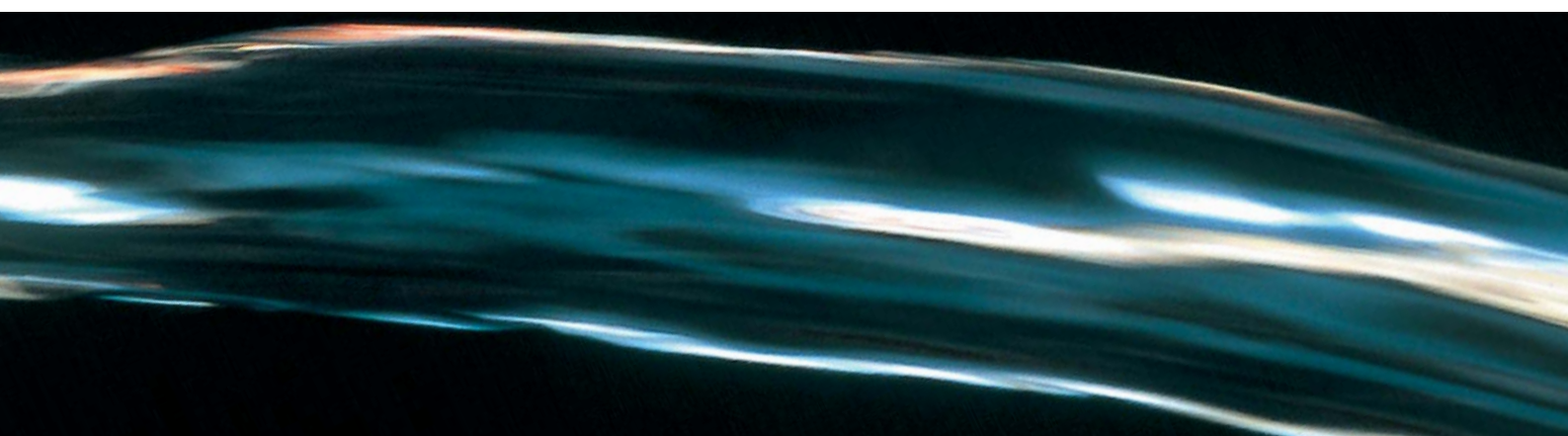
Power and Water Corporation

Water Quality Report 2004



Looking after our water...it's what we do.

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Message from the Managing Director

The provision of safe, good, quality drinking water is the highest priority of our water supply business. Thus, I am pleased to present Power and Water's third public report on the quality of drinking water in urban centres throughout the Northern Territory.

This report includes microbiological, chemical, and physical data on all our urban supplies, and how they compare with the Australian Drinking Water Guidelines. Radiological data has also been included in this report for the first time.

The water supply industry has eagerly been awaiting the release of the new Australian Drinking Water Guidelines, which have been in draft for the last year. Unfortunately, administrative arrangements have delayed their release, and we may not see the new guidelines until 2005.

We are however, very familiar with the proposed structure of the guidelines and their emphasis on proactive and preventive measures to protect drinking water quality. This does not reduce the importance of water quality sampling, but recognises that the risk from potential microbiological contamination must be prevented. Once it is detected, it is too late.

Disinfection using chlorination is a key preventive strategy used by Power and Water to protect water quality while it is being delivered to consumers. We have invested heavily in upgrading chlorination systems throughout the Northern Territory this year, and will complete this program in the coming year.

I am proud of the work we do to continually improve the safety and quality of our drinking water supplies, and the dedication and commitment of our people. We are proud to present our past performance and future strategies to ensure drinking water remains safe.

Kim Wood
Managing Director
Power and Water Corporation

Section 1: Commitment to Drinking Water Quality Management

Power and Water is committed to being a trusted provider of safe, good quality drinking water. Our commitment is outlined in our Drinking Water Policy and Customer Contract. A copy of the Customer Contract is available at any Power and Water Office or at www.powerwater.com.au.

Power and Water's Drinking Water Quality Policy

Power and Water aims to provide a good quality, safe and reliable drinking water supply. To achieve this aim Power and Water undertakes to:

- Supply drinking water appropriate to the environment in which the community is located, to standards in accordance with parameters set by drinking water guidelines
- Develop a drinking water monitoring program in consultation with the Department of Health and Community Services (DHCS), monitor the quality of drinking water supplies in accordance with the agreed program, and report annually to the Chief Health Officer
- Implement and maintain a Drinking Water Quality Management System consistent with the 1996 Australian Drinking Water Guidelines, to minimise risks to drinking water quality at all points along the delivery chain from source water to the consumer
- Ensure that all managers, employees and contractors involved in the supply of drinking water understand and implement the Drinking Water Quality Management System
- Develop and maintain a register of water quality incidents and complaints to benchmark performance and to assist in the identification and resolution of water quality issues
- Develop appropriate contingency and incident response plans to deal effectively with incidents that may adversely affect drinking water quality, including implementation of any emergency precautions notified by the Chief Health Officer, to ensure safety of supply
- Participate in the Cooperative Research Centre for Water Quality and Treatment, to identify issues and research priorities for water quality in regional and rural areas
- Annually assess performance with respect to this policy, review our practices in conjunction with DHCS and consult with the community on water quality issues requiring attention.

A cornerstone of our commitment to drinking water quality is our adoption and progressive implementation of the *Framework for Management of Drinking Water Quality* developed by the National Health and Medical Research Council for future inclusion in the Australian Drinking Water Guidelines.

The basis of this framework is the adoption of a proactive approach to ensuring the safety of water supplies. This report is based on the principles outlined in the framework and reports on our progress to date in the framework and continuously improving of our existing systems and procedures.

While Power and Water has primary responsibility for providing safe drinking water, a number of Government agencies are also involved. DHCS has a key role in setting goals for drinking water quality and in monitoring compliance with those objectives in the interest of public health.

At the end of 2003, DHCS introduced national *Food Act* legislation. This Act recognised water as a food, and this potentially covers water supplies. In the Northern Territory however, the Chief Health Officer recognised that Power and Water is already adequately legislated under the *Water Supply*

and Sewerage Services Act and thus has approved the exemption of Power and Water under Seciton 72 of the *Food Act.*

The Department of Business, Industry and Resource Development independently analyses water samples we provide to its laboratories in Darwin and Alice Springs.

The Department of Infrastructure, Planning and Environment also plays a major role in protecting water quality through land use planning and pollution control.

It is only through the coordination and cooperation of all of these agencies that the water quality objectives of all Territorians will be achieved and maintained now and in the future.

Donkey Camp Pool on the Katherine River forms part of the Katherine Water Supply System.

Section 2: Assessment of the Drinking Water Supply System

From the tropical north to the arid centre, Power and Water has to deal with a range of challenges to deliver good quality water.

Most of Darwin's water supply comes from Darwin River Dam. To ensure good quality water, no development or public access is allowed in the catchment. The reservoir is recharged during the monsoonal wet season (November to April) and is drawn down through the dry season (May to October). This supply is supplemented with about 10% groundwater from the McMinns and Howard East Borefields.

