 750 Western Arrernte people by providing essential services (power, water, housing, sewerage, etc) and by managing the Corporations Community Development Employment Program. As a part of the CDEP there are a number of outstation activities occurring including; horticulture, pastoralism and tourism.

All of the outstations that TORC currently maintains are supplied by groundwater and a limited number of outstations have a supplementary rainwater tank. Landcare officer Andrew Schubert (see figure 17) believes that water is not wasted by occupants of the TORC outstations (personal communication, 2002). There are only 3 air conditioners in the entire region of serviced by TORC and one of them, is situated at TORC. The only areas of water wastage identified is when horses/bullocks turn taps on and leave water running. In order to inhibit this problem, CAT has suggested a fixture to go over the tap that would restrain horses/bullocks from turning taps on (see Appendix C).

Figure 17: Landcare Officer, Andrew Schubert (Tjuwanpa Website, 2002)

Discussions fulfilled with Dennis Ebatarinja (see figure 18), occupant of the Arrkapa outstation, were held at Old Outstation. During these discussions, CAT staff were told by Dennis that he has “got no water”. This was due to a mechanical failure in the windmill that pumps bore water to house. However, attached to the house was a supplementary rainwater tank and only metres away a traditional water soak. The rainwater tank had unpalatable water and the soak had too little water (Ebatarinja, personal communication, 2002). Dennis Ebatarinja eluded that there was a desire within outstations to increase water usage. Ebatarinja wants to grow citrus trees and vegetables at his outstation. TORC have also instituted a number of programs through CDEP in which horticulture ventures are being set up on a number of outstations. These ventures currently do not plan to use grey re-use systems.

Figure 18: Discussion with Dennis Ebatarinja, owner of Arrkapa outstation and CAT staff

The investigations into groundwater at TORC's outstation show that there currently is no management of groundwater supplies occurring on the TORC outstations. TORC and outstations occupants have little knowledge of the amount the aquifers hold and how sustainable their current rates of extraction are. The case study therefore highlights a similar scenario as the Mutitjulu case study, in that there is little management of water supplies. However, TORC outstations do not have the benefit of the research of sustainable groundwater extractions, unlike that of the community of Mutitjulu community's aquifer. Ultimately, meaning that much more work and background research needs to be completed, before effective management can occur.

Other work insituated at CAT in response to TORC's needs suggests that Tjuwanpa outstations have constant house occupants. That is, unlike many other communities, the occupants of the TORC outstations rarely change. The potential to maintain the outstation services and infrastructure is somewhat easier, than those in which occupants are constantly changing.

Diesel for pumping bore water is currently the only costs incurred by consumers for groundwater supplies. The money for this payment on diesel is taken from amount of the outstation occupant's CDEP money. Therefore volume of water is not restricted through

payments. However, water is limited to how much to being pumped out (litres/second on the bore), therefore there is to some degree a limit on how much water is used, but this would only be a problem when there is a large number of occupants at the outstation (Schubert, personal communication, 2002).

5.0 Analysis

The preliminary evaluations (section 3.0) and the case studies highlight that water conservation has had a limited role in remote Indigenous communities. Despite the fact that these communities are situated in areas of Australia where the scarcity of water is the most prevalent. The limited number of past programs have failed or had very little effect because they have not adequately addressed community needs.

The different requirements of water in TORC outstations compared with that of Mutitjulu community suggest that effective programs to conserve water are likely to be very different. For example, TORC outstations are known to have permanent family residents at the outstation. However, Mutitjulu occupantion rates are known to vary quite substantially. Therefore, the notion of who the 'community' is and who the household occupants are contested. This forms a complex basis for conventional community participation programs. Additionally, this example enhances the ideas, that greater knowledge of community/outstation structure is required before the implementation of water conservation strategy can occur. Water conservation strategies in remote Indigenous communities should be directed by community needs and priorities. That fact that no one community will have the same water use patterns means that individual programs for each community need to be designed.

