POWER AND WATER CORPORATION

2009 INDIGENOUS COMMUNITIES OF THE NORTHERN TERRITORY DRINKING WATER QUALITY ANNUAL REPORT

PowerWater

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EXECUTIVE SUMMARY

The Drinking Water Quality Report for the Indigenous communities of the Northern Territory is published annually to report on community drinking water supplies against the Australian Drinking Water Guidelines. It outlines progress on Power and Water's Strategy for Safe Water and management of these water supplies.

The Strategy for Safe Water adopts a risk-management approach and aims to provide water that is compliant with the Australian Drinking Water Guidelines. The Strategy for Safe Water works closely with the Sustainable Water Management Strategy to inform and develop methods to support management of water resources under Power and Water's overall Water for Healthy Communities initiative.

This 2008-09 Report outlines the following water quality:

- The microbiological quality of the water supplied in eight communities did not comply with Australian Drinking Water Guidelines. This is an improvement on the 12 communities highlighted in the 2007-08 reporting, however six precautionary "water boil alerts" were issued as a result.
- The chemical water quality in 15 communities was equal to or exceeded the health-related Guidelines. While these naturally elevated levels do not represent an immediate health risk to consumers, Power and Water is working with the Department of Health and Families to investigate potential improvements.

Power and Water is progressing with the systematic approach of Water for Healthy Communities to lay the foundations for long-term improvements in water quality and sustainability.

HIGHLIGHTS FROM 2008-09

- Successful implementation of the Drinking Water Monitoring Program;
- Commissioning of six automated sodium hypochlorite disinfection systems to replace manual calcium hypochlorite systems;
- Commissioning of four ultraviolet disinfections system as secondary 'barriers' in water supplies with high risks of microbiological contamination;
- Development of the Framework for Operational Water Plans; and,
- Completion of the risk assessment and prioritisation of communities with elevated physical, chemical and radiological qualities.

OUTLOOK FOR 2009-10

- Successful implementation of the Drinking Water Monitoring Program;
- Commission remaining automated sodium hypochlorite disinfection systems to replace calcium hypochlorite systems;
- Commission remaining ultraviolet disinfection systems as secondary 'barriers' in water supplies with high risks of microbiological contamination;
- Develop water quality improvement strategies for the 20 highest risk communities with elevated physical and chemical quality; and
- Completion of Operational Water Plans for all 72 communities.

OUR BUSINESS

ABOUT US

Indigenous Essential Services (IES) Pty Ltd, a not-for-profit subsidiary of Power and Water, was established in 2003 to provide electricity, water and sewerage services to Indigenous communities. Power and Water has been working in larger Indigenous communities since July 1988. In 2008-09, IES provided services to 72 communities and more than 70 nominated outstations. This comes with the challenges of distance between communities and support centres, poor access and communications, low availability and retention rates of locally employed staff and contractors, extreme and highly variable weather conditions.

Revenue from selling electricity, water and sewerage services covers about 20 per cent of the cost of delivering these services. The Northern Territory Government funds the balance of the cost of service delivery and asset replacement through the Department of Housing, Local Government and Regional Services.

Power and Water's Remote Operations unit provides management, technical and professional services to IES, with the administrative and technical support of the full Corporation. Across the Territory, 115 Essential Services Operators play a key role in delivering electricity, water and sewerage services to these communities. They are employed locally by councils or private contractors under period contracts with Power and Water.

OUR COMMITMENT

Power and Water is committed to providing a safe and reliable water supply for 72 nominated Indigenous communities and outstations. Power and Water has developed the *Water for Healthy Communities* initiative to integrate water source sustainability, demand management, strategic asset management, and water quality objectives. This report describes progress toward providing drinking water that is safe, reliable and of good quality; the Sustainable Water Management Report outlines progress towards securing sustainable and reliable water supplies for Indigenous communities.

The Strategy for Safe Water aims to improve the quality of drinking water supplied in the Indigenous communities consistent with the Australian Drinking Water Guidelines and is discussed in more detail later in this report.

MAP 1: INDIGENOUS COMMUNITIES OF THE NORTHERN TERRITORY PROVIDED WITH WATER SUPPLY AND SEWERAGE SERVICES BY POWER AND WATER

**Retail licences for remote Aboriginal communities are not shown on this map.*

STATEMENT OF CORPORATE INTENT

The 2008-09 Statement of Corporate Intent (SCI) commits Power and Water to the Strategy for Safe Water, with the goal of providing drinking water that meets Australian Drinking Water Guidelines (2004) in each community.

The 2009-10 SCI highlights growing challenges in the delivery of essential services to Indigenous communities, including increasing water demand and requirements of new environmental legislation. The Federal Government has selected 20 Territory Growth Towns plus an additional five to be centres for regional service delivery and transition. This means these communities will be the focus of economic development and infrastructure upgrades in the near future. This places increasing pressure on water quality and resource management.

REGULATORY ENVIRONMENT

The provision of safe drinking water is influenced by key policies and collaboration between Power and Water and several Northern Territory Government departments.

The Department of Resources provides diagnostic services through their water chemistry and bacteriological laboratories, which analyse the majority of Power and Water's managed communities' drinking water and wastewater quality. They play a crucial role in reporting data for microbiological, physical and chemical water quality monitoring.

Northern Territory Water Supply and Sewerage Services Act 2009

The Department of Health and Families' Environmental Health Program, under the *Water Supply and Sewerage Services Act,* has a key role in setting goals for drinking water quality and ensuring the protection of public health. Power and Water and the Department of Health and Families work closely on these issues and have developed an agreed monitoring program and strategic management processes consistent with the 2004 Australian Drinking Water Guidelines (ADWG). In 2009-10 the Department of Health and Families and Power and Water will enter into a Memorandum of Understanding for Drinking Water to formalise this partnership.

Northern Territory Water Act 2004

The Department of Natural Resources, Environment, the Arts, and Sport, under the *Water Act* and the *Waste Management and Pollution Control Act,* provide advice towards the regulation of environmental water quality.

Territory 2030 Strategic Plan

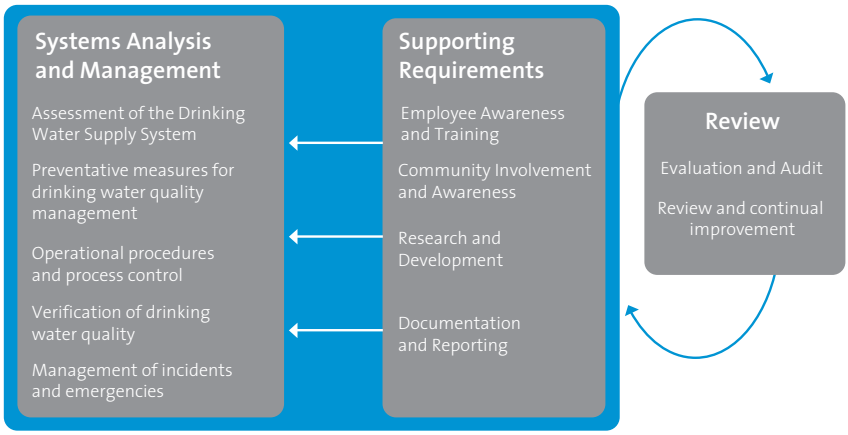
This year the Northern Territory Government released the Territory 2030 Strategic Plan. Parts of this plan will directly impact on the management of remote community drinking water supplies. A key target is to "improve environmental health in remote communities to a standard similar to rural and urban communities by 2020" through "increased access to potable and fluoridated drinking water".

WATER FOR HEALTHY COMMUNITIES

Water for Healthy Communities is a Power and Water initiative to provide water and wastewater services that are safe, reliable and sustainable to support the development of healthy communities.

This is an integrated approach to water service provision through the development of Community Water Plans, which incorporate the Sustainable Water Management Strategy and the Strategy for Safe Water. Community Water Plans are based on the Framework for the Management of Drinking Water Quality (Framework) under the Australian Drinking Water Guidelines (Figure 1). This Framework provides a structured and systematic approach to managing drinking water quality from 'catchment to consumer' to ensure its safety and reliability.

FIGURE 1: FRAMEWORK FOR THE MANAGEMENT OF DRINKING WATER QUALITY



The Framework has 12 elements that provide a systematic and holistic approach to water management. 'System analysis and management' focuses on risk management through the implementation, maintenance, and monitoring of effective 'multiple barriers' to ensure robust systems can effectively manage risks, which is enacted through the completion of Operational Water Plans. 'Supporting requirements' will be focused on increasing community involvement and awareness of the water systems through seeking communities' needs and aspirations for inclusion in water planning, diversification of source options based on end use – and the efficient use of water to increase the longevity of water resources.

Community Water Plans incorporate resident knowledge and outcomes of the Operational Water Plans, which are completed after a process of community engagement. Power and Water is also developing a Wastewater Management Strategy to provide direction to improve the infrastructure, treatment, reuse and disposal of wastewater across remote Indigenous communities over the next five years.

STRATEGY FOR SAFE WATER

The Strategy for Safe Water aims to improve the quality of drinking water supplied in the nominated Indigenous communities, consistent with the Australian Drinking Water Guidelines. Microbiological, physical and chemical water quality issues and the risks that are associated with these are being prioritised for action.

MICROBIOLOGICAL QUALITY

The highest priority is to improve the microbiological security of the water supply systems, since there are acute and immediate health implications from unsafe drinking water.

This is being achieved through the following:

- **Operational Water Plans** – These plans are being developed for the 72 communities to identify system risks and ensure that there are barriers in place to eliminate or minimise their impact. This approach reflects more than a century in public health practice and water supplies, where multiple barriers are in place so that if one fails, there are back-up systems to prevent or reduce potentially harmful contaminants from reaching consumers.

  These plans provide the mechanism to:

  - Systematically evaluate water systems, identify hazards, and assess the risks;
  - Foster a holistic approach to the management of drinking water quality, emphasising the preventative approach to ensuring drinking water quality and reliability;
  - Identify infrastructure and operational strategies to manage the specific risks; and
  - Provide information for communication with employees and the community.
- **Disinfection (Chlorination and Ultraviolet)** – The disinfection system is the primary critical control point in the water supply system for the continuous delivery of safe drinking water. To ensure the reliability of this principal barrier, additional capital investment is being made in automatic disinfection systems (chlorination, ultraviolet) and Supervisory Control and Data Acquisition (SCADA) systems for on-line monitoring. The roll-out of automatic disinfection systems has been prioritised based on a broad risk assessment of the 72 communities, which considers past microbiological performance, absence or effectiveness of disinfection, source water quality characteristics and system infrastructure.

  This identified two high risk areas:

  - Communities using calcium hypochlorite as primary disinfection, which involves the manual addition of chlorine tablets to the storage tank, resulting in fluctuating chlorine residuals in the distribution system and limited ability to control and monitor system performance; and,
  - Communities using water sources with high risk of microbiological contamination that require additional secondary disinfection barriers to adequately manage the risks identified.

  Following the implementation of this the investment programs will continue with the upgrading and standardising of existing automatic sodium hypochlorite systems, especially in communities identified as Territory Growth Towns.

PHYSICAL AND CHEMICAL QUALITY

The natural physical and chemical characteristics of groundwater sources in the Northern Territory (NT) tend to remain relatively consistent.

Power and Water worked with the Department of Health and Families to develop a risk assessment framework for communities with physical and chemical water quality characteristics that exceed health and/or aesthetic Australian Drinking Water Guideline values, based on the likelihood and consequence of the elevated water quality characteristic.

This approach provides a consistent and transparent appraisal of the risks associated with different water quality characteristics and enables water quality issues to be compared across communities and improvements prioritised.

The risk assessment framework considered Australian Drinking Water Guideline values for chemical and select physical characteristics. In general, physical water quality characteristics do not directly impact on public health but do affect the aesthetic quality of the water, which largely determines the amount that consumers drink. If water is unpalatable or appears to be of poor quality, consumers may seek other water sources or consume other drinks.

Iron and total dissolved solids were identified as contributing primarily to the palatability of groundwater and sodium as a compounding factor, and were also included in the risk assessment. High hardness was also assessed because hardness levels of more than 200 milligrams per litre (mg/L) may lead to excessive scaling of pipes and fittings. Scaling can reduce infrastructure life, which indirectly affects health by impeding access to water. This is particularly pertinent in remote Indigenous communities where consistent housing hardware maintenance has been an ongoing challenge and is considered an important determinant of health outcomes.

The risk assessment framework has prioritised 20 communities whose water has shown indication of containing high concentrations of antimony, arsenic, barium, fluoride, hardness, iron, nitrate, selenium, total dissolved solids, and uranium. These concentrations above Drinking Water Guideline values do not represent immediate health risks, as exposure is calculated based on long term exposure, such as a lifetime (often 70 years).

There were two water supplies where elevated radiological levels were reported however, these levels do not warrant action and quarterly monitoring will be undertaken to understand these risks further.

The following options to improve water quality are being considered:

- **Alternative water supply sources** – The preferred option is to identify and develop a better, alternative water source. A desk-top hydrogeological investigation into alternative and supplementary groundwater sources for the 20 highest risk communities identified five communities where there is sufficient information and certainty to warrant more detailed investigations over the next three to five years.
- **Water treatment technology** – The second option is to remove water characteristics of concern. Assessment of treatment options for the 20 communities is complete. This included concept designs for treatment technologies; cost estimates of capital and operational expenditure; and the skills, training and support services required. The assessment considered treatment of all the water supplied to the community for both internal and external demands (full service); and partial treatment, where a smaller portion of the water supply is treated and supplied through a separate reticulation system for selected internal household use and untreated water is supplied through the existing reticulation system (dual reticulation). For the majority of the 20 communities assessed, 'complex' membrane treatment technologies such as Electrodialysis Reversal (EDR) and Reverse Osmosis (RO) have been recommended as most appropriate to significantly improve the quality of the water supplied. These membrane technologies can be packaged in standardised modular systems (with SCADA technology for remote monitoring), and scaled for different flow rates and water qualities.

Currently, Power and Water is refining options for the high risk communities identified through the risk assessment. Based on the long-term health risks associated with physical and chemical characteristics it is likely that a three to five year program will be developed to start in 2010-11 for the implementation of water treatment technology and further hydrogeological investigations.

SUSTAINABLE WATER MANAGEMENT STRATEGY

The Sustainable Water Management Strategy provides an action plan to improve the security and responsible use of water resources across Indigenous communities over the next five years, to enable them to meet their development needs for water into the future. The key objectives are to:

1. Develop and lead the implementation of Community Water Plans in priority communities to improve security and responsible use of water resources, and aid contribution to the Strategy for Safe Water;
2. Develop and refine community engagement methods to seek the participation of and enhance dialogue with community residents and associated stakeholders in water management;
3. Collaborate with town planning for Growth Towns under A Working Future policy to share expertise in the key areas of water sustainability and community engagement;
4. Understand water source status and sustainability through a program of water source assessment and groundwater monitoring;
5. Coordinate within Remote Operations team, government and community stakeholders to ensure appropriate water source infrastructure developments occur and inform community water management actions;
6. Analyse trends and drivers in commercial, government and residential customer water consumption in Indigenous communities;
7. Maintain expertise in and design actions for demand management for implementation within Remote Operations, communities and government;
8. Contribute to policy and practice on Indigenous community access to water services;
9. Promote a culture of collaboration and shared information between relevant Power and Water peers;
10. Meet reporting requirements under Territory and national water agency reporting frameworks.