Apart from Darwin, Katherine and Pine Creek, most other centres rely almost exclusively on groundwater, particularly in the arid centre. In some cases the groundwater is over 10 000 years old. Table 1 outlines existing water sources for the major and minor centres in the Northern Territory.

Most source waters need some form of treatment to purify the water and make it safe for drinking. More details on treatment are in Section 3.

Power and Water has an understanding of water quality issues throughout the Territory. We are continually reviewing strategies to address all issues, in conjunction with the Department of Health and Community Services.

At the end of the 2003-2004 year, Power and Water received a licence from the Utilities Commissioner to provide water supply services to Cox Peninsula. To improve the reliability of the water supply in Cox Peninsula, a new borefield was identified in 2003 and determined suitable for provision of drinking water supply. This borefield will be developed in 2004-2005. The new supply will help ensure a reliable and good quality water supply and will be reported in future water quality reports.

Table 1: Summary of Existing Water Sources in Major and Minor Centres

Location	Source
Adelaide River	Bore water
Alice Springs	Bore water
Batchelor	Bore water
Borroloola	Bore water
Daly Waters	Bore water
Darwin	Surface water (Darwin River Dam) + Bore Water (10%)
Elliott	Bore water
Katherine	Surface water (Katherine River) + Bore water (20%)
Kings Canyon	Bore water
Larrimah	Bore water
Mataranka	Bore water
Newcastle Waters	Bore water
Pine Creek	Surface water (Copperfield Dam) + Bore water (40%)
Tennant Creek	Bore water
Timber Creek	Bore water
Ti Tree	Bore water
Yulara	Bore water

McMinns Borefield in the Darwin Rural Area.

Section 3: Preventative Strategies for Drinking Water Supply

The adoption of preventive strategies to protect drinking water supplies is based on the barrier principle. This means using appropriate barriers to minimise the potential for water supply contamination. The barrier principle is one of the key elements of the Framework for Management of Drinking Water Quality, developed under the Australian Drinking Water Guidelines. The following table summarises the current barriers used in major and minor centres.

Table 2: Water Quality Barriers in Major and Minor Centres

	Source Protection	Detention in Protected Reservoirs	Selected Use of Alternative Sources	Coagulation, Filtration or Membrane Filtration	Disinfection with Chlorine Residual	Protection and Maintenance of Distribution Systems
Adelaide River					■	■
Alice Springs	■				■	■
Batchelor					■	■
Borroloola					■	■
Daly Waters					■	■
Darwin[1]	■	■	■		■	■
Elliott					■	■
Katherine [2]	▒	▒	■	■	■	■
Kings Canyon					■	■
Mataranka					■	■
Newcastle Waters					■	■
Pine Creek[2]	▒	▒	■	▒	■	■
Tennant Creek						■
Timber Creek					■	■
Ti Tree					■	■
Yulara				■	■	■

Notes:
1. Applies to Darwin River Dam. Negotiations are under way to fully protect the new Howard East Borefield as a reserve under Section 74 of the *Territory Parks and Wildlife Conservation Act*.
2. Light blue indicates only a partially effective barrier. Blue area indicates fully effective barrier.

This table shows that all centres, except for Tennant Creek, have at least two barriers to contamination. All major centres have at least three barriers and those centres that rely on surface water supplies, which are more vulnerable, have additional barriers. Each of these barriers is discussed in more detail below.

Source Protection

Source protection is the first, and in many ways the most important barrier for protection of water quality. Over the last year we have focussed on source protection in Pine Creek, Katherine and Darwin. Particular attention has been given to fire management at Darwin River Dam and land management at the McMinns borefield. Satellite imagery has been used to compile a six-year fire history for the Manton and Darwin River Dam catchments. This method distinguishes early and late dry season fires, which can have dramatically different effects in terms of water quality and general catchment health.

On average, 65% of the Darwin River Dam catchment burns each year. The percentage is higher for certain woodland vegetation types (the highest being 86% per year for the low open woodlands). Late or hot fires average 13% per year. As with total fires, woodlands experience more late fires, (78% of low open woodland that have had at least one late season fire). The areas most prone to late fires are in the extreme south of the Manton Dam catchment, next to the Stuart Highway and the southern part of the Darwin River Dam Catchment.

Using this analysis of the historical fire regime, Power and Water Corporation in conjunction the NT Bushfires Council has implemented a fire management regime aimed at reducing the area of the catchment burnt to about 40%, and the number of later dry season fires to not more than 10%. Fire sensitive vegetation types, such as the spring fed rainforests, need special protection and have appropriate management regimes aimed at limiting the area burned to 5% per year. A new fire management regime was implemented in 2003-2004. It is an adaptive approach that protects the fire sensitive vegetation, but still incorporates significant preventive fire management to protect the catchment from illegally lit fires that can affect water quality and catchment health.

The McMinns Borefield provides about 10% of the potable water supply capacity to Darwin. There are six production bores with production rates from about three to five million litres per day, per bore. Two of these production bores are subject to immediate planning development pressures and a third is subject to medium-term development pressure.

Power and Water has had an informal policy of a 400 metres exclusion zone surrounding production bores to reduce potential for septic leachate interacting with these bores. There was little scientific basis for this protection zone, and hence this needed review.

Discharge from septic tanks contains domestic and human waste including bacteria, viruses, nutrients (chiefly ammonia, nitrogen and phosphorus) and a range of organic compounds.

A study on the potential for viral and bacterial contamination from septic tanks indicated that an exclusion zone of 400 metres, would be required to achieve a travel time in excess of 100 days at a pumping rate of 4 ML/d (million litres per day).

It was also recommended that the Exclusion Zone (EZ) be accompanied by a complementary Active Management Zone (AMZ) of a further 200 metres (400 metres to 600 metres from bores). It is proposed that within the AMZ the placement of all bores and domestic septic systems would require demonstrated compliance with all design, construction and operational practises to provide a suitable protection to public water supplies.

Discussions are currently occurring with Department of Infrastructure, Planning and Environment on how to implement the recommended protection zones around the existing bores. This is a strong indication of Power and Water's commitment to proactive and preventative risk management strategies for protection of water supplies.

Detention in Protected Reservoirs

The amount of time water is held in surface water supply reservoirs is a key element to maintaining good water quality. A long detention time allows sediment to settle, improving the clarity of the water, and enables the water to undergo natural disinfection through exposure to solar radiation. On average water in Darwin River Dam has a detention time of up to six years before being used for supply. Detention in deep aquifers (groundwater storage) is usually between 10 to 100 years.

Selected Use of Alternative Sources

Surface water and groundwater supplies vary in their quantity and quality throughout the Territory. Developing and using alternative sources allows greater flexibility in their management and use. For example, different sources can be blended to improve the overall water quality of individual sources, or seasonal changes in surface water supplies can lead to a greater reliance on groundwater at different times. Alternative sources are also an important strategy for enabling continuity of supplies in emergency situations.

Coagulation, Filtration or Membrane Filtration

Power and Water manages two major water treatment plants: a reverse osmosis treatment plant for desalination of groundwater supplies at Yulara and a coagulation filtration plant at Katherine.

Coagulation filtration is used to remove dirt, bacteria and other materials from water. It is a key treatment process for surface water supplies, which may not be adequately protected at their source.