The case studies highlight most specifically that communities have little information on groundwater and hence, understanding of the importance management of their water supplies. Research and management programs need to be translated fluently to community members and those working with communities. Research should not be constrained to knowledge that groundwater researchers and consultants understand. This transparency in knowledge being communicated, means that communities are then able drive water conservation projects. Approaches that genuinely engage local users in water

management will simply be more efficient, more effective, more equitable and more sustainable – and socially and environmentally – than ‘top-down’ approaches used by governments and institutions working with them. It is with this in mind, that this research has been directed at designing a proposal framework to assist communities and those working with communities to make decisions about implementation of water conservation strategies in remote Indigenous Communities.

Proposal

Framework to guide Implementation of Water Conservation Measures in remote Indigenous Communities:

Proposed Stakeholders that could/should be involved in this process:

- A diverse range (as possible) of community members
- Groundwater Researchers (e.g. AGSO, Hydrogeologist Consultants, CMAE)
- Indigenous Development Organisations (e.g. CAT, CLC)
- Health Authorities (e.g. THS- state authority, EnHealth- national authority)
- Community Officers (Education and Training Officer, ESO, Landcare officer)
- Government Authorities (e.g. ATSIC, PAWA, DILPE)
- Facilitators – community liaison officer

The proposed framework (see figure 19) is broken up into 3 main sections, which run sequentially. The framework aims to build up knowledge with steps, in order to achieve outcomes. The outcome is a process formulated from robust decision-making by the community. This framework is flexible in order to be designed/tailored to meet a community's needs.

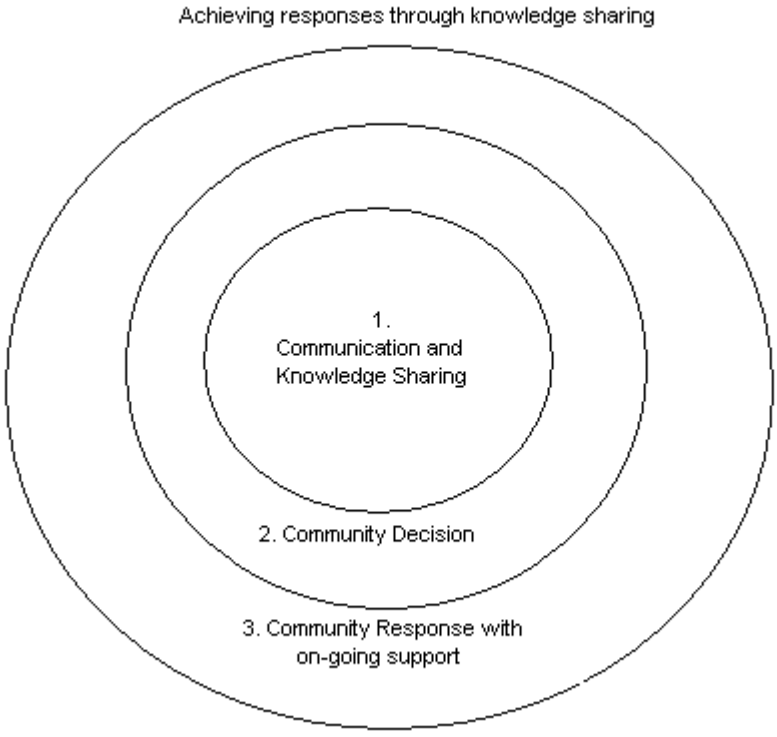


Figure 19: Achieving local communities response through knowledge sharing

STEP ONE

1. Communication and Knowledge Sharing – a 2 way process:

There are 2 parts (a. and b.) to this section, and they are important in allowing a process of knowledge sharing to occur between a range of determined stakeholders, including government institutions, service providers and community members.

a). Information shared by Institutions and groundwater managers to communities about their knowledge on water supplies and budgeting the groundwater balance through knowledge of current levels, extraction rates and current sustainable extraction rate (if known). This can be done in a number of ways, the most appropriate ways that I have researched are:

- Simple 3-Dimensional version of groundwater extraction that has little recharge, as is with arid and semi arid environments have. One way this could be set up is through a fish tank like structure, with tube acting as a bore and water is extracted through this tube with little recharge occurring (Wischusen, personal communication, 2002).