The vision of community water planning is to advocate on behalf of community aspirations and sustainable water management to improve water service delivery. CWP activities will enable Indigenous community residents' aspirations to be accounted for in prioritisation of capital expenditure and works, and provide an opportunity for residents to be more directly engaged in the sustainable management of their own water supply.

ABOUT OUR WATER SYSTEMS

The Northern Territory spans 1.4 million square kilometres, from Australia's central desert to the northern tropical coastlines. The northern region has two official seasons, the wet and the dry, while the remaining regions are influenced by semi-arid to arid climates with cool winters and hot summers.

The communities serviced by Power and Water are sparsely spread across the Territory, which creates a changing and challenging environment in which to supply water services. The communities range in population from 100 to nearly 3,000 people and these can fluctuate throughout the year due to social and cultural events or seasonal influences such as flooding during the monsoon in the Top End.

WATER SOURCES

There are more than 200 production bores, 160 water storage tanks and 600 kilometres of water distribution systems that supply drinking water across the 72 communities. In 68 of these communities, this water primarily comes from groundwater sources (Figure 2). Aquifers are found at various depths and provide a wide range of yields and water quality. Water accumulates in aquifers as it percolates through the soil from recharge areas, for example from river beds or from saturated ground after rainfall.

Geology varies tremendously and aquifers can present a wide range of naturally occurring minerals and deposits. As groundwater flows through a mineral-rich aquifer, it is subject to several relatively slow hydrochemical processes such as dissolution/precipitation, oxidation/reduction, absorption / desorption, as well as various acid-based reactions. These processes will alter the groundwater quality over time. The longer the groundwater stays in an aquifer the more pronounced the influence of the surrounding geology will be. Some groundwater from aquifers in Central Australia is believed to be more than 10,000 years old while groundwater in the Top End may remain in an aquifer for less than a few years.

Groundwater supplies near the coast in the Northern region are described as 'soft', as the water is drawn from relatively shallow aquifers and maintains naturally low pH and hardness levels. Groundwater supplies in the Southern region are often described as 'hard', as the

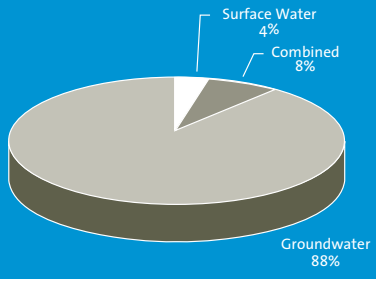
water is stored for longer periods in deeper aquifers resulting in the water having 'rich' water chemistry as the interaction between the water and the rocks is greater. These groundwater sources are usually within pristine environments with limited development and are sufficiently underground to provide high levels of protection from microbiological contamination compared to many urban surface water sources.

Three communities exclusively use surface water sources for drinking water. Barunga and Pirlangimpi draw water from freshwater springs, Yuelamu draws water from a dam. Angurugu, Gunbalanya, Bulla, Kybrook Farm, Ngukurr and Robinson River use a combination of groundwater and surface water sources (freshwater springs and rivers).

These surface water supplies are directly influenced by the environment and are more susceptible to contamination from the catchment activity than the groundwater sources.

FIGURE 2:

WATER SOURCES (%) USED BY POWER AND WATER TO SUPPLY INDIGENOUS COMMUNITIES WITH DRINKING WATER IN THE NORTHERN TERRITORY



WATER SUPPLY SYSTEMS

The majority of water supply systems comprise of a number of production bores which pump water from the underground aquifer to a central storage area. This consists of at least one large tank on the ground and a smaller tank elevated on a stand where the water is disinfected and delivered via the distribution system using gravity. Some community water supply systems are pressurised by pressure pumps in place of high level tanks.

Chlorine is predominantly the primary disinfection barrier in these communities due to its simplicity, effectiveness in destroying pathogenic microorganisms, and ability to maintain residual protection throughout the distribution system. The majority of water systems in the Northern region are disinfected with sodium hypochlorite using an automated system. Historically, disinfection of water supplies in the Southern region has been achieved by using manual calcium hypochlorite dosing, however this does not provide effective and reliable disinfection and capital investment over 2008-09 and 2009-10 is focussed on upgrading these to automated sodium hypochlorite systems.

Automated sodium hypochlorite systems are considered more reliable and effective. To achieve effective disinfection, chlorine residuals must be maintained at adequate levels throughout the supply system. Automated sodium hypochlorite systems with continuous online monitoring are considered the most effective way to disinfect the water supply system in these communities.

Ultra Violet (UV) disinfection, which involves exposing water to radiation from UV light to disrupt microorganisms at that single point, is also used in a number of indigenous communities. In 2008-09, UV systems have been introduced in communities in the Northern and Katherine regions to complement existing sodium hypochlorite disinfection. This helps to manage the risk of contamination in supplies at higher risk by providing a secondary barrier in the system so if one barrier fails then the other is in place to ensure the continuous delivery of safe water.

Supervisory Control and Data Acquisition (SCADA) systems will be introduced in targeted communities to monitor critical control points at the water source and the water disinfection system. This will enable Power and Water to continuously monitor and proactively manage water supply systems to ensure water quality in remote communities.

NORTHERN REGION

FIGURE 3: LOCATION OF NORTHERN REGION COMMUNITIES

Most communities in the Northern Region are within 100km of the coastline. Typically, these communities have soft water (low hardness levels) and low pH levels. The majority of these communities have low average fluoride levels of less then 0.5mg/L and currently fluoride is not added to the water supplies.

Water supplies in this area are typically disinfected with sodium hypochlorite. Maningrida and Milyakburra are still using calcium hypochlorite (Table 1). Maningrida uses UV disinfection, although calcium hypochlorite may be used if the primary UV system is not available or contamination enters the system downstream of the UV.

In 2008-09 UV systems were installed in Maningrida, Gunbalanya and Pirlangimpi and results have been very positive. It is proposed that during 2009-10, Milyakburra will have an automated sodium hypochlorite system installed to replace the calcium hypochlorite and Angurugu will have a secondary UV disinfection barrier installed.

TABLE 1: SUMMARY OF WATER SUPPLY SYSTEMS IN THE NORTHERN REGION

Community	Alternative Name[1]	Supply comments	Source of supply	Treatment	Disinfection type			
					Sodium Hypochlorite	Calcium Hypochlorite	Chlorine Gas	UV disinfection
Acacia Larrakia	Acacia Gap		GW		✓			
Angurugu		Treatment provided by external agency	GW & SW	Soda Ash	✓			
Belyuen	Delisaville		GW		✓			
Galiwinku	Elcho Island		GW		✓			
Gapuwiyak	Lake Evella		GW		✓			
Gunbalanya	Oenpelli		GW & SW		✓			✓
Gunyangara	Ski Beach		GW		✓			
Maningrida			GW			✓		✓
Milikapiti	Snake Bay		GW		✓			
Milingimbi			GW		✓			
Milyakburra	Bickerton Island		GW			✓		
Minjilang	Croker Island		GW		✓			
Nauiyu Nambiyu	Daly River		GW		✓			
Nguiu	Bathurst Island		GW		✓			
4 Mile Camp (Outstation)		Nguiu water grid	GW		✓			
Numbulwar			GW		✓			
Nganmarriyanga	Palumpa		GW		✓			
Peppimenarti			GW		✓			
Pirlangimpi	Garden Point		SW	Sand Filter	✓			✓
Ramingining			GW		✓			
Wulkabimirri (Outstation)		Ramingining water grid	GW		✓			
Umbakumba			GW		✓			
Wadeye	Port Keats		GW		✓			
Warruwi			GW		✓			
Yirrkala			GW		✓			

[1] Alternative names provided are commonly known, other titles for the majority of these communities also exist.
GW Groundwater *SW Surface Water*

KATHERINE REGION

FIGURE 4: LOCATION OF KATHERINE REGION COMMUNITIES

The groundwater sources for the majority of the communities in the Katherine region are influenced by the surrounding geology, resulting in higher concentration of natural physical, chemical, and radiological characteristics in the water. In some instances the physical and chemical quality of the water may exceed the levels recommended in the Australian Drinking Water Guidelines.

Typically in the Katherine region, the aesthetic water qualities in communities are within the recommended pH range of 6.5-8.5 pH units. About half the communities have higher total dissolved solids and hardness levels than recommended.

The majority of community water supplies in the Katherine region are treated with sodium hypochlorite, although calcium hypochlorite and chlorine gas is also used. In 2008-09, a UV disinfection system was installed in Barunga and is operating well as an additional barrier. It is proposed that in 2009-10, automatic sodium hypochlorite systems will be installed in Binjari and Eva Valley.

TABLE 2: SUMMARY OF WATER SUPPLY SYSTEMS IN THE KATHERINE REGION

Community	Alternative Name[1]	Supply comments	Source of supply	Treatment	Disinfection type			
					Sodium Hypochlorite	Calcium Hypochlorite	Chlorine Gas	UV Disinfection
Amanbidji	Kildurk		GW		✓			
Barunga	Bamyili		SW	Cartridge Filtration	✓			✓
Beswick	Wugularr		GW		✓			
Binjari			GW			✓		
Bulla			GW & SW	Sand Filtration	✓			
Bulman			GW		✓			
Dagaragu			GW				✓	
Jilkminggan	Duck Creek		GW		✓			
Jodetluk (Outstation)	Gorge Camp	Katherine water grid	GW		✓			
Kalkarindji	Wave Hill		GW				✓	
Kybrook Farm			GW & SW		✓			
Lajamanu			GW		✓			
Manyallaluk	Eva Valley		GW			✓		
Minyerri			GW		✓			
Ngukurr			GW & SW	Sand Filtration			✓	
Pigeon Hole			GW		✓			
Rittarangu	Urapunga		GW		✓			
Robinson River			GW & SW		✓			
Weemol			GW		✓			
Yarralin			GW		✓			

[1] Alternative names provided are commonly known, other titles for the majority of these communities also exist.
GW Groundwater SW Surface Water

BARKLY REGION

FIGURE 5: LOCATION OF BARKLY REGION COMMUNITIES

- Power Stations
- Transmitted Power Supply (These centres recieve their Electricity by line from adjacent centres.)
- Sewerage Services

Water — All the above communities have reticulated supply

Similar to the Katherine Region, the groundwater sources in the Barkly region are often highly mineralised. In some instances the physical and chemical quality of the water may exceed the recommended levels, such as total dissolved solids and hardness.

Disinfection is achieved through both calcium hypochlorite and sodium hypochlorite. In 2008-09, disinfection systems in Canteen Creek and Willowra were upgraded from calcium hypochlorite to sodium hypochlorite systems. Disinfection upgrades to automatic sodium hypochlorite systems are proposed for Ali Curung, Lake Nash, Imangara and Tara in 2009-10.

TABLE 3: SUMMARY OF WATER SUPPLY SYSTEMS IN THE BARKLY REGION

					Disinfection type			
Community	Alternative Name[1]	Supply comments	Source of supply	Treatment	Sodium Hypochlorite	Calcium Hypochlorite	Chlorine Gas	UV Disinfection
Ali Curung	Warrabri		GW		✓			
Alpururrulam	Lake Nash		GW			✓		
Canteen Creek	Orwaitilla		GW		✓			
Imangara	Murray Downs		GW			✓		
Nturiya	Ti Tree Station		GW					✓
Tara			GW			✓		
Willowra			GW		✓			
Wilora			GW					✓
Wutunugurra	Epenarra		GW		✓			

[1] Alternative names provided are commonly known, other titles for the majority of these communities also exist.
GW Groundwater

SOUTHERN REGION

FIGURE 6: LOCATION OF SOUTHERN REGION COMMUNITIES

- Power Stations
- Transmitted Power Supply (These centres recieve their Electricity by line from adjacent centres.)
- Sewerage Services

Water — All the above communities have reticulated supply

Recharge into groundwater aquifers in the Southern region is believed to be slow and sporadic with long residence times for water in the aquifers. As a result, the groundwater in the region is characterised by high total dissolved solids and high hardness levels, which impact the palatability of the water and can cause moderate to severe scaling problems with infrastructure.

Disinfection of the water supplies is achieved using both calcium hypochlorite and sodium hypochlorite. In 2008-09, sodium hypochlorite systems were installed in Haasts Bluff, Nyirripi and Papunya. It is proposed that the remaining communities in the Southern region using calcium hypochlorite be replaced with automatic sodium hypochlorite and UV systems in 2009-10,

TABLE 4: SUMMARY OF WATER SUPPLY SYSTEMS IN THE SOUTHERN REGION

					Disinfection type			
Community	Alternative Name[1]	Supply comments	Source of supply	Treatment	Sodium Hypochlorite	Calcium Hypochlorite	Chlorine Gas	UV disinfection
Amoonguna		Alice Springs water grid	GW				✓	
Ampilatwatja	Ammaroo		GW					✓
Areyonga	Utju		GW		✓			
Atitjere	Hart Range		GW			✓		
Engawala	Alcoota		GW			✓		
Finke	Apatula		GW			✓		
Haasts Bluff	Ikuntji		GW		✓			
Hermannsburg	Ntaria		GW			✓		
Imanpa			GW	Aeration		✓		
Kaltukatjara	Docker River		GW	Aeration		✓		
Kintore			GW					✓
Laramba	Napperby		GW			✓		
Mt Liebig			GW		✓			
Nyirripi			GW		✓			
Papunya			GW		✓			
Pmara Jutunta		Ti Tree water grid	GW		✓			
Santa Teresa			GW			✓		
Titjikala	Maryvale Station		GW			✓		
Tjuwanpa outstation: Kaporilya		Hermannsburg water grid	GW			✓		
Tjuwanpa outstation: Lyilyalanama		Hermannsburg water grid	GW			✓		
Tjuwanpa Resource Centre		Hermannsburg water grid	GW			✓		
Tjuwanpa outstation: Ulpunda		Hermannsburg water grid	GW			✓		
Wallace Rockhole			GW		✓			
Yuelamu	Mt Allan		SW	Sand Filtration				✓
Yuendumu			GW		✓			

[1] Alternative names provided are commonly known, other titles for the majority of these communities also exist.
GW Groundwater SW Surface Water

VERIFICATION OF DRINKING WATER QUALITY

The quality of Indigenous community water supplies is monitored regularly to:

- Check that the processes and infrastructure in place to protect and enhance water quality are working;
- Verify the quality of the water being provided to the consumers; and
- Increase understanding of a water supply system, identify and characterise potential hazards and fill gaps in knowledge.

Monitoring includes sample collection and laboratory analysis to determine the microbiological, physical, chemical, and radiological characteristics of the water. This is carried out in accordance with the Power and Water Drinking Water Monitoring Program. The monitoring program is developed in consultation between Power and Water business units and the Department of Health and Families, and is approved by the Chief Health Officer. The program is currently under review.