Most of Katherine's water supply comes from flows in the Katherine River. This quality of the river water is highly variable and therefore requires filtration to ensure a high quality water supply throughout the year.

The amount of time water is held in surface water supply reservoirs is a key element to maintaining good water quality.

Disinfection with Chlorine Residual

A disinfection control barrier is an essential component of good water quality management. We see this as a high priority in protecting water supplies microbiologically and maintaining good quality water throughout the distribution system.

A major challenge for water suppliers is how to balance the risks from disease causing organisms and the potential for disinfection by-products. Section 5 contains further information on disinfection by-products.

Disinfection systems exist in all the major and minor centres, except Tennant Creek. Power and Water uses chlorine, because it is simple and effective.

We are in the process of upgrading all our chlorine dosing facilities to improve their reliability and control. All chlorine dosing facility upgrades will be completed in 2004-2005.

Maintenance inspection at the Katherine Water Treatment Plant.

Protection and Maintenance of Distribution Systems

Protecting water supply distribution systems is a key element to ensuring good water quality. Any breaks in the water supply main are isolated and repaired before being chlorinated, flushed and reconnected to the water supply system. This minimises any potential contamination from entering the distribution system. Any new mains that are built are also disinfected before use.

The water supply system is routinely flushed due to seasonal changes in demand and water quality. This ensures a continual supply of good quality water is being distributed to customers.

All storage tanks are covered with a roof to minimise contamination from birds or animals as well as dirt, leaves and other matter. Special flaps help prevent frogs from entering the tanks. The tanks are routinely cleaned to remove any sediment accumulated on the bottom of the tank.

Hazard Analysis Critical Control Point (HACCP)

Hazard Analysis Critical Control Point (HACCP) is an internationally recognised risk management framework. It is widely used in food production to ensure its safety and suitability for consumption. It enables suppliers and producers to recognise risks as well as providing a framework for auditing water quality measures. Australia has led the world in applying HACCP to protecting water quality. It is a logical and structured approach and aligns with the principles of the Australian Drinking Water Guidelines.

In April 2004 we started a 12 month implementation trial of an operational HACCP plan for the Katherine water supply system. This project will focus on improvements in system operation and management.

Power and Water has also awarded a scholarship to a student from Charles Darwin University to undertake a study on the risks to water quality in the Katherine drinking water supply catchment area. This risk assessment is expected to be finalised in June 2005.

Over the coming year it is proposed to start the application of HACCP to the Tennant Creek water supply system. This will help to identify and strengthen the barriers to potential contamination in Tennant Creek given the lack of disinfection residual.

Water tank at Tennant Creek.

Donkey Camp Weir on the Katherine River.

Section 4: Operational Procedures and Process Control

Operational Procedures

Formal operational procedures are critical to ensure consistent delivery of good quality water across the Northern Territory. Work can be done in a standardised way with all data recording and reporting needs identified.

Over 200 standard operating procedures are currently in use across the Territory, these include:

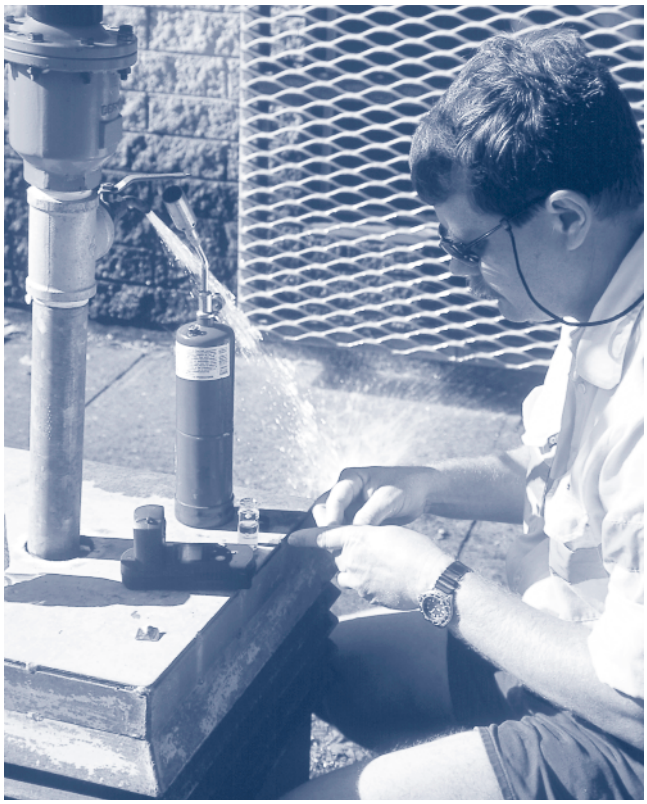
- water quality failure reporting
- annual cleaning of storage tanks (including confined space entry procedures covering work in storage tanks)
- chlorine dosing of tanks
- disinfection of mains prior to connection to water supply
- disinfection of mains following breakage
- flushing of water mains to remove sedimentation
- water quality sampling of new bores
- *Water Quality Sampling Manual.*

The *Water Quality Sampling Manual* provides guidance on the correct method for taking water samples. All staff are trained and assessed using this manual to ensure that compliance with the water quality sampling procedures is maintained.

Operational procedures have also been developed to deal with water quality issues in particular centres. These include:

- Blending of groundwater and surface water supplies in Pine Creek to ensure guideline levels for arsenic are not exceeded. A number of individual bores in the Pine Creek, Kybrook Farm area have arsenic levels above recommended guidelines. When these are mixed with other bores and surface water, the result is below guideline values
- Blending of groundwater bores at Tennant Creek to ensure guideline levels for fluoride are not exceeded
- Development of a water supply flushing program in Darwin, Katherine and Alice Springs to minimise water quality complaints.

Further standard operating procedures/processes will be developed to cover operational systems, work activities and practical assessments in the coming year.



Taking regular water quality samples is an important component of our Water Quality Management System.

Operational Monitoring and Process Control

Operational monitoring is done in all centres. Operational monitoring for water quality focuses on maintenance of adequate chlorine residuals as a barrier against microbiological contamination. Section 5 details the results of microbiological water quality monitoring throughout 2003-2004.

Microbiological sample collection and analysis can take up to 72 hours. The long time between sampling and results has led to a focus on risk management and a pro-active approach to preventing potential contamination.

To help us control water treatment processes, we have installed a number of chlorine, fluoride, conductivity, turbidity and pH analysers on the water supply system in all centres.

Data from monitoring equipment is collected through our system control and data acquisition (SCADA) system. This means specific parameters can be continuously monitored and controlled, particularly in remote locations. This results in more effective management and reduced response times to water quality incidents.

SCADA also makes it easier to collect, store, analyse and report data.

Over the coming year this data will be used to improve our treatment processes, particularly the dosing and control of chlorination systems.

On-line Water Quality Analysis at Darwin River Dam.

Section 5:
Verification of Drinking Water Quality

Water Quality Monitoring Program

Water Quality Analysis for Power and Water is undertaken at the Department of Industry, Business and Resource Development Laboratories.

Power and Water's Water Quality Monitoring Program is used to verify the success or otherwise of current water quality management strategies. The program incorporates chemical, physical, radiological and aesthetic parameters as well as bacteriological parameters.