- Posters about water supply, i.e. similar versions to that which was made by Andrew Schubert, landcare co-ordinator of Tjwunpa Resource Centre; this was initiated as a response to drought. Preferably this type of information could be initiated proactively.

- Videos:
  An example of an influential video is UWANKARA PALYANKU KANYINTJARU: Shower Song Video (Nganampa Health, 1994), similar structures might be important to look when planning of the video (i.e. use of traditional language, humour, use of influential people, etc).
  Water from Stone (AGSO 1998) is also an important video and could be used in groups who already have an understanding of the technical background.

Essential components: use of traditional language, presenters being cross-cultural trained, provision of something of value to the community during the process (see Miller and Rainow, 1997) in addition to long term sustainability.

b). Information shared by community members on they concepts of water usage:

- Views shared by community members on their understanding of the water cycle

- Where high consumption of water is, and where it can be reduced

- Outline future plans/ideals (e.g. vegetable garden, swimming pools) within community and how this will impact on their water resource

Ideas to think about: An appropriate facilitation style allows information and personal understanding to be shared in an informal way. Facilitators must be aware that they may need to ask questions to start this process, questions should be based around allowing community members to take a personal stance on the issues and not just reply in yes/no answers, whenever possible facilitators should try to induce conservation style meetings

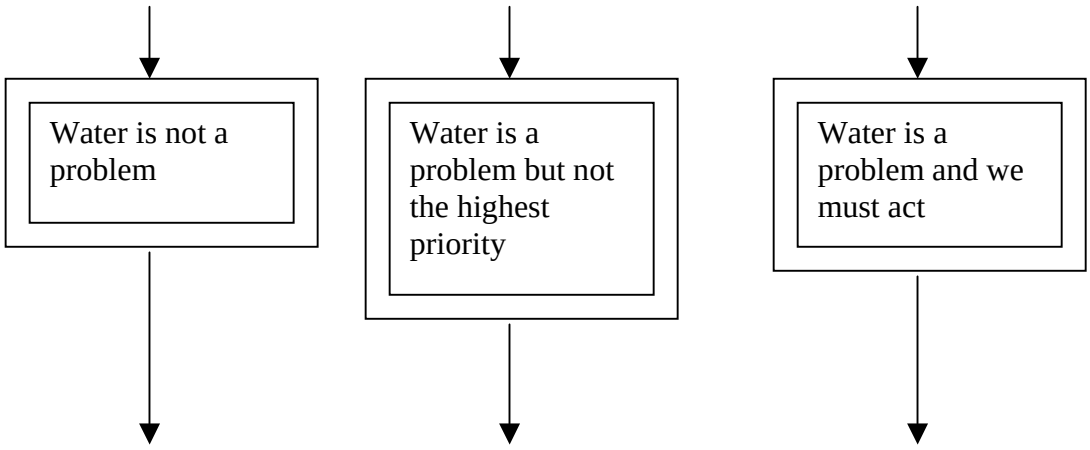
See: Aboriginal Framework for the Facilitation of Water Supply, as example of the types of processes that may be used (Appendix D)

STEP TWO

2. Community Decision

In this section, communities reach a decision on needs and established whether water conservation measures are to be pursued. This can be done through a variety of measures (e.g. voting system).

Community members make a decision:



See 3A over page
See 3B over page
See 3C over page

STEP THREE

3. Community Response and on-going support

A.” Water is not a problem”: Monitoring of water supplies continues and communities are kept informed.

B. “Water is a problem but not the highest priority”: Priorities are ranked by community members. Prioritising more urgent problems, what are the most productive strategies and programs to implement, community members should be supported in their decisions on what “needs doing” in their community. Monitoring of water supplies continues and communities kept informed, particularly in drought situations.

C. “Water is a problem and we must act”: Provision of information and support by Institutions and Organisations. A mix of approaches: technological, educational, restrictions, maintenance, other sources of water (rainwater tanks), water re-use systems will most likely be used to form a Water Conservation Strategy and should be based on community consultation.

Essential components: community members should decide on what strategy/approaches they wish to take, on the ground training has shown to be most effective and can be used whenever possible, trials need to occur on approaches implemented, monitoring of groundwater should be on-going: improvements need to be represented (i.e. poster format) that is accessible to all community members.