This section reports the results of verification monitoring that occurred in 2008-09 for microbiological characteristics and the historical monitoring since 2007 for the physical, chemical, and radiological characteristics. These are assessed for compliance with the Australian Drinking Water Guidelines values in consultation with the Department of Health and Families.

MICROBIOLOGICAL MONITORING

Consistent with the Australian Drinking Water Guidelines, the routine microbiological monitoring program includes regular testing for bacterial indicators of faecal contamination and system cleanliness. These indicators include *Escherichia coli (E. coli),* total coliforms and heterotrophic plate counts:

- *E. coli* is a bacterial coliform that indicates recent faecal contamination. If *E. coli* is detected in a drinking water supply, immediate action is taken in accordance with established protocols to safeguard public health; and
- Total coliforms and heterotrophic plate counts provide information on the cleanliness of a system, if there are high detections over long periods throughout the system remedial actions may be taken to improve the protection of the water supply from contamination.

Water samples collected for microbiological analysis need to be delivered to the laboratory within six to 24 hours of collection to ensure a high degree of reporting quality. As

the communities are located sparsely across the Territory, Power and Water has established a three-year contact with a local charter company to travel nine specified routes a month. These visit the nominated communities, collect the water samples and deliver them to the laboratories in Darwin and Alice Springs for analysis.

In addition, 13 communities with a population of more than 1,000 people are scheduled for sampling on a weekly basis, and are collected using the monthly charter planes and existing Regular Passenger Transport and freight services. Seven of these communities do not have reliable transport services and therefore five of these communities' water samples are collected through an additional charter plane; two communities are not currently collected weekly.

The Australian Drinking Water Guidelines recognise that it is unrealistic for a water supply system to have zero indicator bacteria at all times and therefore set a compliance level of 98% of scheduled samples to be free of indicator bacteria. The Australian Drinking Water Guidelines also recommend that over a 12 month period, water supply systems providing drinking water for populations from 1,000 to 5,000 people be sampled weekly (minimum of 52 samples per year). There is no specific recommendation on the frequency of sampling for communities with populations of less than 1,000, therefore in agreement with the Department of Health and Families, Power and Water has adopted a minimum sample frequency of monthly (minimum of 12 samples per year) for the majority of communities.

Communities' drinking water system performance in relation to the Australian Drinking Water Guidelines recommendation of having 98% of samples free of *E. coli* is detailed in Tables 5-9. These tables also illustrate Power and Water's annual targets for sampling frequency (as scheduled in the Drinking Water Quality Monitoring Program), and whether or not those targets were achieved.

TABLE 5: SUMMARY OF MICROBIOLOGICAL MONITORING IN THE NORTHERN REGION COMMUNITIES AND PERFORMANCE AGAINST AUSTRALIAN DRINKING WATER GUIDLEINE RECOMMENDATIONS IN 2008-09

Location	Number of samples recommended (ADWG)	Frequency of Sample Collection		Number of Samples Collected		Drinking water system performance	
		Scheduled	Achieved	Scheduled	Achieved	No. of *E. coli* detections	Compliant with 98% of samples free of *E. coli*
Acacia	*	12	12	36	35	0	Yes
Angurugu	52	38	32	156	98	0	Yes
Belyuen	*	12	12	36	36	0	Yes
Galiwinku	52	52	51	156	128	0	Yes
Gapuwiyak	52	38	33	156	99	0	Yes
Maningrida	52	52	53	156	141	0	Yes
Marngarr	*	12	11	36	33	0	Yes
Milikapiti	*	12	12	36	35	0	Yes
Millingimbi	52	52	49	156	139	0	Yes
Milyakburra	*	12	12	36	36	0	Yes
Minjilang	*	12	12	36	35	0	Yes
Nauiyu Nambiyu	*	12	12	48	46	0	Yes
Nguiu	52	52	40	156	111	0	Yes
Numbulwar	52	38	34	156	102	0	Yes
Oenpelli	52	38	37	156	114	0	Yes
Palumpa	*	12	12	36	37	4	No
Peppimenarti	*	12	11	36	33	0	Yes
Pirlangimpi	*	12	12	36	38	3	No
Ramingining	*	12	11	48	43	0	Yes
Umbakumba	*	12	12	36	35	0	Yes
Wadeye	52	52	51	260	186	3	No
Warruwi	*	12	11	36	33	0	Yes
Yirrkala	52	52	34	156	116	0	Yes

* *Australian Drinking Water Guidelines do not recommend a specific number of samples or frequency for monitoring communities with populations of less then 1,000 people*

Positive *E. coli* detections occurred in Palumpa, Pirlangimpi and Wadeye during 2008-09, and the Department of Health and Families issued Precautionary Advices for Drinking Water. Additional information on these incidents, including immediate responses, investigations and improvements are provided in the section on Management of Incidents and Emergencies. The positive detections resulted in the water supply systems at Palumpa and Pirlangimpi not complying with the Australian Drinking Water Guidelines recommendation of 98% of samples being free of *E. coli*. However, the higher sampling frequency at Wadeye – weekly rather than monthly – resulted in the water supply system remaining compliant with the Australian Drinking Water Guidelines recommendation.

The majority of the communities in the Northern region, scheduled for monthly sampling achieved the recommended frequency of samples for microbiological analysis. Marngarr, Peppimenarti, Ramingining, and Warruwi had water samples collected 11 of the 12 scheduled months.

The 10 communities in the Northern region with a population greater than 1,000 people were scheduled to be sampled on a weekly basis, but this did not take place due to the logistical challenge of increasing the frequency and number of samples collected across a number of communities.

Power and Water is committed to improving the microbiological performance of all community water supplies through the Strategy for Safe Water. This includes the successful implementation of the drinking water monitoring program, which will improve the compliance with the scheduled frequency and number of samples consistent with the recommendations of the Australian Drinking Water Guidelines.

TABLE 6: SUMMARY OF MICROBIOLOGICAL MONITORING IN THE KATHERINE REGION COMMUNITIES AND PERFORMANCE AGAINST AUSTRALIAN DRINKING WATER GUIDLEINE RECOMMENDATIONS IN 2008-09

		Frequency of samples collected		Number of samples collected		Drinking water system performance	
Location	Number of samples recommended (ADWG)	Scheduled	Achieved	Scheduled	Achieved	No. of *E. coli* detections	Compliant with 98% of samples free of *E. coli*
Amanabidji	*	12	11	36	33	0	Yes
Barunga	*	12	12	36	44	0	Yes
Beswick	*	12	12	36	35	0	Yes
Binjarri	*	12	12	36	36	0	Yes
Bulla	*	12	12	36	36	0	Yes
Bullman	*	12	11	36	34	0	Yes
Daguragu	*	12	12	24	23	0	Yes
Djilkminggan	*	12	12	36	41	0	Yes
Eva Valley	*	12	12	36	35	0	Yes
Jodetluk	*	12	11	24	25	0	Yes
Kalkarindgi	*	12	12	36	36	0	Yes
Kybrook Farm	*	12	12	36	36	0	Yes
Lajamanu	52	12	12	156	36	0	Yes
Minyerri	*	12	12	36	36	0	Yes
Ngukurr	52	38	33	156	95	0	Yes
Pigeon Hole	*	12	12	36	35	0	Yes
Rittarangu	*	12	11	36	33	0	Yes
Robinson River	*	12	12	36	36	0	Yes
Weemol	*	12	11	36	32	0	Yes
Yarralin	*	12	9	36	27	0	Yes

* *Australian Drinking Water Guidelines do not recommend a specific number of samples or frequency for monitoring communities with populations of less then 1,000 people*

A total 760 drinking water samples were collected from communities in the Katherine region, all were free of *E. coli* and complied with Australian Drinking Water Guideline recommendations for drinking water system performance.

The majority of the communities in the Katherine region, scheduled for monthly sampling, achieved the scheduled frequency. Water samples were collected 11 out of 12 months for Amanbidji, Bulman, Jodetluk, Rittarangu, and Weemol. Yarralin missed three months of sampling during recruitment of a new Essential Services Operator.

Ngukurr and Lajamanu are both recommended for weekly sampling as they have populations greater than 1,000 people. Neither community achieved the Australian Drinking Water Guidelines recommended frequency however, sampling for Ngukurr was significantly more regular with charter plane collection than in 2007-08. There is currently no Regular Passenger Transport service between Lajamanu and Darwin to ensure that the samples are analysed in Darwin within 24 hours so it is scheduled for monthly sampling.

TABLE 7: SUMMARY OF MICROBIOLOGICAL MONITORING IN THE BARKLY REGION COMMUNITIES AND PERFORMANCE AGAINST AUSTRALIAN DRINKING WATER GUIDLEINE RECOMMENDATIONS IN 2008-09

		Frequency of samples collected		Number of samples collected		Drinking water system performance	
Location	Number of samples recommended (ADWG)	Scheduled	Achieved	Scheduled	Achieved	No. of *E. coli* detections	Compliant with 98% of samples free of *E. coli*
Ali Curung	*	12	11	36	32	3	No
Alpurrurulum	*	12	11	36	37	0	Yes
Canteen Creek	*	12	12	36	35	0	Yes
Imangara	*	12	12	36	36	0	Yes
Nturiya	*	12	11	36	33	0	Yes
Tara	*	12	11	36	33	0	Yes
Willowra	*	12	6	36	16	2	No
Wilora	*	12	11	36	32	0	Yes
Wutunugurra	*	12	10	36	17	0	Yes

* *Australian Drinking Water Guidelines do not recommend a specific number of samples or frequency for monitoring communities with populations of less then 1000*

All communities in the Barkly region, except Ali Curung, which is further detailed under Management of Incidents and Emergencies, achieved compliance against the drinking water system performance in 2008-09. Sample numbers achieved and the frequency of sampling achieved was close but just below the targeted schedule for the majority of these communities, except for Wutunugurra.

TABLE 8: SUMMARY OF MICROBIOLOGICAL MONITORING IN THE SOUTHERN REGION COMMUNITIES AND PERFORMANCE AGAINST AUSTRALIAN DRINKING WATER GUIDLEINE RECOMMENDATIONS IN 2008-09

		Frequency of samples collected		Number of samples collected		Drinking water system performance	
Location	Number of samples recommended (ADWG)	Scheduled	Achieved	Scheduled	Achieved	No. of *E. coli* detections	Compliant with 98% of samples free of *E. coli*
Alcoota	*	12	11	36	33	0	Yes
Ampilatwatja	*	12	10	36	35	0	Yes
Apatula	*	12	11	36	41	0	Yes
Areyonga	*	12	12	36	47	4	No
Haasts Bluff	*	12	12	36	35	0	Yes
Harts Range	*	12	11	36	34	0	Yes
Hermannsburg	*	12	12	36	38	0	Yes
Imanpa	*	12	10	36	30	0	Yes
Kaltukatjara	*	12	12	36	36	0	Yes
Kintore	*	12	9	36	35	0	Yes
Laramba	*	12	11	36	34	1	Yes
Mount Leibig	*	12	11	36	33	0	Yes
Nyirripi	*	12	12	36	38	2	No
Papunya	*	12	12	36	33	3	No
Pmara Jutunta	*	12	12	36	34	0	Yes
Santa Teresa	*	12	11	36	34	0	Yes
Titjikala	*	12	12	36	36	0	Yes
Wallace Rockhole	*	12	12	36	36	0	Yes
Yuelamu	*	12	12	36	44	0	Yes
Yuendumu	52	12	11	156	34	0	Yes

* *Australian Drinking Water Guidelines do not recommend a specific number of samples or frequency for monitoring communities with populations of less then 1000*

Areyonga, Laramba, Nyirripi, Papunya and Willowra had detections of *E. coli* in 2008-09 and investigations found there to be insufficient disinfection at the time of sampling. The detections at Nyirripi, Areyonga and Papunya resulted in Precautionary Advice for Drinking Water (Water Boil Alerts) being issued, which are further detailed under Management of Incidents and Emergencies. Yuendumu is the only community in the Southern Region recommended for weekly sampling, however Power and Water schedules monthly sampling due to logistical and feasibility constraints.

An *E. coli* detection of any level triggers remedial actions and investigation into the source, as agreed with the Department of Health and Families, to minimise the risks to public health. In most situations, *E. coli* in the system can be managed by chlorinating and flushing the system, the safety of the water supply is verified by collecting additional water samples.

The cause of every incident is investigated and corrective and precautionary measures are put in place to reduce the risk of recurrence. Sometimes the nature of the water supply system makes it very difficult to significantly reduce the risk of contamination, for example surface water supplies can only be protected to a certain degree and other options also need to be considered. On some occasions, the Department of Health and Families identifies that the potential risk to the health of consumers cannot be controlled by Power and Water's operational measures and issues a Precautionary Advice for Drinking Water (Water Boil Alert), which is only lifted when Power and Water and the Department of Health and Families are satisfied the water supply is safe to drink.

PHYSICAL AND CHEMICAL MONITORING

The Australian Drinking Water Guidelines provide two types of guidelines for the physical and chemical characteristics of water.

Health-related guideline level, where the concentration of a water quality characteristic, based on present knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumption.

Aesthetic guideline level, where the concentration of a water quality characteristic is associated with acceptability of water to the consumer, e.g. appearance, taste and odour.

Health-related guideline levels are typically conservative and calculated using a range of safety factors over long-term exposure (often 70 years). Deviations from the guideline levels over a short period do not necessarily mean that the water is unsuitable for consumption. The amount and the period for which any guideline level could be exceeded without causing concern depends on the parameter and other compounding factors, such as the risk to public health.

The frequency of water quality monitoring for chemical, physical, and radiological characteristics of community water supplies varies depending on water sources and local circumstances. Comprehensive analysis including a range of chemical and physical water quality characteristics is scheduled at least annually and radiological analysis every three years.

Samples collected for physical, chemical, and radiological analysis also need to be delivered to the laboratory within certain timeframes, but this is not as time critical as with microbiological analysis. These water samples are collected using the existing charter flights for the microbiological monitoring, regular transport services, and postal systems.

Based on verification monitoring the majority of Indigenous communities are supplied with water that meets health-related guideline values for physical, chemical, and radiological water quality parameters. The specific concentrations of these characteristics for each community are detailed in Appendix 1.

There are some communities that rely on groundwater aquifer sources that have naturally high concentrations of physical, chemical, and radiological characteristics in the water. Power and Water developed a risk assessment process with the Department of Health and Families to assess the potential adverse health impacts of long-term human exposure to physical and chemical water quality characteristics detected in the Indigenous communities above recommended guideline values.

The risk profiles established in 2008 are guiding the prioritisation of water quality improvement strategies in Indigenous communities and will be reviewed as more data is gained.

HEALTH PARAMETERS

Water quality monitoring of some community water supplies indicates that the physical and chemical qualities that exceed the health-related guideline values recommended in the Australian Drinking Water Guidelines. However, the Chief Health Officer has determined that the community water supplies managed by Power and Water are safe to drink in the short to medium term.