The water quality monitoring program is based on the 1996 Australian Drinking Water Guidelines, however bacteriological samples in minor centres (accounting for 15% of all consumers) are only taken monthly, compared with weekly in major centres.

Microbiological Monitoring

Microbiological monitoring checks for potential disease-causing organisms. Given the range of potentially dangerous organisms and difficulty of detecting them, indicator organisms are used to show whether contamination may have occurred. The indicator organisms are:

- Total coliforms: a range of bacteria found in many soil and water environments;
- Faecal coliforms: are from the total coliform group and come from the gut of warm blooded animals; and
- *Escherichia Coli* (*or E. Coli*): are from the faecal coliform group.

The current industry trend is to move away from the use of total coliforms, and to focus on faecal coliforms and in particular *E. Coli* as the primary indicator for potential contamination.

The 1996 Australian Drinking Water Guidelines require that for assessment of microbiological performance:

- At least a minimum number of routine samples has been tested for indicator micro-organisms;
- At least 98% of scheduled samples (as distinct from repeat or special purpose samples) contain no thermotolerant coliforms (or alternatively *E. Coli*); and
- At least 95% of scheduled samples (as distinct from repeat or special purpose samples) contain no coliforms.

Heterotrophic plate counts are also used as a general indication of all organisms that may be present in a water supply, and are a useful indicator of operational performance. The count shows mainly environmental organisms, as well as some faecal organisms. It is a useful measure of general water quality in addition to the indicator organisms (*E. Coli*). An operational target level of <1000 is used for Power and Water's systems (Refer Appendices 1-2).

Microbiological Results Summary

A summary of the *E. Coli* water quality results for major centres over the past year is provided on the right. Full details of sample numbers, total coliforms and heterotrophic plate counts are contained in Appendix 1.

Figure 1 (see page 20) illustrates that all the major centres achieved microbiological performance targets for *E. Coli*, in accordance with the 1996 Australian Drinking Water Guidelines and as agreed to by the Department of Health and Community Services.

Due to the absence of continuous disinfection in Tennant Creek, Power and Water respond to any microbiological failures through a process of flushing mains, and hand dosing with chlorine. Over the last year the water supply system in Tennant Creek was hand-dosed with chlorine 27 times out of the total of 47 times that it was sampled.

Figure 2 (see page 20) presents results for *E. Coli* microbiological performance for all the minor centres throughout the Northern Territory. Full details of sampling numbers, total coliforms and heterotrophic plate counts are presented in Appendix 2.

This illustrates that all minor centres passed *E. Coli* performance targets except for Elliott and Daly Waters. System performance in Elliott reflects the fluctuations that have occurred in water supply and have resulted in reduced performance target. Chlorine analysers have recently been installed on the water supply system at Elliott to enable remote monitoring of chlorine levels and improve the reliability of the chlorination system.

System performance in Daly Waters reflects the difficulties in remote monitoring of the chlorine dosing system. A new automatic chlorine dosing system with a chlorine analyser has recently been installed in Daly Waters, which will improve remote monitoring and hence the reliability of the chlorination system.

The microbiological performance in Larrimah, Mataranka, Pine Creek, Kings Canyon and Newcastle Waters improved compared to last year.

In June 2004, Power and Water received a licence from the Utilities Commissioner to provide water supply services to Cox Peninsula. We are currently upgrading the water supply system and microbiological performance results from Cox Peninsula will be made available in the 2004-2005 Water Quality Report.

All surface water supplies have been tested for the presence of protozoa and no viable organisms have been detected to date. Protozoa are naturally occurring aquatic organisms, some of which can be potentially infectious to human beings if ingested. *Cryptosporidium and Giardia* are the most commonly known. Surface water supplies are most at risk from these, which are most appropriately controlled through catchment management programs.

Chemical and Physical Monitoring

Microbiological parameters are the key concern from a human health perspective. The risk from these can vary from day to day within water supplies. However, we also monitor a wide range of physical, chemical and radiological parameters under our Water Quality Monitoring Program to check that drinking water is safe and good to drink. These parameters are less likely to alter on a day to day basis, but are characteristic of each supply source.

Aesthetic Parameters

Aesthetic parameters are those that pose no threat to human health but can affect drinking water appearance, taste and odour. In water supplies in central Australia, high total dissolved solids (salts) and hardness (calcium) are common, which can cause calcification on hot water systems and fixtures. Full details of the aesthetic parameters for each major and minor centre are located in Appendices 3 and 4.

Total dissolved solids (TDS) is a measure of all the dissolved material in water. The level of salts in the water affects the taste, however salt-free water is regarded as unpalatable. Generally, water containing a TDS of less than 500mg/L is desirable, however there is no evidence of harmful effects in consumers drinking water up to 1000mg/L. Less than 800mg/L is considered reasonable quality by the Department of Health and Community Services. It is difficult to remove dissolved solids from drinking water. Technologies such as distillation and reverse osmosis can be used, but require considerable energy, are expensive to operate and waste up to 30% of the water supply.

At Yulara, where natural TDS levels are in the range of 1500 to 2000 mg/L and no other water supply exists, reverse osmosis is used. This has enhanced the taste of the water and eliminated staining problems.

Hardness relates to the specific concentrations of calcium and magnesium in the water. Hardness comes from water in contact with limestone and other similar rock formations. Hardness has no known detrimental effect on human health but causes scaling in hot water systems. Hardness between 60 to 200 mg/L is generally considered good quality, while between 200 to 500 mg/L can be associated with increasing scaling problems. **Figure 3** (see page 20) indicates typical levels of salinity and hardness measured in the drinking water supplies of the major centres from 2002-2004.

Figure 4 (see page 20) indicates typical levels of salinity and hardness measured in the drinking water supplies of the minor centres over the years 2002-2004.

Iron and manganese are naturally occurring minerals that can stain clothes, fixtures and bathroom fittings. In general, Power and Water manages the occurrence of iron and manganese through regular pipeline flushing to prevent build up within reticulation systems.

Problems with iron and manganese in the Adelaide River water supply have been partially addressed through the installation of a sequestering treatment system. This means chemically suspending the iron in the water, which reduces discolouration. **Figure 5** (see page 21) indicates average iron and manganese levels in the major centres from 2002–2004.

Figure 6 (see page 21) indicates average iron and manganese levels in the minor centres over the years 2002-2004.

Health Parameters

Health parameters are those where the risk of potential health impacts increases as concentration increases. The guideline levels are based on various assumptions, including how much water is consumed, and what is the level of intake of particular parameters from other sources. It also assumes that a person is exposed to these levels

Aeration of ground water at the Katherine Water Treatment Plant helps improve water quality.

over a lifetime. Full details of the health parameters for each major and minor centre are located in Appendices 3 and 4.

Naturally occurring *uranium* concentrations above the guideline value have been identified in the drinking water supply at Ti Tree and Pmara Jutunta.

The community has been informed and the Department of Health and Community Services has stated that there is no immediate threat to public health. A new groundwater supply has been developed close to Pmara Jutunta that has both uranium and total dissolved solids below guideline values. Power and Water is in the process of building a pipeline that will connect the new bore water supply to Ti Tree/Pmara Jutunta. The new borewater supply will be operational in 2004-2005.