It is important to build the capacity of local communities to assess, control and sustain resources and technology. It needs to be more clearly recognized that local communities have a great amount of detailed knowledge and understanding of their own environment. Indigenous people often have particular knowledge of the spiritual value of water, which they can share with others. Concerted actions are needed to enhance capacities and knowledge, secure rights, develop leadership, overcome inequalities and ensure that local communities have access to technical, financial and other resources that they need to turn choices in actions. This framework is presented as an approach to support communities in decisions on the development of the land, and aims to make use of the community structures and knowledge. Remote Indigenous communities need to become active participants throughout the design and implementation of programs and projects that deal with all aspects of their community's planning (Zweekhorst et al 2001), including those related to water supply.

6.0 Recommendations

Further Research

- This report has found that mobility factors, lack of ownership, increasing needs, different understandings of water usage, different community design are areas which impact highly on water use patterns. More research is required to better understand how these themes in lifestyles and cultures of remote Indigenous Communities impact on the amount of water used.
- Investigations into water pricing needs to occur, to evaluate a payment system suitable to Indigenous lifestyles (such as mobility) which can provide an affordable and adequate quantity and quality of water to remote Indigenous communities (see section 3.6)

Future Design

- Design of water efficient technology, such as those discussed in section 3.1, needs to be more economically, socially and environmentally appropriate for remote Indigenous communities.
- Framework presented (section 5.0) within this report needs to be tested and evaluated, it is a flexible approach that should be designed and manipulated to suit individual communities.
- Maintenance issues, such as lack of technological ownership, government organisation of maintenance programs, changing occupancies in houses (see section 3.3) need to be addressed.
- Water conservation strategies need to be designed for a specific remote community and not simply a package for all remote Indigenous Communities, due to different community structures, such as occupancy of houses (see section 5.0).

Potential Management

- Maintenance needs to be carried out on a more frequent basis, i.e. more than annual checks (see section 3.3)
- A review of the basic water restrictions policies for use in extreme droughts that assesses their possible use in remote Indigenous communities (see section 3.5)
- Management of water supplies needs to driven by community decisions, the most important step in aiding this process is communication of knowledge. This can occur through a process of knowledge sharing, between those working with communities and community members (see proposed Framework in section 5.0)
- Installation of water conservation strategies in remote Indigenous Communities needs to be consistently monitored and evaluated

7.0 Conclusion

It might be argued that sustainability would be most effective when consumers have reached a desirable level of development. However the reality is that the implications of unsustainable water use patterns will be felt initially by remote Aboriginal communities, relying on limited groundwater supplies and not urban dwellers that rely on water supplies of much larger sizes. Yet, the past reveals that water conservation projects have been designed solely for urban societies and any work that has been initiated/completed in remote Indigenous Communities has been based mainly on technological changes designed for urban standards. This problem is further escalated because implementation of technology has occurred without the knowledge of water available in the supply and with contested notions of what an adequate water supply is.

There is much more research required before an outcome of water conservation could observed in remote Indigenous communities. A shift is required whereby; Technological designs are more considerate of the environmental, social and economical surroundings are engineered, as current urban designed technology is often inappropriate, particularly in environments where there high levels of mobility, concentrated TDS levels and dynamic climatic conditions; Water conservation education and water restrictions need to better understand the cultural setting in which they are placed, and; Maintenance needs to be more widely incorporated in the lifestyles of Indigenous people. However, the most important step forward is allowing communities the opportunity to better understand their water supplies and for them to be incorporated into the management of this resource.

Whilst this report does not undermine the technological importance of water supply, it argues that unless the human dimensions of water supply is uppermost in the design, a sustainable water supply is not achieved without considerable expense. It is the human dimensions of water supply that aids in the implementation of a diversity of water conservation measures, such as efficient technology, conservation education, restrictions, management, maintenance programs and pricing mechanisms, that are accepted and used in appropriate ways by community members. The answers to development of water

conservation in remote Indigenous communities lies in the ability to understand, determine and address individual community priorities.

Appendix A.

Appendix B.

Appendix C.

Appendix D.

Hard copies of all appendices are available from CAT.

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