Power and Water continues to increase the monitoring in communities to provide a more

accurate picture of water supplies. More information on the parameters of interest to Power and Water are outlined below:

ANTIMONY

The Australian Drinking Water Guidelines recommend the concentration of antimony in drinking water should be kept below 0.003mg/L. Groundwater and surface water sources are typically significantly below this, ranging from 0.0001mg/L to 0.0002mg/L. Detections of antimony in natural source waters as salts usually occur in areas near copper or lead smelting operations. There are limited studies on the effects of consuming antimony through drinking water. The World Health Organisation (WHO) has set a guideline of 0.02mg/L. Monitoring over the last three years has identified Beswick to have elevated levels of antimony.

ARSENIC

The Australian Drinking Water Guidelines recommend the concentration of arsenic in drinking water should not exceed 0.007mg/L. Arsenic can be present in a water supply naturally, through dissolution of minerals and ores, due to industrial effluent, atmospheric deposition, drainage from old gold mines or the use of sheep dips. In Australia, concentrations typically range from less than 0.005mg/L to 0.015mg/L. Studies into the consumption of drinking water above 0.3mg/L over five to 25 years have shown effects on the skin, vascular system, nervous system, with the possibility of being carcinogenic.

Levels slightly above guideline have been seen in Nauiyu Nambiyu and Beswick, but these are lower than the World Health Organisation guideline of 0.01mg/L.

BARIUM

The Australian Drinking Water Guidelines recommend barium be less than 0.7mg/L in drinking water. A number of epidemiological studies have been carried out on the effects of barium in drinking water on cardiovascular disease. No adverse effects were found with barium concentrations up to 7mg/L. In a study using a small number of volunteers, after eight weeks' exposure to drinking water with up to 10mg/L barium.

Barium has been detected at levels approaching guideline levels in Bulla, and exceeding in Ngukurr, Robinson River and Yarralin. The levels at Bulla are reduced by combining the groundwater source with the surface water source, however the levels can be highly variable and will often exceed the guideline when the groundwater is used to supply water to the system. Ngukurr's level will be managed by the employment of a new groundwater source with lower barium levels and seasonal use of the surface water source. Over the next five years, investigation into alternative groundwater sources with improved quality in Yarralin and Robinson River will continue.

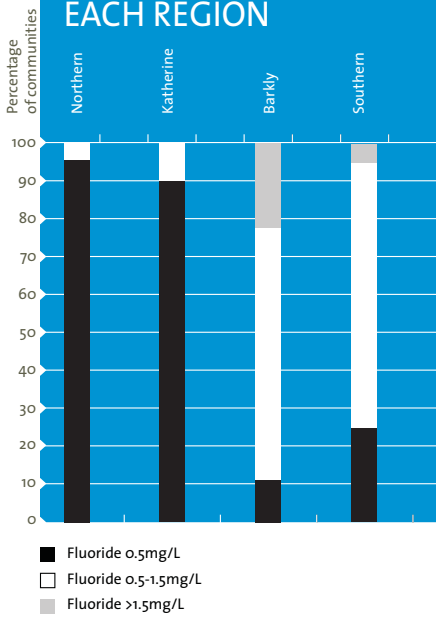
FLUORIDE

The concentration of natural fluoride in drinking water depends on the type of soil and rock that the water comes into contact with. Generally surface water sources have low natural fluoride concentrations (around <0.1 to 0.5mg/L) and groundwater sources may have relatively high levels (range from 1-10 mg/L), particularly when the rock surrounding the water in the aquifer is rich in fluoride. The minimum fluoride for protection against dental caries is about 0.5mg/L, although around 1mg/L is required in temperate climates for optimal caries prevention. At concentrations of 1.5 to 2mg/L, teeth may become mottled due to dental fluorosis.

The majority of water supplies in the Northern and Katherine regions have naturally low fluoride levels due to the nature of the shallow groundwater supplies and use of surface water supplies in some communities. The upper limit of levels detected range from 0.05mg/L to 0.9mg/L closer to the Barkly region. The majority of communities in the Barkly and Southern regions have fluoride levels between 0.5mg/L and 1.5mg/L (Figure 7), some communities experience fluoride above the Australian Drinking Water Guideline value of 1.5mg/L.

FIGURE 7:

FLUORIDE LEVELS (95TH PERCENTILE) DETECTED IN DRINKING WATER SUPPLIES IN EACH REGION



Regular quarterly monitoring of fluoride levels is being carried out in Ali Curung, Alpurrurulam and Nyirripi, where the fluoride levels are approaching or exceeding the Australian Drinking Water Guidelines recommended value of 1.5mg/L.

NITRATE

Nitrate is the product of oxygenated nitrogen created from the breakdown of organic matter; lightning strikes; inorganic pesticides; or explosives. The Australian Drinking Water Guidelines recommend that nitrate levels between 50-100mg/L are a health consideration for infants less than three months, although levels up to 100mg/L can be safely consumed by adults.

Elevated levels have been identified in Ali Curung, Kintore and Pmara Jutunta. Regular monthly monitoring is scheduled for these communities to improve our understanding of the nitrate levels and the most appropriate improvement strategies.

URANIUM

Uranium may be present as a result of natural deposits, fuel combustion, mine tailings and the use of phosphate pesticides. The Australian Drinking Water Guideline value for uranium is 0.02mg/L. Monitoring over the past three years has highlighted a limited number of communities in the Barkly and Southern region that experience uranium levels in their water supplies above guideline level. These communities are: Nturiya, Willowra, Wilora, Laramba and Papunya. These communities are being monitored monthly and quarterly to improve our understanding of the uranium levels and the most appropriate improvement strategies.

AESTHETIC PARAMETERS

The physical characteristics of a water supply influence appeal to consumers. This includes the appearance, taste and odour and may also cause corrosion or scaling on infrastructure. Important aesthetic parameters include pH, total dissolved solids, dissolved oxygen, turbidity, colour, temperature and hardness.

pH

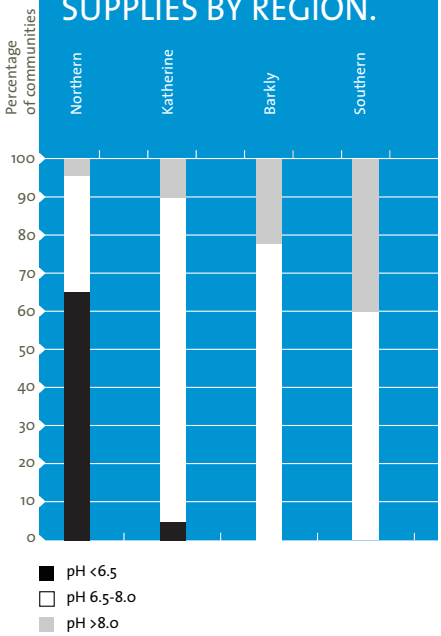
The Australian Drinking Water Guidelines recommend drinking water should be between 6.5-8.5 pH units. Levels below 6.5 pH units are likely to be associated with corrosion of pipes and fittings while levels above 8.5 can cause scaling particularly on hot water systems.

pH is a measure of the hydrogen ion concentration of water. It is measured on a logarithmic scale from 0 to 14. A pH of 7 is neutral, greater than 7 is alkaline, and less than 7 is acidic.

The majority of communities have drinking water within the recommended pH range. Communities in the Northern region do experience pH levels less than 6.5 pH units. Some communities south of Katherine may experience pH levels greater than 8.0 pH units (Figure 8).

FIGURE 8:

SUMMARY OF PH LEVELS DETECTED IN DRINKING WATER SUPPLIES BY REGION.



IRON

The Australian Drinking Water Guidelines recommend iron levels below 0.3mg/L which is believed to be around the taste threshold in drinking water. Levels above 3mg/L are believed to be objectionable. Iron bacteria concentrate iron and can cause issues with taste and odour as well as pipe restrictions and blockages. Iron generally occurs in drinking water as oxidised ferric or ferrous compounds, in surface waters it can complex with organic matter. Groundwater sources that are oxygen depleted have reportedly provided drinking water with iron concentrations up to 100mg/L. The concentration of iron at the customer tap can also be affected by factors such as rusting iron pipes.

There are a number of communities regularly monitored for iron levels above 0.3mg/L and a limited number above 1mg/L (Figure 9). Power and Water investigated alternative groundwater sources for Nauiyu Nambiyu in 2008-09 and in the next two years a further three production bores will be equipped to reduce the iron levels.

Options to reduce iron levels in the other communities with high levels are being investigated. Short-term solutions to reduce iron levels such as blending water supplies are being trialled.

FIGURE 9:

COMMUNITIES WITH AN AVERAGE IRON CONCENTRATION GREATER THAN 0.3MG/L IN THE DISTRIBUTION SYSTEM

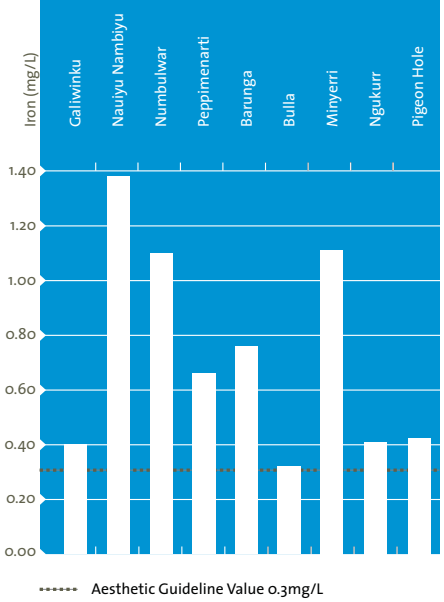
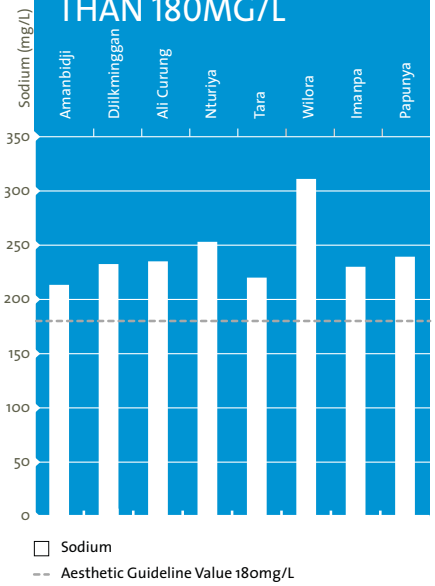


FIGURE 10:

DRINKING WATER SUPPLIES WITH AVERAGE SODIUM LEVELS GREATER THAN 180MG/L

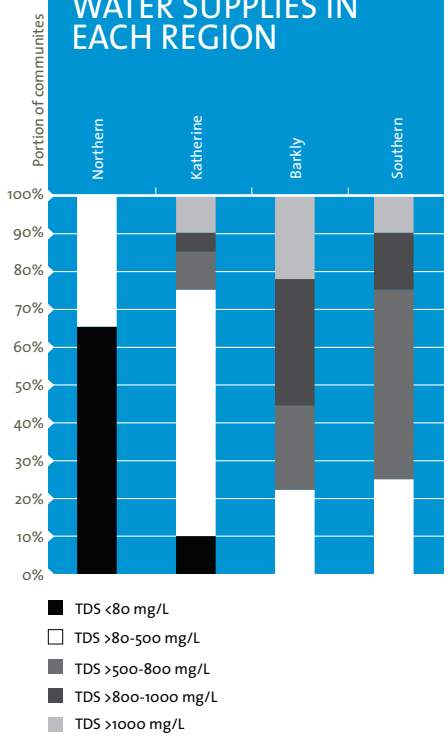


SODIUM

Sodium is an essential element for humans, although there is currently no agreement on the minimum amount required. The sodium ion is widespread in water due to the high solubility of sodium salts and the abundance of mineral deposits. The Australian Drinking Water Guidelines recommend no more than 180mg/L, when the taste becomes appreciable. There are eight communities with mean sodium levels above 180mg/L (Figure 10).

FIGURE 11:

AVERAGE TDS LEVELS DETECTED IN DRINKING WATER SUPPLIES IN EACH REGION



TOTAL DISSOLVED SOLIDS

Total dissolved solids are small organic and inorganic particles dissolved in water, which can affect how it tastes. No health guideline has been set in the Australian Drinking Water or World Health Organisation guidelines. The Australian drinking Water Guidelines rates the taste of drinking water based on total dissolved solids levels and recommends levels be below 500mg/L as follows:

mg/L	quality
<80	excellent
80-500	good
500-800	fair
800-1000	poor
>1000	unacceptable

Levels above 500mg/L will affect taste and could cause scaling on taps, pipes, and hot water systems. Levels greater than 800mg/L significantly affect taste and may also cause moderate to severe scaling. On the other hand, a water supply with extremely low dissolved solids can taste flat and insipid.

FIGURE 13:

AVERAGE HARDNESS (AS CACO3) LEVELS DETECTED IN DRINKING WATER SUPPLIES IN EACH REGION

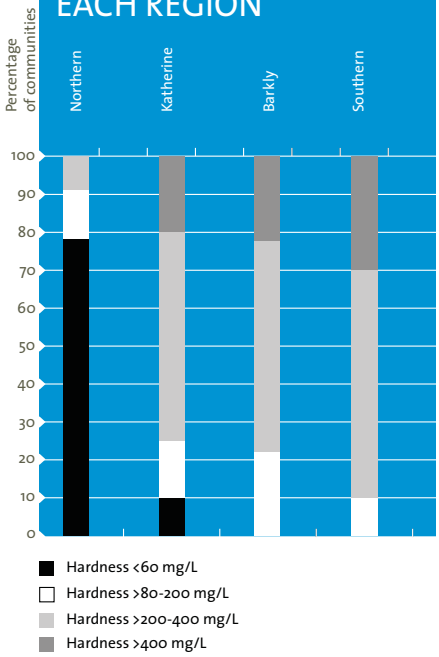
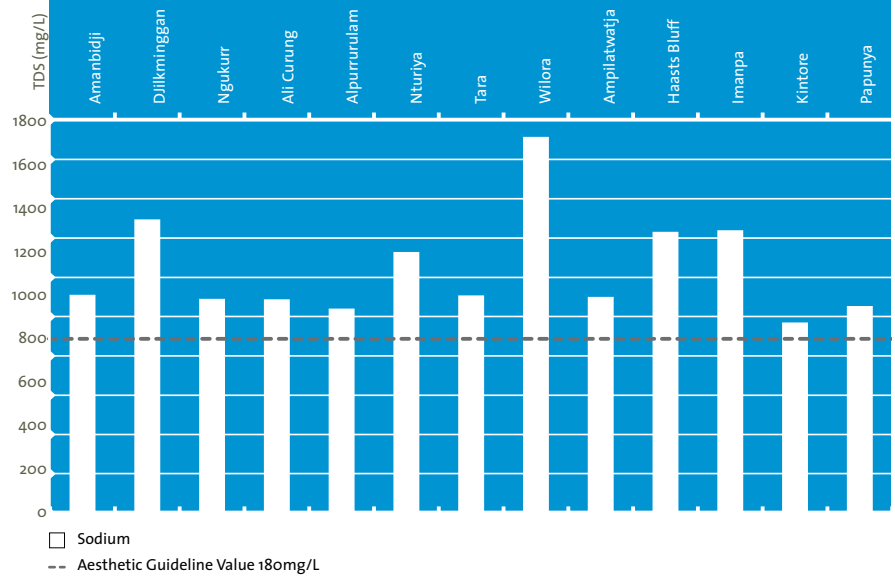


FIGURE 12:

COMMUNITIES WITH AVERAGE TDS LEVELS GREATER THAN 800MG/L.