Natural *arsenic* has previously been identified in some bores in Pine Creek slightly above the Australian Drinking Water Guideline value. These bores have since been decommissioned from supply. The remaining bores are blended and mixed with surface water in order to produce water in accordance with the Australian Drinking Water Guidelines.

Fluoride is added to the water in both Darwin and Katherine at a level of 0.6 mg/L, as recommended by the Department of Health and Community Services to protect against dental caries. Fluoride also occurs naturally in various water supplies, particularly in the southern region of the Northern Territory. Fluoride in the Tennant Creek water supply is managed to achieve an average below 1.5 mg/L, as recommended by the Australian Drinking Water Guidelines. Fluoride also occurs naturally in Alice Springs drinking water supply at a level of approximately 0.4 mg/L, which is sufficient for dental health protection. **Figure 7** (see page 21) indicates average levels of fluoride in the drinking water supplies in the major centres from 2002-2004.

The fluoride average in both Darwin and Katherine is lower than 0.6 mg/L due to fluoride not being dosed in the water supply at times.

Figure 8 (see page 21) indicates the average levels of fluoride in the drinking water supplies in the minor centres from 2002-2004.

Radionuclides or radiation emitting elements are sometimes found in drinking water supplies. In the Northern Territory these elements are natural to the environment and are characteristic of the local hydrogeology. Within the new Australian Drinking Water Guidelines, the measurement of these parameters is not based on concentration as with other parameters, but in terms of risk associated with annual dose per year. These results are shown in Appendices 3 to 4. **Figure 9** (see page 22) shows the total annual radiological dose for the major centres. **Figure 10** (see page 22) shows the total annual radiological dose for the minor centres. A dose above the guideline trigger value of 0.5 mSv/Yr requires ongoing monitoring and operational solutions to be investigated. In the coming year, Power and Water will be investigating options to reduce the total annual radiological dose to below the trigger value in Kings Canyon.

Pesticides are used for controlling insects in agricultural areas. Testing for pesticides in the Northern Territory is not required by the Department of Health and Community Services unless a potential exists for a water supply to be at risk from contamination. Power and Water has taken limited tests for pesticides in the water from the McMinns Borefield in Darwin and at Batchelor. The pesticides tested were based on a list from the Department of Infrastructure, Planning and Environment, Natural Resource Management Division Report *Review of Pesticide Monitoring, Use and Risk to Water Resources in the Darwin Region* January 2004. To date no issues have been identified.

Disinfection by-products are formed when disinfectants react with organic materials in the water supply. Chlorine is the primary defence against disease causing microbiological contaminants in public water supply systems. However, chlorine reacts with naturally occurring organic matter such as dissolved leaves and other vegetation, to produce a range of potential by-products, most commonly Trihalomethanes (THMs). THMs include the compounds Chloroform, Bromodichloromethane, Dibromochloromethane and Bromoform. As the concentration of THMs measured is typically proportional to the amount of organic material contained in the water, surface water supplies usually have higher THM levels than that of ground water supplies.

The Australian Drinking Water Guidelines have set a guideline value for THMs of 0.25 mg/L. THMs measured in Power and Water supplies range from less than 0.08 mg/L in Darwin to less than 0.004 mg/L in Alice Springs, concentrations that are well below the recommended national guideline level.

Figure 11 (see page 22) indicates average levels of total THMs in the drinking water supplies of the major centres for 2002–2004. No THM data has been collected for Tennant Creek because the water supply is not continually chlorinated

Figure 12 (see page 22) indicates average levels of THMs in the drinking water supplies of the minor centres over the year 2002–2004. Kings Canyon and Ti Tree data is currently not available but is anticipated to be of similar low levels to the other minor centres.

Customer Satisfaction

Water Quality Customer Complaints

Power and Water records customer complaints on water quality for both the Darwin and Alice Springs water supply systems. **Table 3** opposite shows the total number of complaints and the number of complaints per 1 000 properties.

Power and Water provides its number of customer complaints to the Water Services Association of Australia publication (WSAA) and is reported annually included along with other water utilities around Australia.

Table 3: Darwin and Alice Springs Water Quality Complaints 2003-2004

	Total number of complaint	Complaints per 1 000 properties
Darwin	78	
Alice Springs	8	
Total	**86**	**2.46**

The pattern of water quality complaints in the Darwin Water supply is largely governed by changes in water demand associated with the wet and dry seasons. Changing water demand often mobilises iron and manganese in the water supply resulting in more complaints. Power and Water works pro-actively to reduce complaints, chiefly through a mains flushing program in all major centres. Mains are flushed prior to increased demands associated with seasonal changes or if several complaints are received from any one street or suburb. The levels of iron and manganese found in the drinking water do not constitute a health risk.

Less common customer complaints relate to elevated chlorine odour and taste, milky water or floating particles. **Figure 13** below shows a breakdown of customer complaints from Darwin for 2003-2004.

Taste and odour complaints are often related to fluctuating chlorine levels due to changing water demand. The chlorine residual throughout the reticulation network is regularly monitored and adjusted when required. On line water quality monitoring units are being installed throughout the water supply system in order to improve water quality monitoring across the whole network.

One of the other complaints sometimes received is milky water. This is usually associated with dissolved oxygen coming out of solution. It is common following pipe flushing or repairs and is a result of aeration of the water within the pipe.

In the Darwin supply, a harmless white algae can also sometimes be observed. Neither the algae nor the aeration presents a health risk. If there is some doubt as to the cause of a water quality problem, an investigation will be carried out and if necessary water samples taken and analysed.

Power and Water is continuously updating and expanding the customer complaint register for all major centres to better measure and benchmark customer feedback and satisfaction.

A national customer satisfaction survey on water quality was held in 2003 on all the capital cities in Australia. Darwin was included in the national survey, however the results have not yet been made available for reporting.

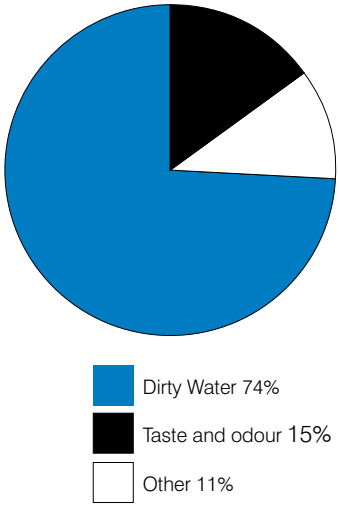


Figure 13: *Type of Drinking Water Customer Complaints for Darwin 2003-2004.*

Figures 1 to 4

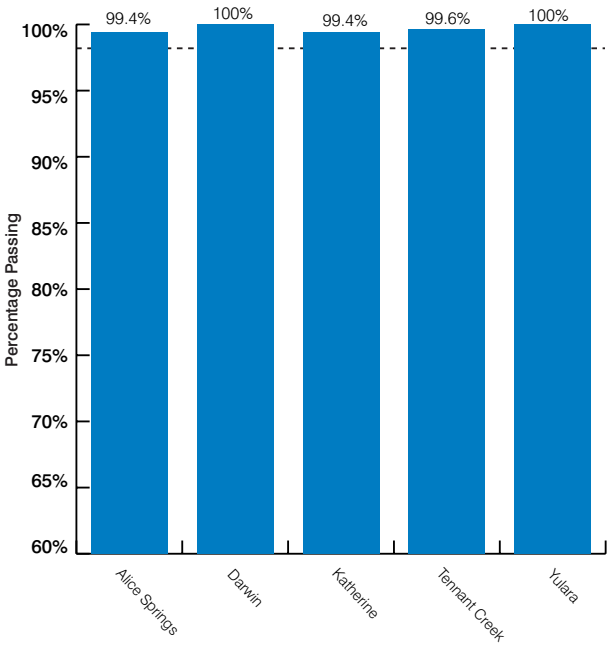


Figure 1: *Percentage of Samples Taken in Major Centres in which no E. Coli were recorded.*

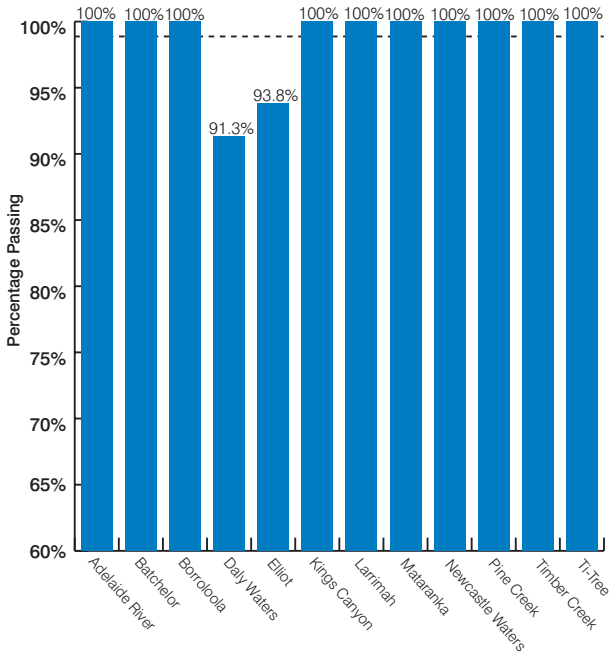


Figure 2: *Percentage of Samples Taken in Minor Centres in which no E. Coli were recorded.*

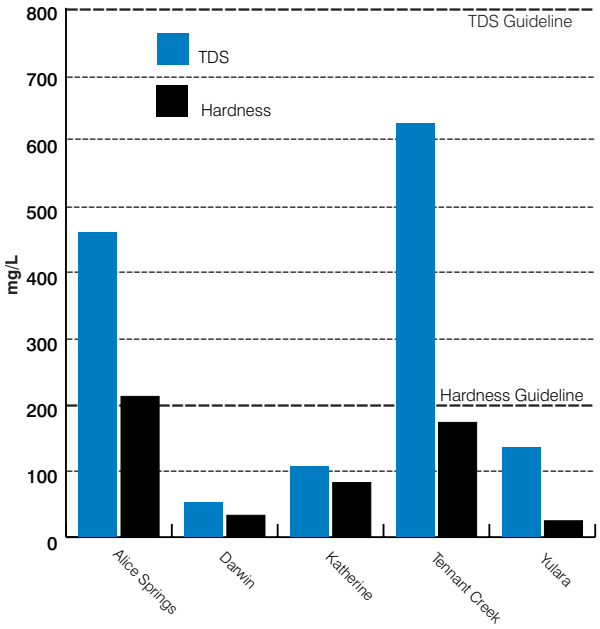


Figure 3: *Average Hardness and Total Dissolved Solids in Major Centres 2002-2004.*

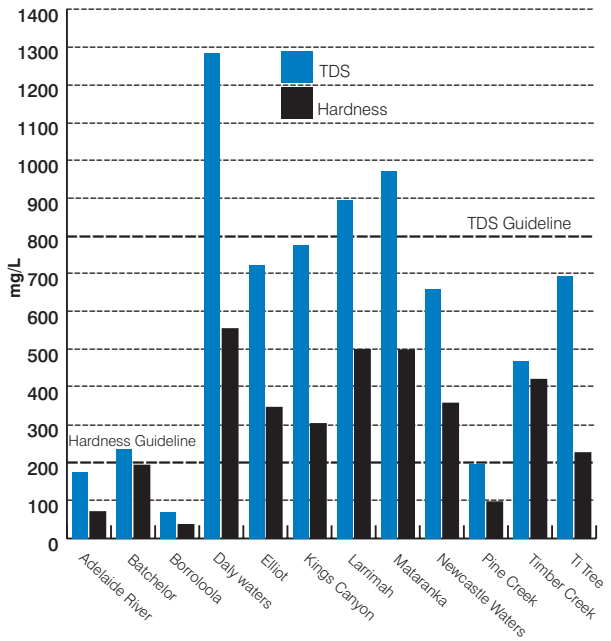


Figure 4: *Average Hardness and Total Dissolved Solids in Minor Centres 2002-2004.*