Levels vary between regions across the Territory (Figure 11) and increase from the Northern region to the Southern region.

There are 13 community water supplies with mean total dissolved solids levels above 800mg/L (Figure 12). Ten of these are in the Barkly and Southern Region.

HARDNESS

Hardness is primarily the amount of calcium and magnesium ions in water. The Australian Drinking Water Guidelines recommend hardness levels below 200mg/L to minimise scaling in hot water systems (Figure 13).

The Australian Drinking Water Guidelines classify degrees of hardness as:

<60 mg/L $CaCO_3$	soft but possibly corrosive
60-200 mg/L $CaCO_3$	good quality
200-500 mg/L $CaCO_3$	increasing scaling problems
>500 mg/L $CaCO_3$	severe scaling

Hardness levels below 60mg/L may cause corrosion in pipes depending on other physical and chemical characteristics (pH, alkalinity and dissolved oxygen). Studies into the effects of hard water on consumers found some indication that it may be beneficial to health, however the data is still inconclusive.

Twelve communities have average hardness levels above 400mg/L (Figure 14). These elevated levels may lead to excessive scaling of pipes and fittings.

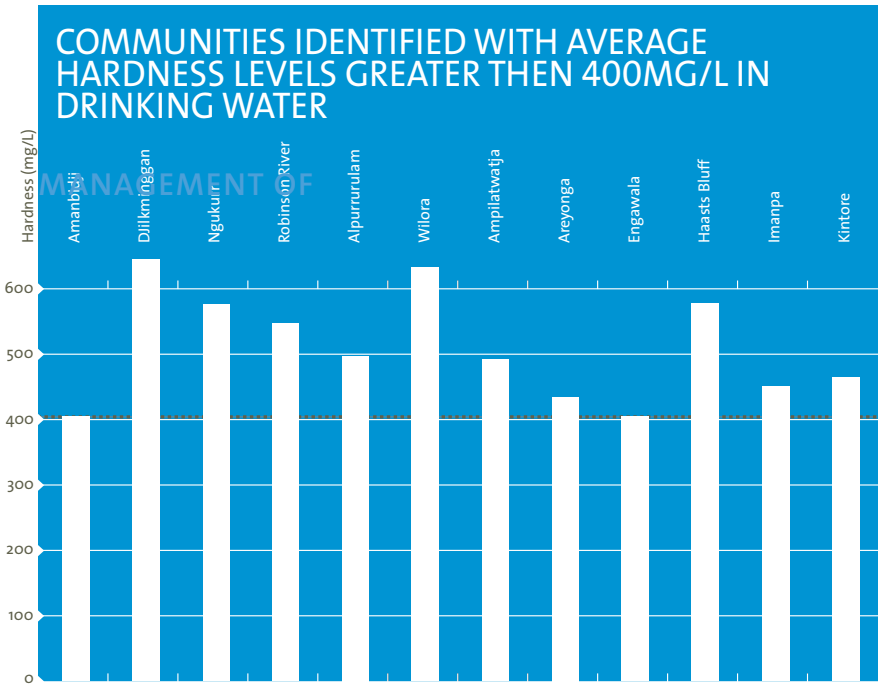
DATA LIMITATIONS

This report summarises the best available information, however in most cases there are a relatively small number of data points, which limits the ability for statistical evaluation.

The microbiological monitoring data collected in 2008-09 was consistent with the frequencies recommended in the Australian Drinking Water Guidelines. However, where there were fewer than 50 samples per year, even if each sample was free of contamination, this only provides a certain degree of confidence that the water system as a whole was free of contamination. Considering the remote location of many of the communities and the prohibitive transport systems and costs, Power and Water will focus on more reliable disinfection systems with on-line monitoring to improve confidence in water quality.

The physical and chemical monitoring data includes data collected from early 2007 to June 2009 as there are a relatively small number of data points for these characteristics for each community. In some communities this quality will exceed the health-related guideline values recommended in the Australian Drinking Water Guidelines, the monitoring program has been extended to enhance the ability for statistical evaluation and data interpretation.

FIGURE 14:



INCIDENTS AND EMERGENCIES

PRECAUTIONARY ADVICE FOR DRINKING WATER

To minimise the risks to public health from microbiological contamination of drinking water, Power and Water has an established Drinking Water Reporting Triggers and Protocol, endorsed by the Chief Health Officer. This details the actions required when *E. coli* is detected in the distribution system. In some incidents the Department of Health and Families will take an extra precautionary step and issue a "Precautionary Advice for Drinking Water" to advise the community that drinking water should be boiled before consumption.

During the 2008-09 seven "Precautionary Advice for Drinking Water" alerts were issued (Table 10).

TABLE 10: DETAILS OF INCIDENCES RESULTING IN PRECAUTIONARY ADVICE FOR DRINKING WATER DURING 2008-09.

Community	Date of issue	Details of Incident
Nyirripi	9 – 14 April, 2009	**Incident:** High levels of *E. coli* were detected from the production bore and three distribution system samples. **Immediate Response:** Power and Water undertook an inspection to verify the system security and identify the source of contamination at the bore and increased chlorine disinfection levels. The system was then comprehensively flushed to draw through the chlorinated water and remove the potentially contaminated water. Analysis of additional water samples confirmed that the water was clear from *E. coli* and other indicator bacteria and the Department of Health and Families lifted the Precautionary Notice. **Investigation and Improvements:** The incident investigation was unable to specifically identify the source of contamination at the bore, although the disinfection system should have prevented the contaminated water from being potentially supplied to consumers. A new sodium hypochlorite system had been installed but was not operating correctly at the time. These issues have been rectified.
Areyonga	4 – 6 March, 2009	**Incident:** Significant levels of *E. coli* were detected throughout the distribution system, with the higher levels reported downstream in the distribution system. **Immediate Response:** Power and Water undertook an inspection to identify the source of contamination in the distribution system and increased chlorine disinfection levels. The system was comprehensively flushed and analysis of additional water samples confirmed that the water was clear from *E. coli* and other indicator bacteria and the Department of Health and Families lifted the Precautionary Notice. **Investigation and Improvements:** Investigation was unable to specifically identify the source of contamination in the distribution system. However the chlorine residuals in the distribution system were insufficient to manage the contamination and the disinfection system configuration has been reviewed to ensure that adequate chlorine residuals will be maintained in the future.
Palumpa	16 – 19 February, 2009	**Incident:** Following heavy rainfall in February 2009, floodwater inundated large areas in and around Palumpa. Significant areas of low-lying water and sewerage infrastructure were inundated with floodwater resulting in the sewage system being overloaded, inhibiting the ability to ensure the integrity of the water system. **Immediate Response:** Power and Water advised the Department of Health and Families, who immediately issued a Precautionary Notice to the community. Once the floodwaters receded analysis of additional water samples from the system confirmed that the water was clear from *E. coli* and other indicator bacteria and the Department of Health and Families lifted the Precautionary Notice. **Investigation and Improvements:** An upgrade to the sewerage system in low lying areas has been proposed for 2010 to minimise the impacts of flooding on the infrastructure.

Wadeye	18 – 20 December, 2008	**Incident:** In December 2008, Cyclone Billy crossed the coast close to the community of Wadeye. Heavy rain resulted in floodwater inundating large areas including a significant portion of the Wadeye borefield. Scheduled microbiological monitoring detected varying levels of *E. coli* and very high levels of total coliforms throughout the water supply system. **Immediate Response:** Power and Water undertook an inspection to verify the system security and increased chlorine disinfection levels. The system was comprehensively flushed and analysis of additional water samples confirmed that the water was clear from *E. coli* and other indicator bacteria and the Department of Health and Families lifted the Precautionary Notice. **Investigation and Improvements:** Although the chlorination disinfection system was operating, the chlorine demand from the ingress exceeded the chlorine dose rate and potentially contaminated water was delivered to consumers. The reliability of the disinfection system has been reviewed and an upgrade is proposed.
Palumpa	4 – 6 December, 2008	**Incident:** All four water samples positively detected low levels of *E. coli*. **Immediate Response:** Power and Water undertook an inspection to verify the system security and increased chlorine disinfection levels. The system was comprehensively flushed and analysis of additional water samples confirmed that the water was clear from *E. coli* and other indicator bacteria and the Department of Health and Families lifted the Precautionary Notice. **Investigation and Improvements:** Investigation was unable to identify the source of contamination at the bore, although the disinfection system should have prevented the contaminated water from being potentially supplied to consumers. An upgrade of the disinfection system is proposed.
Papunya	9 – 11 October, 2008	**Incident:** Three water samples identified the presence of low levels of *E. coli* within the distribution system. The sample from the production bore did not identify *E. coli*. **Immediate Response:** Power and Water undertook an inspection to identify the source of contamination in the tank and increased chlorine disinfection levels. The system was comprehensively flushed and analysis of additional water samples confirmed that the water was clear from *E. coli* and other indicator bacteria and the Department of Health and Families lifted the Precautionary Notice. **Investigation and Improvements:** Investigation was unable to identify the source of contamination at the tank, although the disinfection system should have prevented the contaminated water from being potentially supplied to consumers. The reliability of the disinfection system has been reviewed and upgrade is proposed.
Pirlangimpi	3 – 5 September , 2008	**Incident:** Significant levels of *E. coli* were detected in the surface water source and throughout the distribution system. This water supply relies on a single surface water source and has been identified as having a high risk of contamination. **Immediate Response:** Power and Water undertook an inspection to verify the system security and increased chlorine disinfection levels. The system was comprehensively flushed and analysis of additional water samples confirmed that the water was clear from *E. coli* and other indicator bacteria and the Department of Health and Families lifted the Precautionary Notice. **Investigation and Improvements:** Investigation identified the unsecured surface water as the source of contamination, although the disinfection system failure allowed the contaminated water to be potentially supplied to consumers. The water supply system had already been identified as having a high risk of contamination and three weeks later an additional UV disinfection barrier was commissioned.

AWARENESS AND TRAINING

ESSENTIAL SERVICES OPERATORS TRAINING

The on-site day-to-day operations and maintenance of electricity, water and sewerage services in remote Indigenous communities is undertaken by Essential Services Operators (ESO), employed by Shire Councils and private contractors. Power and Water provides training with three-day familiarisation courses in Darwin, Katherine and Alice Springs once or twice a year. There are presentations and practical sessions on all aspects of electricity, water and sewerage services including the fundamentals of providing a safe water supply.

This group training is supported by on-the-job training where the ESO can complete a Certificate II in Remote Essential Services through the Charles Darwin University. This training is directly linked to regular duties such as water sampling carried out by the ESO.

For more information on the training refer to the Indigenous Essential Services Annual Report available at the Power and Water website:

http://www.powerwater.com.au/newsroom/publications

COMMUNITY ENGAGEMENT AND AWARENESS

CUSTOMER SATISFACTION

To ascertain customer satisfaction and perception of the quality and reliability of the electricity, water and sewerage services provided in the Indigenous communities, Power and Water engaged a specialist consultant to undertake customer satisfaction surveys. These surveys have been conducted in 2004, 2007, 2008 and will continue on an annual basis.

The customer satisfaction survey was carried out in October 2008 and included both telephone and face-to-face components. Those surveyed by telephone were key stakeholders, consisting of community staff and business customers including Shire Services Managers, Australian Government Business Managers. Health Clinic Managers, School Principals and Community Store.

The face-to-face components were conducted with community residents. The main findings, relevant to water quality, from the telephone survey to business customers revealed:

- 92% of business customers identified Power and Water as the water supplier;
- The number of water supply interruptions has increased from the 2007 survey however, the length of interruption had decreased;
- 6% of those business stakeholder expressed dissatisfaction with water supplied, each expressed this was due to poor water quality;
- 18% of Barkly respondents suggested improvements to the water quality; and,
- Water quality issues surrounding taste and hardness.

For the first time Indigenous residential customers were included in the survey through a pilot in two communities: Gunbalanya (Kunbarllanjnja/Oenpelli) in the Northern region; and Lajamanu in the Katherine region. Residents were engaged through qualitative, face-to-face discussions. Gunbalanya is involved in Power and Water's Community Water Planning initiative and Lajamanu represents a significantly different geographical location for comparison.

The main issues in both communities surrounded infrastructure such as leaking or broken taps, blocked and or broken pipes. Most residents did not have significant concern over the water supply, although there were concerns over people wasting water in the community (in Lajamanu) and taste (in Gunbalanya) and one resident raised the importance of keeping water safe so people didn't get sick (in Gunbalanya).

Power and Water plans to coordinate telephone surveys each year with business customers and other people as available; and face-to-face interviews with a number of communities every two years. For further information regarding the Customer Satisfaction Survey, refer to the Indigenous Essential Services Annual Report:

http://www.powerwater.com.au/newsroom/publications

COMMUNITY WATER PLANNING

Power and Water instigated Community Water Planning (CWP) early in 2008 to foster greater community engagement in water management and to improve water management across the Indigenous communities it services.

A central pillar of the success of Community Water Plans is the appropriate engagement of Indigenous community residents and stakeholders. High importance is placed on the Planning team using appropriate and effective methods of fostering community participation. This will allow Power and Water to foster dialogue with Indigenous community residents on sustainable and collaborative planning and management of water services. The dialogue will emphasise sharing the aspirations, concerns and knowledge of a community to incorporate into the Community Water Plans.

The development of community-specific plans is driven by the need to allocate resources to improve water quality and quantity issues. In 2008-09, community water planning continued with Yuelamu, Nguiu, Minyerri and Gunbalanya. Community Water Plans were developed in two communities, for completion in 2009-10. Three new communities sought to engage with Power and Water to develop Community Water Planning: Nauiyu (Daly River), Ali Curung and Millingimbi.

The key focus of Community Water Planning is to clarify community water needs and aspirations, risks, local water management roles and responsibilities, developing greater understandings between service provider and residents as joint managers of the water resource. By improving the dialogue between service provider and service recipients/beneficiaries, Community Water Planning aims to improve our ability to meet each community's water needs and improve conservation and management of water.