Figures 5 to 8

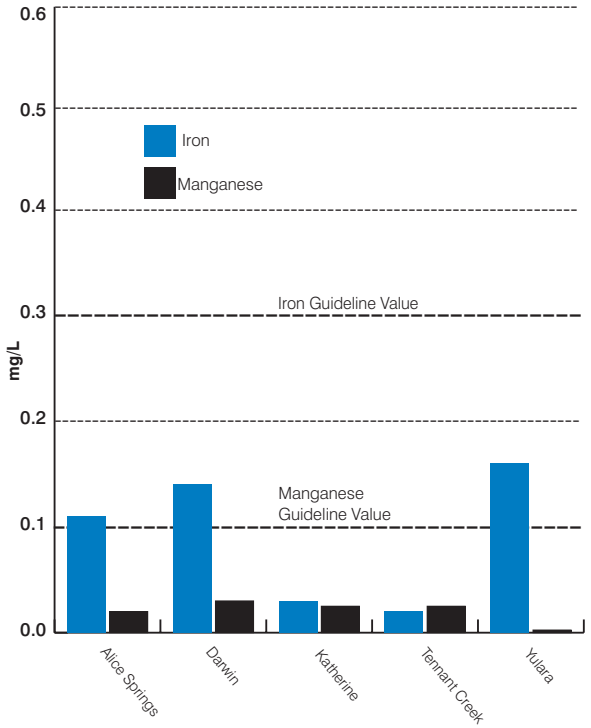


Figure 5: *Average Iron and Manganese in Major Centres 2002-2004.*

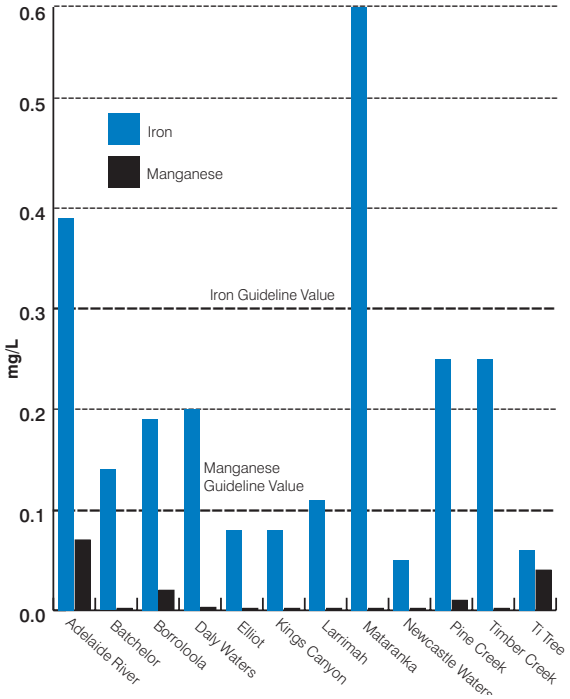


Figure 6: *Average Iron and Manganese in Minor Centres 2002-2004.*

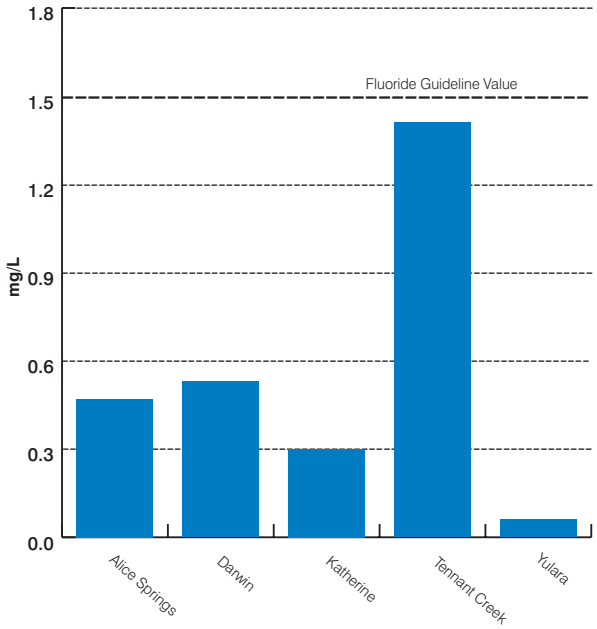


Figure 7: *Average Fluoride in Major Centres 2002-2004.*

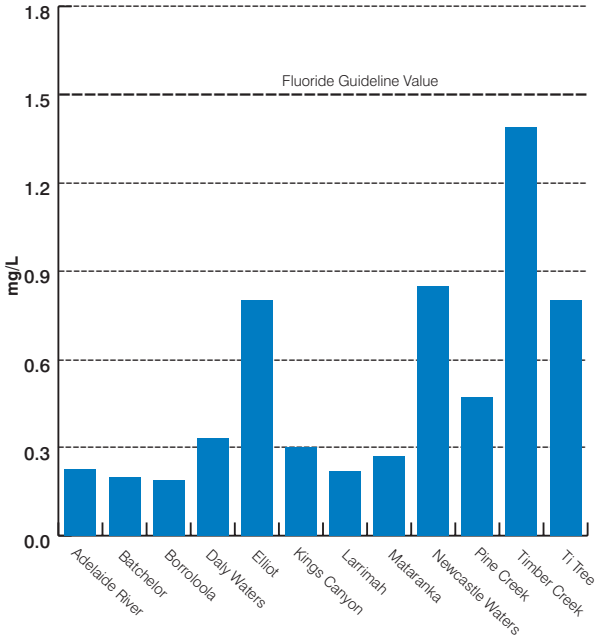


Figure 8: *Average Fluoride in Minor Centres 2002-2004.*

Figures 9 to 12

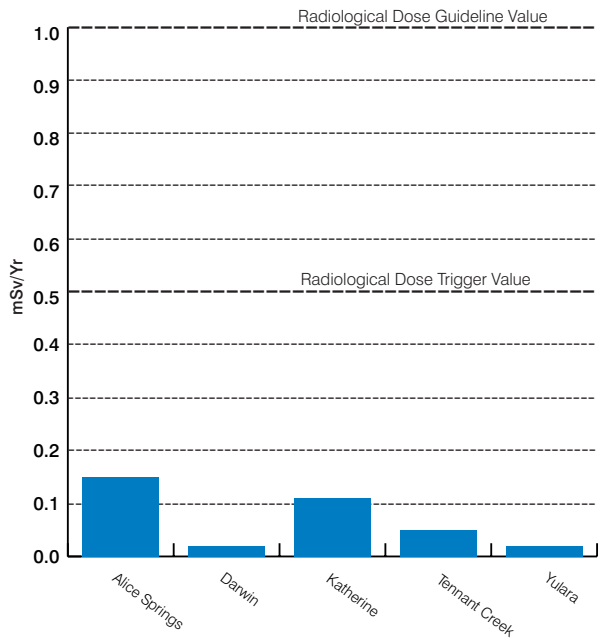


Figure 9: *Total Annual Radiological Dose in Major Centres 2002-2004.*

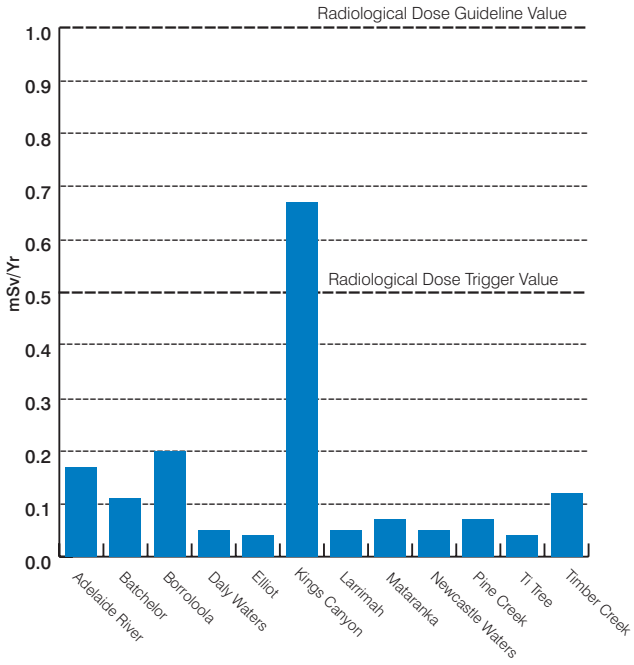


Figure 10: *Total Annual Radiological Dose in Minor Centres 2002-2004.*

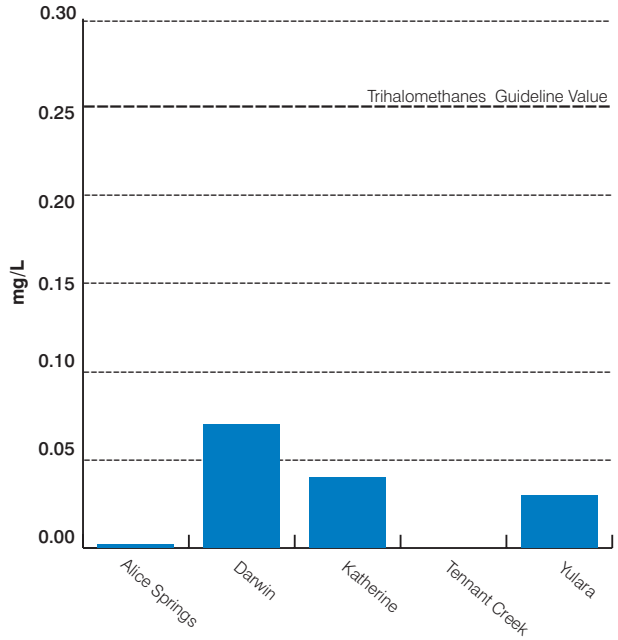


Figure 11: *Average Total Trihalomethanes in Major Centres 2002-2004.*

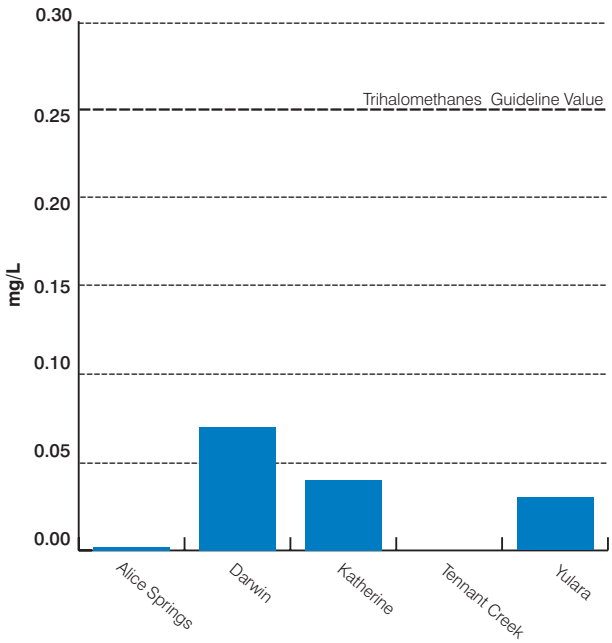


Figure 12: *Average Total Trihalomethanes in Minor Centres 2002-2004.*

Section 6:
Incident and Emergency Response

Considered and controlled responses to incidents or emergencies that can compromise the safety of water quality are essential for protecting public health, as well as maintaining consumer confidence.

While we use preventive strategies such as security and disinfection facilities, some events can not be anticipated or controlled. Having a planned response is critical to minimising potential consequences.

Incident Response

A microbiological incident response procedure has been established in agreement with the Department of Health and Community Services for any microbiological samples that exceed the agreed limit. The procedure was approved by the Chief Health Officer in May 2002.

The Department of Business, Industry, Resources and Development (DBIRD) laboratories in Darwin and Alice Springs immediately notify Power and Water if they identify a microbiological failure. This process is governed by a formal three-year, service level agreement signed between the two agencies on 1 July 2003.

Responses by Power and Water include resampling, flushing and hand disinfection with chlorine. The Department of Health and Community Services is notified immediately of any microbiological failures.

Emergency Response

In 2001-02, Power and Water developed a protocol in conjunction with the Police and the Department of Health and Community Services for dealing with potential contamination of potable water supplies.

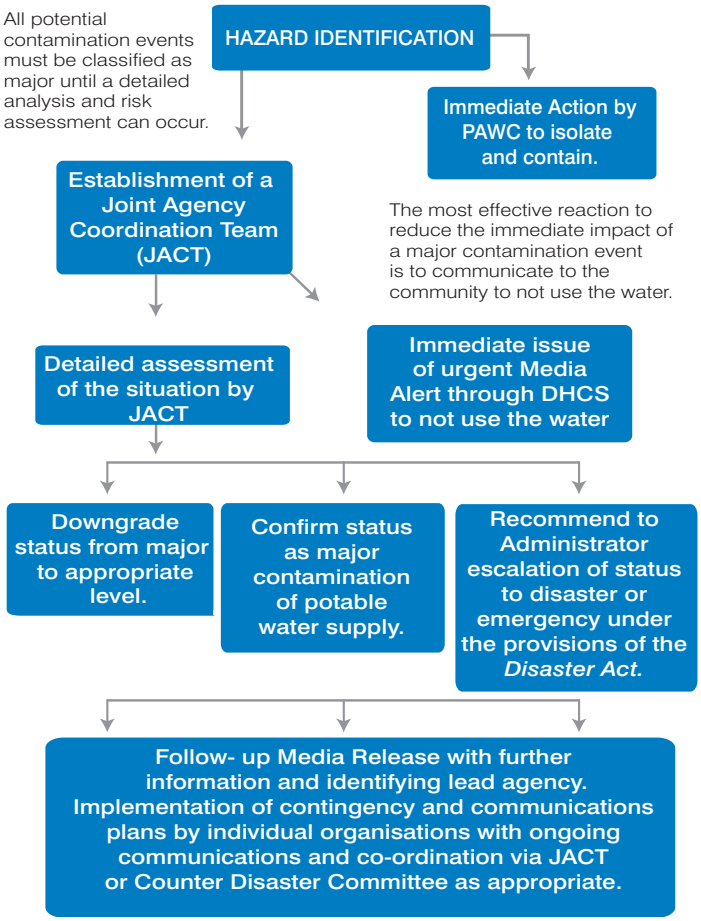
In an emergency a Joint Agency Coordination Team (JACT) is established. The response team consists of the General Manager Water Services, Chief Health Officer and Assistant Commissioner, Police Operations Command.