Further details on Community Water Planning, the engagement methodology, and the Sustainable Water Management Strategy is presented in the IES Sustainable Water Management Annual Report which is available on the Power and Water website:

http://www.powerwater.com.au/newsroom/publications

APPENDIX 1: PHYSICAL/CHEMICAL CHARACTERISTICS OF DRINKING WATER IN EACH COMMUNITY DISTRIBUTION SYSTEM

DRINKING WATER QUALITY IN NORTHERN REGION COMMUNITIES

	Reported unit	ADWG 2004	Acacia Larrakia	Angurugu[4]	Belyuen	Galiwinku[3]	Gapuwiyak	Gunbalanya	Gunyangara
Health Characteristics[2]									
Antimony	mg/L	0.003	0.0001	0.0001	0.0001[1]	0.001	0.0001	0.0001[1]	0.0001
Arsenic	mg/L	0.007	0.0005	0.0003	0.0005[1]	0.0003	0.0003	0.0003[1]	0.0003
Barium	mg/L	0.7	0.03	0.025	0.025[1]	0.03	0.03	0.025[1]	0.03
Boron	mg/L	4	0.01	0.01	0.016[1]	0.01	0.01	0.01[1]	0.01
Cadmium	mg/L	0.002	0.0001	0.0001	0.0001[1]	0.0001	0.0001	0.0001[1]	0.0001
Chromium	mg/L	0.05	0.003	0.0025	0.0025[1]	0.01	0.003	0.0025[1]	0.003
Fluoride	mg/L	1.5	0.05[4]	0.05	0.17[1]	0.05[4]	0.05[4]	0.05[1]	0.05
Lead	mg/L	0.01	0.002	0.001	0.0031[1]	0.008	0.002	0.0016[1]	0.003
Mercury	mg/L	0.001	0.00005	0.0001	0.00005[1]	0.00005	0.00005	0.00005[1]	0.00005
Molybdenum	mg/L	0.05	0.003	0.0025	0.0025[1]	0.003	0.003	0.0025[1]	0.003
Nickel	mg/L	0.02	0.001	0.001	0.002[1]	0.001	0.001	0.001[1]	0.002
Nitrate	mg/L	50	0.5[4]	2.6	0.5[1]	1.1[4]	2.8[4]	1[1]	0.5
Annual Exposure to Radioactivity	mSv/yr	1	GROSS α,β <0.5 Bq/L	GROSS α,β <0.5 Bq/L	GROSS α,β < 0.5 Bq/L	GROSS α,β <0.5 Bq/L	GROSS α,β <0.5 Bq/L	GROSS α,β <0.5 Bq/L	GROSS α,β <0.5 Bq/L
Selenium	mg/L	0.1	0.0005	0.0005	0.0005[1]	0.0005	0.0005	0.0005[1]	0.0005
Silver	mg/L	0.1	0.005	0.005	0.005[1]	0.005	0.005	0.005[1]	0.005
Uranium	mg/L	0.02	<0.001	0.00003	0.003[1]	<0.001	<0.001	<0.001[1]	<0.001
Aesthetic Characteristics[2]									
Aluminium	mg/L	0.2	0.01	0.01	0.027	0.01	0.01	0.06	0.03
Chloride	mg/L	250	4.9[4]	12	8	13[4]	13[4]	7	12
Copper	mg/L	2	0.01	0.06	0.019	0.02	0.01	0.01	0.01
Hardness	mg/L	200	218[4]	4.7	19	3.8[4]	3.9[4]	6	15
Iodine	mg/L	0.15	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Iron	mg/L	0.3	0.01	0.01	0.14	0.4*	0.08*	0.17	0.02
Manganese	mg/L	0.1	0.003	0.0025	0.012	0.003	0.009	0.005	0.003
pH	pH Units	6.5-8.5	7.9[4]	6	6	5.8[4]	6[4]	6	6.9
Sodium	mg/L	180	3.8[4]	9.9	7	6.5[4]	8.3[4]	5	7
Sulfate	mg/L	250	1.3[4]	0.54	0.8	1.3[4]	0.32[4]	1	0.4
Total Dissolved Solids	mg/L	500	239[4]	53	73	32[4]	40[4]	30	42
True Colour	CU	15	N/A	N/A	3.5	N/A	N/A	5.6	1.1
Turbidity	NTU	5	N/A	N/A	1.5	N/A	N/A	1.34	0.2
Zinc	mg/L	3	0.01	0.1	0.039	0.01	0.01	0.02	0.02
Other Characteristics[2]									
Alkalinity	mg/L	#	228[4]	12	15	5.4[4]	7.1[4]	5	8
Beryllium	mg/L	#	0.0005	0.0001	0.001	0.0005	0.0005	0.0005	0.0005
Bromine	mg/L	#	0.02	0.04	0.01	0.03	0.03	0.02	0.03
Calcium	mg/L	#	44[4]	0.69	7	0.42[4]	0.45[4]	1.8	4.9
Conductivity	µS/cm	#	440[4]	61	57	52[4]	64[4]	36	56
Magnesium	mg/L	#	26[4]	0.71	0.62	0.66[4]	0.66[4]	0.5	0.6
Potassium	mg/L	#	1.4[4]	0.24	3	0.75[4]	0.08[4]	0.17	0.33
Silica	mg/L	#	19[4]	13	31	12[4]	11[4]	11	11
Tin	mg/L	#	0.005	0.005	0.005	0.005	0.005	0.005	0.005

[1] *95th percentile reported*
[2] *Mean value reported*
[3] *Value includes data from the past 8 years*
[4] *Level represents a single reticulation sample*

* *Mean values reported from all source waters*
\# *no guideline (ADWG 2004) set*
N/A *Value not available*

DRINKING WATER QUALITY IN NORTHERN REGION COMMUNITIES

	Reported unit	ADWG 2004	Maningrida	Milikapiti[3]	Milingimbi	Milyakburra	Minjilang	Nauiyu Nambiyu	Nguiu	Numbulwar
Health Characteristics[2]										
Antimony	mg/L	0.003	0.0001	0.0001	0.0001[1]	0.0001	0.00035[1]	0.001[1]	0.0001	0.0001
Arsenic	mg/L	0.007	0.0003	0.0002	0.00025[1]	0.0003	0.0009[1]	0.013[1]	0.0003	0.001
Barium	mg/L	0.7	0.03	0.01	0.025[1]	0.03	0.025[1]	0.036[1]	0.03	0.35
Boron	mg/L	4	0.02	0.2	0.04[1]	0.04	0.02[1]	0.029[1]	0.01	0.04
Cadmium	mg/L	0.002	0.0001	0.0001	0.0003[1]	0.0001	0.0001[1]	0.0001[1]	0.0001	0.0001
Chromium	mg/L	0.05	0.003	0.001	0.0025[1]	0.003	0.0025[1]	0.0025[1]	0.003	0.003
Fluoride	mg/L	1.5	0.05	0.1[4]	0.08[1]	0.05	0.05	0.5	0.05	0.2
Lead	mg/L	0.01	0.004	0.001	0.0045[1]	0.002	0.0025[1]	0.0032[1]	0.003	0.001
Mercury	mg/L	0.001	0.00005	0.00003	0.00005[1]	0.00005	0.00005[1]	0.00005[1]	0.00005	0.00005
Molybdenum	mg/L	0.05	0.003	0.001	0.0025[1]	0.003	0.0025[1]	0.0025[1]	0.003	0.003
Nickel	mg/L	0.02	0.001	0.001	0.001[1]	0.001	0.001[1]	0.001[1]	0.001	0.001
Nitrate	mg/L	50	0.5	0.5[4]	5.5[1]	0.5	0.5	0.5	0.5	0.5
Annual Exposure to Radioactivity	mSv/yr	1	GROSS α,β <0.5 BQ/L	GROSS α,β <0.5 BQ/L	GROSS α,β <0.5 BQ/L	GROSS α,β <0.5 BQ/L	GROSS α,β <0.5 BQ/L	GROSS α,β <0.5 BQ/L	0.25	GROSS α,β <0.5 BQ/L
Selenium	mg/L	0.1	0.0005	0.0004	0.0005[1]	0.0005	0.0008[1]	0.0005[1]	0.0005	0.0005
Silver	mg/L	0.1	0.005	0.002	0.005[1]	0.005	0.005[1]	0.005[1]	0.005	0.005
Uranium	mg/L	0.02	<0.001	<0.001	<0.001[1]	<0.001	0.001[1]	<0.001[1]	<0.001	<0.001
Aesthetic Characteristics[2]										
Aluminium	mg/L	0.2	0.01	0.01	0.08	0.01	0.06	0.14	0.01	0.01
Chloride	mg/L	250	8	12[4]	66	47	15	6	8	27
Copper	mg/L	2	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.01
Hardness	mg/L	200	7	4.6[4]	34	33	4	128	25	201
Iodine	mg/L	0.15	0.005	0.004	0.005	0.013	0.005	0.018	0.005	0.008
Iron	mg/L	0.3	0.01	0.06*	0.06	0.01	0.16	1.38	0.01	1.1
Manganese	mg/L	0.1	0.003	0.002	0.016	0.035	0.005	0.56	0.003	0.15
pH	pH Units	6.5-8.5	6.5	6.2[4]	5.2	5.8	4.8	7.4	6.3	8.2
Sodium	mg/L	180	5	12[4]	34	27	9	21	5	21
Sulfate	mg/L	250	1	1.6[4]	6	4	4	5	0.4	30
Total Dissolved Solids	mg/L	500	49	47[4]	158	108	43	202	39	274
True Colour	CU	15	1.6	N/A	2.8	4.2	0.5	3.5	1.6	6
Turbidity	NTU	5	0.17	N/A	0.33	0.18	2.4	5.8	0.23	12
Zinc	mg/L	3	0.13	0.01	0.16	0.02	0.09	0.03	0.13	0.01
Other Characteristics[2]										
Alkalinity	mg/L	#	8	19[4]	5	9	1	167	14	176
Beryllium	mg/L	#	0.0005	0.0003	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bromine	mg/L	#	0.01	0.02	0.13	0.15	0.02	0.02	0.01	0.08
Calcium	mg/L	#	1.5	0.82[4]	7.7	2.2	0.6	27.3	9.1	62
Conductivity	µS/cm	#	45	80[4]	267	192	66	345	50	485
Magnesium	mg/L	#	0.8	0.63[4]	3.9	2.2	0.6	14.3	0.5	11.2
Potassium	mg/L	#	0.98	1[4]	0.46	0.27	0.05	1	0.03	2.5
Silica	mg/L	#	13.7	12[4]	18.2	16	12	37.7	13.7	17.7
Tin	mg/L	#	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005

[1] *95th percentile reported*
[2] *Mean value reported*
[3] *Value includes data from the past 8 years*
[4] *Level represents a single reticulation sample*

* *Mean values reported from all source waters*
\# *no guideline (ADWG 2004) set*
N/A *Value not available*

DRINKING WATER QUALITY IN NORTHERN REGION COMMUNITIES

	Reported unit	ADWG 2004	Palumpa*	Peppimenarti[4]	Pirlangimpi	Ramingining	Umbakumba[3]	Wadeye[4]	Warruwi	Yirrkala[4]
Health Characteristics[2]										
Antimony	mg/L	0.003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002
Arsenic	mg/L	0.007	0.0015	0.0005	0.0003	0.0003	0.001	0.0003	0.0003	0.0003
Barium	mg/L	0.7	0.1	0.1	0.03	0.03	0.02	0.03	0.03	0.03
Boron	mg/L	4	0.3	0.04	0.01	0.02	0.01	0.01	0.02	0.01
Cadmium	mg/L	0.002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium	mg/L	0.05	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.003
Fluoride	mg/L	1.5	0.3[4]	0.5	0.05	0.05	0.05[4]	0.05	0.09	0.05
Lead	mg/L	0.01	0.002	0.001	0.008	0.003	0.009	0.001	0.003	0.004
Mercury	mg/L	0.001	0.00005	0.00005	0.00005	0.00005	0.00004	0.00005	0.00005	0.00005
Molybdenum	mg/L	0.05	0.003	0.003	0.003	0.003	0.001	0.003	0.003	0.003
Nickel	mg/L	0.02	0.001	0.001	0.001	0.001	0.001	0.001	0.004	0.001
Nitrate	mg/L	50	0.5[4]	1.8	0.5	0.5	0.5[4]	0.5	0.5	0.5
Annual Exposure to Radioactivity	mSv/yr	1	0.003	0.02	GROSS α,β <0.5 BQ/L	GROSS α,β <0.5 BQ/L	GROSS α,β <0.5 BQ/L	0.007	0.005	0.006
Selenium	mg/L	0.1	0.005	0.0005	0.0005	0.0005	0.0004	0.0005	0.0005	0.0005
Silver	mg/L	0.1	0.005	0.005	0.005	0.005	0.003	0.005	0.005	0.005
Uranium	mg/L	0.02	0.009	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Aesthetic Characteristics[2]										
Aluminium	mg/L	0.2	0.01	0.01	0.17	0.01	N/A	0.01	0.04	0.04
Chloride	mg/L	250	28[4]	12	7	9	42[4]	8	40	5
Copper	mg/L	2	0.1	0.01	0.8	0.01	0.06	0.01	0.1	0.03
Hardness	mg/L	200	85[4]	88	7	35	26[4]	9	27	5
Iodine	mg/L	0.15	0.35	0.005	0.005	0.005	0.006	0.005	0.005	0.005
Iron	mg/L	0.3	0.29*	0.66	0.26	0.01	0.25*	0.12	0.03	0.1
Manganese	mg/L	0.1	0.003	0.14	0.003	0.003	0.01	0.003	0.003	0.005
pH	pH Units	6.5-8.5	7.7[4]	7.5	6.2	5.9	5.5[4]	5.7	5.8	6.1
Sodium	mg/L	180	39[4]	14	4	5	19[4]	4	21	7
Sulfate	mg/L	250	11[4]	3	0.3	1	4.4[4]	0.4	6	1
Total Dissolved Solids	mg/L	500	231[4]	140	24	52	73[4]	27	115	33
True Colour	CU	15	N/A	3.6	5.4	0.9	N/A	1	3.5	N/A
Turbidity	NTU	5	N/A	4.45	6.6	0.22	N/A	0.1	0.65	N/A
Zinc	mg/L	3	0.01	0.01	0.04	0.01	0.03	0.01	0.09	0.04
Other Characteristics[2]										
Alkalinity	mg/L	#	130[4]	112	4	7	6.8[4]	6	9	6
Beryllium	mg/L	#	0.0005	0.0005	0.0005	0.0005	0.0003	0.0005	0.0005	0.0005
Bromine	mg/L	#	0.92	0.03	0.01	0.008	0.01	0.02	0.08	0.04
Calcium	mg/L	#	27[4]	21.3	2.6	12.4	5.8[4]	3	5.1	0.8
Conductivity	µS/cm	#	367[4]	258	28	41	141[4]	32	174	52
Magnesium	mg/L	#	4.1[4]	8.4	0.2	1	2.7[4]	0.5	3.5	0.6
Potassium	mg/L	#	5.7[4]	5.23	0.08	0.11	0.79[4]	0.43	0.06	0.54
Silica	mg/L	#	45[4]	33.7	10.5	15.5	8.8[4]	17	11.2	12
Tin	mg/L	#	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005

[1] *95th percentile reported*
[2] *Mean value reported*
[3] *Value includes data from the past 8 years*
[4] *Level represents a single reticulation sample*

* *Mean values reported from all source waters*
\# *no guideline (ADWG 2004) set*
N/A *Value not available*

DRINKING WATER QUALITY IN KATHERINE REGION COMMUNITIES

	Reported unit	ADWG 2004	Amanbidji	Barunga	Beswick	Binjari	Bulla	Bulman[4]	Dagaragu
Health Characteristics[2]									
Antimony	mg/L	0.003	0.00072[1]	0.0001	0.0074[1]	0.0001[1]	0.0001	0.0001	0.0001
Arsenic	mg/L	0.007	0.002[1]	0.0003	0.0079[1]	0.0015[1]	0.002	0.0003	0.002
Barium	mg/L	0.7	0.2[1]	0.03	0.15[1]	0.2[1]	0.37	0.03	0.1
Boron	mg/L	4	0.73[1]	0.01	0.02[1]	0.04[1]	0.06	0.02	0.1
Cadmium	mg/L	0.002	0.0001[1]	0.0001	0.0001[1]	0.0001[1]	0.0001	0.0001	0.0001
Chromium	mg/L	0.05	0.0025[1]	0.003	0.0025[1]	0.0025[1]	0.0025	0.003	0.003
Fluoride	mg/L	1.5	0.3[1]	0.1	0.1	0.4	0.47	0.05	0.29
Lead	mg/L	0.01	0.0016[1]	0.002	0.023[5]	0.0025[1]	0.0005	0.0005	0.002
Mercury	mg/L	0.001	0.00005[1]	0.00005	0.0002[1]	0.00005[1]	0.00005	0.00005	0.00005
Molybdenum	mg/L	0.05	0.0025[1]	0.003	0.0025[1]	0.0025[1]	0.003	0.003	0.003
Nickel	mg/L	0.02	0.002[1]	0.001	0.0025[1]	0.0025[1]	0.001	0.001	0.001
Nitrate	mg/L	50	2.3[1]	0.7	2.4	0.5	1.5	0.5	3.4
Annual Exposure to Radioactivity	mSv/yr	1	0.06	0.003	0.003	0.28	0.3	Gross α,β <0.5 Bq/L	0.3
Selenium	mg/L	0.1	0.0014[1]	0.0005	0.0005[1]	0.001[1]	0.0005	0.0005	0.0005
Silver	mg/L	0.1	0.005[1]	0.005	0.005[1]	0.005[1]	0.005	0.005	0.005
Uranium	mg/L	0.02	0.001[1]	<0.001	0.0003[1]	0.0013[1]	<0.001	<0.001	0.002
Aesthetic Characteristics[2]									
Aluminium	mg/L	0.2	0.01	0.05	0.03	0.02	0.01	0.01	0.01
Chloride	mg/L	250	176	7	5	8	21	9	22
Copper	mg/L	2	0.01	0.01	0.15	0.01	0.01	0.01	0.01
Hardness	mg/L	200	405	169	310	295	250	322	249
Iodine	mg/L	0.15	0.024	0.015	0.006	0.005	0.005	0.005	0.017
Iron	mg/L	0.3	0.21	0.76	0.06	0.07	0.32	0.16*	0.01
Manganese	mg/L	0.1	0.017	0.01	0.018	0.006	0.42	0.003	0.039
pH	pH Units	6.5-8.5	7.8	6.8	7.7	7.6	8	7.8	8
Sodium	mg/L	180	213	6	5	7	13	7	27
Sulfate	mg/L	250	203	2	3	7	1	1	8
Total Dissolved Solids	mg/L	500	1003	194	320	333	255	338	309
True Colour	CU	15	3.7	9.3	4.1	3.3	8.7	3.7	0.9
Turbidity	NTU	5	1.39	1.87	0.27	0.83	3.4	0.26	1.13
Zinc	mg/L	3	0.02	0.03	0.19	0.02	0.005	0.02	0.02
Other Characteristics[2]									
Alkalinity	mg/L	#	480	171	338	322	264	357	295
Beryllium	mg/L	#	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bromine	mg/L	#	0.2	0.03	0.02	0.07	0.09	0.02	0.08
Calcium	mg/L	#	65	34	60	67	33	62	48
Conductivity	µS/cm	#	1667	316	590	594	535	617	598
Magnesium	mg/L	#	60	20	39	32	40	40	31
Potassium	mg/L	#	4.5	1.5	2.2	4.4	3.0	2.5	3.9
Silica	mg/L	#	34	22	24	29	18	25	26
Tin	mg/L	#	0.005	0.005	0.005	0.005	0.005	0.005	0.005

[1] *95th percentile reported*
[2] *Mean value reported*
[3] *Value includes data from the past 8 years*
[4] *Level represents a single reticulation sample*
* *Mean values reported from all source waters*
\# *no guideline (ADWG 2004) set*
N/A *Value not available*
[5] *Two high results from 14 samples. 95th percentile excluding these (n=12) equals 0.002mg/L*

DRINKING WATER QUALITY IN KATHERINE REGION COMMUNITIES

	Reported unit	ADWG 2004	Djilkminggan	Jodetluk	Kalkarindji	Kybrook Farm	Lajamanu	Eva Valley	Minyerri
Health Characteristics[2]									
Antimony	mg/L	0.003	0.0001	0.0001	0.0001	0.0001	0.00074[1]	0.0001	0.0001[1]
Arsenic	mg/L	0.007	0.0005	0.0003	0.0015	0.0045	0.001[1]	0.0003	0.0035[1]
Barium	mg/L	0.7	0.03	0.03	0.1	0.03	0.15[1]	0.03	0.39[1]
Boron	mg/L	4	0.46	0.01	0.12	0.02	0.21[1]	0.01	0.22[1]
Cadmium	mg/L	0.002	0.0001	0.0001	0.0001	0.0001	0.0002[1]	0.0001	0.0001[1]
Chromium	mg/L	0.05	0.003	0.003	0.003	0.003	0.0025[1]	0.003	0.0025[1]
Fluoride	mg/L	1.5	0.5	0.05	0.3	0.79	0.3[1]	0.05[4]	0.3[1]
Lead	mg/L	0.01	0.001	0.001	0.001	0.002	0.0009[1]	0.007	0.003[1]
Mercury	mg/L	0.001	0.00005	0.00005	0.00005	0.00005	0.00005[1]	0.00005	0.00005[1]
Molybdenum	mg/L	0.05	0.003	0.003	0.003	0.003	0.0025[1]	0.003	0.0025[1]
Nickel	mg/L	0.02	0.001	0.001	0.001	0.001	0.007[1]	0.015	0.003[1]
Nitrate	mg/L	50	0.5	0.1	3.4	0.5	8.7[1]	0.5[4]	0.5[1]
Annual Exposure to Radioactivity	mSv/yr	1	0.005	N/A	0.01	GROSS α,β <0.5 BQ/L	0.02	0.008	0.01
Selenium	mg/L	0.1	0.002	0.0005	0.0005	0.0005	0.0048[1]	0.0005	0.0005[1]
Silver	mg/L	0.1	0.005	0.005	0.005	0.005	0.005[1]	0.005	0.005[1]
Uranium	mg/L	0.02	0.01	<0.001	0.002	0.001	0.003[1]	<0.001	<0.001[1]
Aesthetic Characteristics[2]									
Aluminium	mg/L	0.2	0.01	0.01	0.01	0.02	0.01	0.02	0.01
Chloride	mg/L	250	275	7	29	6	147	5.8[4]	13
Copper	mg/L	2	0.02	0.01	0.01	0.01	0.02	0.03	0.03
Hardness	mg/L	200	645	4	262	154	315	2.7[4]	68
Iodine	mg/L	0.15	0.22	0.005	0.02	0.01	0.19	0.01	0.005
Iron	mg/L	0.3	0.22	0.04	0.01	0.02	0.05	0.26	1.11
Manganese	mg/L	0.1	0.025	0.003	0.003	0.033	0.003	0.003	0.24
pH	pH Units	6.5-8.5	7.6	7.2	8	7.7	7.8	5.3[4]	6.6
Sodium	mg/L	180	233	6	36	48	89	3.3[4]	17
Sulfate	mg/L	250	240	0.2	13	3	62	0.16[4]	8
Total Dissolved Solids	mg/L	500	1350	22	356	281	660	33[4]	143
True Colour	CU	15	6	3.4	0.5	1.1	1.4	N/A	4.8
Turbidity	NTU	5	2.39	0.25	0.59	0.72	0.24	N/A	7.18
Zinc	mg/L	3	0.01	0.05	0.01	0.01	0.02	0.09	0.02
Other Characteristics[2]									
Alkalinity	mg/L	#	530	8	314	259	264	4.7[4]	87
Beryllium	mg/L	#	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bromine	mg/L	#	0.99	0.008	0.11	0.03	0.41	0.02	0.03
Calcium	mg/L	#	100	0.7	52	26	49	0.18[4]	15
Conductivity	µS/cm	#	2100	40	669	486	1063	32[4]	229
Magnesium	mg/L	#	96.5	0.5	32	22	46.8	0.55[4]	8
Potassium	mg/L	#	29	0.35	4.37	1.65	8.94	0.44[4]	3.6
Silica	mg/L	#	121	17	26	42	104	21[4]	27
Tin	mg/L	#	0.005	0.005	0.005	0.005	0.005	0.005	0.005

[1] *95th percentile reported*
[2] *Mean value reported*
[3] *Value includes data from the past 8 years*
[4] *Level represents a single reticulation sample*

* *Mean values reported from all source waters*
\# *no guideline (ADWG 2004) set*
N/A *Value not available*

DRINKING WATER QUALITY IN KATHERINE REGION COMMUNITIES

	Reported unit	ADWG 2004	Ngukurr	Pigeon Hole[4]	Rittarangu[4]	Robinson River	Weemol	Yarralin
Health Characteristics[2]								
Antimony	mg/L	0.003	0.0001[1]	0.0001	0.0001	0.0001	0.0001	0.0001
Arsenic	mg/L	0.007	0.00085[1]	0.0003	0.0003	0.0003	0.0003	0.0015
Barium	mg/L	0.7	0.8[1]	0.03	0.15	1.14	0.03	0.7
Boron	mg/L	4	0.04[1]	0.08	0.04	0.12	0.04	0.08
Cadmium	mg/L	0.002	0.0001[1]	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium	mg/L	0.05	0.0025[1]	0.003	0.003	0.003	0.003	0.003
Fluoride	mg/L	1.5	0.2	0.3	0.1	0.9	0.19	0.1
Lead	mg/L	0.01	0.003[1]	0.001	0.001	0.001	0.001	0.001
Mercury	mg/L	0.001	0.00005[1]	0.00005	0.00005	0.00005	0.00005	0.00005
Molybdenum	mg/L	0.05	0.0025[1]	0.003	0.003	0.003	0.003	0.003
Nickel	mg/L	0.02	0.001[1]	0.001	0.001	0.004	0.001	0.001
Nitrate	mg/L	50	1	16	3	6	1	6
Annual Exposure to Radioactivity	mSv/yr	1	0.004	0.004	0.004	0.05	0.004	0.2
Selenium	mg/L	0.1	0.0017[1]	0.0005	0.0005	0.0005	0.0005	0.001
Silver	mg/L	0.1	0.005[1]	0.005	0.005	0.005	0.005	0.005
Uranium	mg/L	0.02	0.001[1]	0.002	0.001	0.003	<0.001	0.002
Aesthetic Characteristics[2]								
Aluminium	mg/L	0.2	0.02	0.01	0.01	0.01	0.01	0.01
Chloride	mg/L	250	343	9	70	31	9	23
Copper	mg/L	2	0.11	0.01	0.06	0.01	0.01	0.01
Hardness	mg/L	200	576	214	291	547	366	396
Iodine	mg/L	0.15	0.013	0.02	0.01	0.028	0.007	0.037
Iron	mg/L	0.3	0.42	0.41*	0.01	0.02	0.01	0.03
Manganese	mg/L	0.1	0.01	0.003	0.003	0.003	0.003	0.018
pH	pH Units	6.5-8.5	7.8	7.5	7.8	7.5	7.5	7.5
Sodium	mg/L	180	90	16	28	19	8	25
Sulfate	mg/L	250	39	6	4	6	0.2	9
Total Dissolved Solids	mg/L	500	984	267	381	568	393	474
True Colour	CU	15	9.6	21	1.1	2.3	4.5	4.5
Turbidity	NTU	5	4.91	14[4]	0.1	0.39	0.28	0.23
Zinc	mg/L	3	0.02	0.01	0.04	0.02	0.01	0.12
Other Characteristics[2]								
Alkalinity	mg/L	#	314	228	286	539	395	425
Beryllium	mg/L	#	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bromine	mg/L	#	1.2	0.09	0.19	0.08	0.02	0.17
Calcium	mg/L	#	101.8	48.5	53	47.2	65.8	75.3
Conductivity	µS/cm	#	1620	453	724	988	677	834
Magnesium	mg/L	#	80	22.4	39	105.2	49.2	51
Potassium	mg/L	#	6.38	1.57	2.7	4.04	2.73	2.9
Silica	mg/L	#	26.6	45.5	24	35.8	34.3	41.7
Tin	mg/L	#	0.005	0.005	0.005	0.005	0.005	0.005

[1] *95th percentile reported*
[2] *Mean value reported*
[3] *Value includes data from the past 8 years*
[4] *Level represents a single reticulation sample*

* *Mean values reported from all source waters*
\# *no guideline (ADWG 2004) set*
N/A *Value not available*

DRINKING WATER QUALITY IN BARKLY REGION COMMUNITIES

	Reported unit	ADWG 2004	Ali Curung	Alpurrurulam	Canteen Creek	Epenarra[4]	Imangara[4]	Nturiya	Tara[4]	Willowra	Wilora
Health Characteristics[2]											
Antimony	mg/L	0.003	0.0004	0.0004	0.0001	0.0001	0.0001	0.0004[1]	0.0001	0.0001	0.0004[1]
Arsenic	mg/L	0.007	0.0025	0.0015	0.0003	0.001	0.001	0.0018[1]	0.0003	0.002	0.002[1]
Barium	mg/L	0.7	0.05	0.1	0.1	0.2	0.5	0.05[1]	0.03	0.05	0.05[1]
Boron	mg/L	4	0.72	0.26	0.22	0.18	0.28	0.644[1]	0.42	0.44	0.68[1]
Cadmium	mg/L	0.002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001[1]	0.0002	0.0001	0.0001[1]
Chromium	mg/L	0.05	0.003	0.003	0.003	0.003	0.003	0.0025[1]	0.003	0.003	0.0025[1]
Fluoride	mg/L	1.5	1.9	1.57	0.6	0.4	0.8	0.96	0.9	0.8	0.9
Lead	mg/L	0.01	0.001	0.001	0.002	0.001	0.001	0.0017[1]	0.001	0.001	0.0017[1]
Mercury	mg/L	0.001	0.00009	0.00005	0.00005	0.00005	0.00005	0.00005[1]	0.00005	0.00005	0.00005[1]
Molybdenum	mg/L	0.05	0.003	0.003	0.003	0.003	0.003	0.0025[1]	0.003	0.003	0.0025[1]
Nickel	mg/L	0.02	0.001	0.002	0.006	0.001	0.001	0.002[1]	0.006	0.001	0.0031[1]
Nitrate	mg/L	50	76.9	2.6	4	8.7	9.1	44.6	22	35.7	17
Annual Exposure to Radioactivity	mSv/yr	1	0.01	0.005	0.01	0.006	0.02	N/A	0.02	0.02	0.003
Selenium	mg/L	0.1	0.0036	0.002	0.00095	<0.001	0.0005	0.0053[1]	0.002	0.0038	0.006[1]
Silver	mg/L	0.1	0.005	0.005	0.005	0.005	0.005	0.005[1]	0.005	0.005	0.005[1]
Uranium	mg/L	0.02	0.011	0.011	0.002	0.001	0.013	0.02[1]	0.004	0.026	0.025[1]
Aesthetic Characteristics[2]											
Aluminium	mg/L	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Chloride	mg/L	250	220	200	100	80	21	350	355	178	456
Copper	mg/L	2	0.01	0.3	0.04	0.02	0.01	0.02	0.01	0.02	0.05
Hardness	mg/L	200	249	497	168	174	285	334	348	253	633
Iodine	mg/L	0.15	0.358	0.175	0.163	0.12	0.1	0.331	0.34	0.288	0.4
Iron	mg/L	0.3	0.04	0.01	0.13	0.1*	0.05*	0.09	0.02	0.04	0.09
Manganese	mg/L	0.1	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.014
pH	pH Units	6.5-8.5	8.2	7.7	7.4	7.7	8	7.7	7	8.2	7.8
Sodium	mg/L	180	235	156	100	62	36	253	220	140	311
Sulfate	mg/L	250	110	96	42	27	11	200	160	81	244
Total Dissolved Solids	mg/L	500	982	939	544	419	468	1200	1000	759	1730
True Colour	CU	15	5	2.1	3.2	N/A	N/A	3.8	N/A	3.4	2.8
Turbidity	NTU	5	0.32	0.2	0.98	N/A	N/A	0.24	N/A	0.21	0.14
Zinc	mg/L	3	0.01	0.02	0.03	0.01	0.01	0.03	0.04	0.03	0.03
Other Characteristics[2]											
Alkalinity	mg/L	#	344	479	288	177	340	228	210	249	399
Beryllium	mg/L	#	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bromine	mg/L	#	0.89	0.67	0.53	0.42	0.17	1.92	1.53	1.11	2.51
Calcium	mg/L	#	34	64.7	30.6	32	46.0	82.4	44	50.4	99.4
Conductivity	µS/cm	#	1575	1571	916	629	693	1830	1650	1213	2640
Magnesium	mg/L	#	39.5	81.7	36.4	23	42	31.2	58	30.9	93.6
Potassium	mg/L	#	54.5	8.09	13.8	14	35	26.2	31	32.75	63
Silica	mg/L	#	64	71.7	64.8	87	81	88.6	21	88.9	93.2
Tin	mg/L	#	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005

[1] *95th percentile reported*
[2] *Mean value reported*
[3] *Value includes data from the past 8 years*
[4] *Level represents a single reticulation sample*

* *Mean values reported from all source waters*
\# *no guideline (ADWG 2004) set*
N/A *Value not available*

DRINKING WATER QUALITY IN SOUTHERN REGION COMMUNITIES

	Reported unit	ADWG 2004	Ampilatwatja	Areyonga	Atitjere	Engawala	Finke	Haasts Bluff	Hermannsburg[3]
Health Characteristics[2]									
Antimony	mg/L	0.003	0.0004	0.0001	0.0002	0.0001	0.0001	0.0013	0.0001
Arsenic	mg/L	0.007	0.0003	0.003	0.0003	0.0005	0.0005	0.0009	0.0003
Barium	mg/L	0.7	0.03	0.1	0.1	0.1	0.15	0.03	0.03
Boron	mg/L	4	0.29	0.22	0.18	0.18	0.08	0.32	0.14
Cadmium	mg/L	0.002	0.0001	0.0008	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium	mg/L	0.05	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Fluoride	mg/L	1.5	1.1	0.4	0.6[4]	0.69	0.2	0.5	0.4
Lead	mg/L	0.01	0.002	0.008	0.008	0.001	0.001	0.003	0.001
Mercury	mg/L	0.001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Molybdenum	mg/L	0.05	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Nickel	mg/L	0.02	0.003	0.01	0.001	0.001	0.001	0.001	0.001
Nitrate	mg/L	50	26	6.3	28[4]	12.6	7.7	7.3	4.4
Annual Exposure to Radioactivity	mSv/yr	1	0.004	0.02	0.002	0.001	N/A	0.004	0.005
Selenium	mg/L	0.1	0.002	0.004	0.003	0.003	0.00095	0.002	0.0005
Silver	mg/L	0.1	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Uranium	mg/L	0.02	0.008	0.011	0.007	0.005	0.003	0.01	0.005
Aesthetic Characteristics[2]									
Aluminium	mg/L	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Chloride	mg/L	250	164	114	118[4]	164	150	359	113
Copper	mg/L	2	0.01	0.05	0.05	0.02	0.03	0.04	0.01
Hardness	mg/L	200	492	435	294[4]	405	189	578	335
Iodine	mg/L	0.15	0.18	0.12	0.1	0.15	0.03	0.23	0.11
Iron	mg/L	0.3	0.03	0.11	0.17	0.08	0.16	0.12	0.25
Manganese	mg/L	0.1	0.003	0.003	0.003	0.003	0.003	0.003	0.003
pH	pH Units	6.5-8.5	7.8	8.3	7.9[4]	8.4	7.8	7.9	8.2
Sodium	mg/L	180	120	63	120[4]	98	88	171	65
Sulfate	mg/L	250	228	79	160[4]	76	58	263	66
Total Dissolved Solids	mg/L	500	993	669	704[4]	762	480	1293	585
True Colour	CU	15	2.8	0.5	N/A	4.1	3	5.2	3.7
Turbidity	NTU	5	0.18	0.33	N/A	0.1	0.38	0.98	1.7
Zinc	mg/L	3	0.04	0.17	0.04	0.03	0.02	0.13	0.05
Other Characteristics[2]									
Alkalinity	mg/L	#	307	326	221[4]	339	126	238	271
Beryllium	mg/L	#	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bromine	mg/L	#	0.93	0.17	0.77	1.02	0.19	1.31	0.65
Calcium	mg/L	#	106	77.7	48[4]	68.7	54.7	107.1	64
Conductivity	µS/cm	#	1480	1083	1150[4]	1300	853	1957	993
Magnesium	mg/L	#	55.8	58.3	42[4]	56.7	12.7	75	42.7
Potassium	mg/L	#	25.4	9.2	9.2[4]	7.7	6.8	27.86	6.83
Silica	mg/L	#	40.8	19.7	35[4]	73.3	16.7	46.6	15.3
Tin	mg/L	#	0.005	0.005	0.005	0.005	0.005	0.005	0.0001

[1] *95th percentile reported*
[2] *Mean value reported*
[3] *Value includes data from the past 8 years*
[4] *Level represents a single reticulation sample*

* *Mean values reported from all source waters*
\# *no guideline (ADWG 2004) set*
N/A *Value not available*

DRINKING WATER QUALITY IN SOUTHERN REGION COMMUNITIES

	Reported unit	ADWG 2004	Imanpa	Kaltukatjara	Kintore	Laramba	Mt Liebig	Nyirripi	Papunya
Health Characteristics[2]									
Antimony	mg/L	0.003	0.0001	0.0001	0.00052[1]	0.0001	0.0001	0.0001	0.0002[1]
Arsenic	mg/L	0.007	0.0014	0.0003	0.0015[1]	0.001	0.0005	0.0015	0.0025[1]
Barium	mg/L	0.7	0.03	0.03	0.05[1]	0.3	0.05	0.1	0.1[1]
Boron	mg/L	4	0.78	0.14	0.29[1]	0.42	0.24	0.32	0.42[1]
Cadmium	mg/L	0.002	0.0001	0.0001	0.0001[1]	0.0001	0.0001	0.0001	0.0001[1]
Chromium	mg/L	0.05	0.005	0.003	0.0025[1]	0.003	0.003	0.003	0.0025[1]
Fluoride	mg/L	1.5	0.9[4]	0.4	0.8[1]	1.1	1.13	1.6	0.97[1]
Lead	mg/L	0.01	0.001	0.002	0.002[1]	0.007	0.004	0.001	0.0005[1]
Mercury	mg/L	0.001	0.00005	0.00005	0.00008[1]	0.00005	0.00005	0.00005	0.00005[1]
Molybdenum	mg/L	0.05	0.003	0.003	0.0025[1]	0.003	0.003	0.003	0.0025[1]
Nickel	mg/L	0.02	0.004	0.001	0.0052[1]	0.003	0.006	0.001	0.002[1]
Nitrate	mg/L	50	30[4]	0.5	95.6[1]	28	13.5	32	19.7[1]
Annual Exposure to Radioactivity	mSv/yr	1	0.07	0.01	0.003	N/A	0.005	N/A	0.001
Selenium	mg/L	0.1	0.008	0.0005	0.0046[1]	0.003	0.0028	0.002	0.008[1]
Silver	mg/L	0.1	0.005	0.005	0.005[1]	0.005	0.005	0.009	0.005[1]
Uranium	mg/L	0.02	0.012	<0.00001	0.0017[1]	0.044	0.006	0.01	0.024[1]
Aesthetic Characteristics[2]									
Aluminium	mg/L	0.2	0.01	0.01	0.03	0.01	0.02	0.01	0.01
Chloride	mg/L	250	374[4]	86	117	103	120	104	202
Copper	mg/L	2	0.01	0.01	0.23	0.21	0.02	0.01	0.02
Hardness	mg/L	200	451[4]	282	464	276	284	244	265
Iodine	mg/L	0.15	0.57	0.1	0.16	0.31	0.25	0.18	0.26
Iron	mg/L	0.3	0.07	0.14	0.05	0.08	0.13	0.06	0.09
Manganese	mg/L	0.1	0.007	0.005	0.003	0.006	0.003	0.003	0.003
pH	pH Units	6.5-8.5	8.2[4]	8.4	7.8	7.9	7.9	8.2	8.2
Sodium	mg/L	180	230[4]	55	100	73	103	88	239
Sulfate	mg/L	250	240[4]	64	71	36	107	40	93
Total Dissolved Solids	mg/L	500	1300[4]	448	875	639	626	615	951
True Colour	CU	15	N/A	3.9	2	3.8	0.5	N/A	2.7
Turbidity	NTU	5	N/A	0.9	0.25	0.29	0.18	0.25	0.22
Zinc	mg/L	3	0.09	0.02	0.06	0.29	0.02	0.01	0.01
Other Characteristics[2]									
Alkalinity	mg/L	#	203[4]	246	411	308	265	270	437
Beryllium	mg/L	#	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bromine	mg/L	#	1.99	0.62	1.02	0.59	0.46	0.3	1.23
Calcium	mg/L	#	89[4]	53.7	70	55.4	62.7	47.2	53.6
Conductivity	µS/cm	#	1850[4]	839	1313	1019	1083	970	1586
Magnesium	mg/L	#	56[4]	36	70.1	33.4	31	30.8	31.7
Potassium	mg/L	#	33[4]	11.33	5.39	38.2	14	28.4	11.71
Silica	mg/L	#	29[4]	12.3	92.9	94.6	50.3	94.6	65.9
Tin	mg/L	#	0.005	0.005	0.005	0.005	0.005	0.005	0.005

[1] *95th percentile reported*
[2] *Mean value reported*
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[4] *Level represents a single reticulation sample*

* *Mean values reported from all source waters*
\# *no guideline (ADWG 2004) set*
N/A *Value not available*

DRINKING WATER QUALITY IN SOUTHERN REGION COMMUNITIES

	Reported unit	ADWG 2004	Pmara Jutunta	Santa Teresa[4]	Titjikala[4]	Wallace Rockhole[4]	Yuelamu	Yuendumu
Health Characteristics[2]								
Antimony	mg/L	0.003	0.0001	0.0001	0.0001	0.0001	0.0001	0.00025
Arsenic	mg/L	0.007	0.001	0.0003	0.001	0.0005	0.001	0.00025
Barium	mg/L	0.7	0.1	0.5	0.3	0.03	0.05	0.04
Boron	mg/L	4	0.3	0.06	0.1	0.3	0.12	0.25
Cadmium	mg/L	0.002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium	mg/L	0.05	0.003	0.003	0.003	0.015	0.003	0.0025
Fluoride	mg/L	1.5	0.8[1]	0.2	0.5	0.6	0.5[4]	0.6
Lead	mg/L	0.01	0.001	0.001	0.001	0.002	0.007	0.001
Mercury	mg/L	0.001	0.00005	0.00005	0.00005	0.00005	0.00005	0.00006
Molybdenum	mg/L	0.05	0.003	0.003	0.003	0.003	0.003	0.0025
Nickel	mg/L	0.02	0.001	0.001	0.001	0.001	0.001	0.001
Nitrate	mg/L	50	54.2[1]	9.8	19	8.9	0.5[4]	3.4
Annual Exposure to Radioactivity	mSv/yr	1	N/A	0.15	N/A	0.01	0.001	0.008
Selenium	mg/L	0.1	0.002	0.002	0.001	0.003	0.0005	0.0006
Silver	mg/L	0.1	0.005	0.005	0.005	0.005	0.005	0.005
Uranium	mg/L	0.02	0.008	0.007	0.004	0.004	0.006	0.009
Aesthetic Characteristics[2]								
Aluminium	mg/L	0.2	0.01	0.01	0.01	0.01	0.29	0.01
Chloride	mg/L	250	68	9	28	77	44[4]	135
Copper	mg/L	2	0.02	0.01	0.01	0.01	0.02	0.02
Hardness	mg/L	200	211	255	239	265	95[4]	210
Iodine	mg/L	0.15	0.135	0.030	0.040	0.190	0.120	0.22
Iron	mg/L	0.3	0.03	0.05*	0.05*	0.05*	0.08	0.04
Manganese	mg/L	0.1	0.003	0.003	0.003	0.003	0.035	0.01
pH	pH Units	6.5-8.5	7.9	7.7	7.8	7.8	7.9[4]	8.2
Sodium	mg/L	180	68	6	32	70	53[4]	108
Sulfate	mg/L	250	54	11	15	31	86[4]	96
Total Dissolved Solids	mg/L	500	521	322	353	507	268[4]	540
True Colour	CU	15	2.9	N/A	N/A	N/A	N/A	3.7
Turbidity	NTU	5	0.6	N/A	N/A	N/A	N/A	2.2
Zinc	mg/L	3	0.01	0.01	0.01	0.09	0.11	0.09
Other Characteristics[2]								
Alkalinity	mg/L	#	219	262	228	292	66[4]	191
Beryllium	mg/L	#	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bromine	mg/L	#	0.48	0.078	0.156	0.608	0.28[4]	1.22
Calcium	mg/L	#	48	62	68	58	28[4]	39.3
Conductivity	µS/cm	#	775	531	566	858	455[4]	975
Magnesium	mg/L	#	22.3	24	17	29	5.9[4]	27
Potassium	mg/L	#	19.11	4.2	4.6	7.7	4.2[4]	14.67
Silica	mg/L	#	102	18	31	41	3.1[4]	15.7
Tin	mg/L	#	0.005	0.005	0.005	0.005	0.005	0.005

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