The team's role is to evaluate and manage the incident as well as to provide initial advice to the community regarding what action to take.

Supporting documents to the protocol have been developed on hazard identification, which outlines what specific events would constitute an emergency and what actions should be taken in particular emergencies. An outline of the emergency response is shown in the flow-chart below.

Recorded Incidents and Emergencies

No significant water quality incidents or emergencies were recorded in 2003-2004. However significant investment in upgrading of facilities and security systems continues to occur to further reduce potential risks.



Incident and Emergency Response flow chart.

Section 7:
Employee Awareness and Training

Awareness Opportunities and Strategies

We use a range of strategies to ensure staff appreciate, reinforce and further develop awareness of the way their duties may impact on water quality. These strategies include:

- Section meetings on a monthly basis
- Periodic toolbox meetings of work groups
- Rotation of staff to other sections and centres
- Management feedback sessions
- Support for further education of employees
- Employee development and learning plans
- Employee performance management processes
- Development and implementation of job models for service workers.

Training

Normal operational activities may adversely affect water quality if not performed correctly. For example, refitting a bore pump, cleaning a tank, dosing of chemicals or repairing a main break.

Procedures are continually revised due to new equipment or techniques. Employees' ongoing training and re-skilling are required to ensure their safety and that of the communities. Such safety training includes:

- Handling dangerous goods and chemicals such as chlorine and fluoride
- Operating self-contained breathing apparatus
- Entering confined spaces
- Performing rescues from tanks and trenches
- Electric shock avoidance and response
- First aid

Power and Water is committed to ensuring that all employees are appropriately trained and aware of their responsibilities. There is no room for compromising on this commitment where the community's health is at stake.

- Cardio-pulmonary resuscitation
- Fire and emergency evacuation
- Managing unauthorised access situations
- Operating dangerous equipment in public places
- Fire and emergency evacuation
- Perform water sampling
- Perform basic water tests
- Monitor, identify and respond to water quality problems
- Monitor, operate and report on disinfection systems
- Coordinate and monitor application of environmental plans and procedures (catchment staff)
- SCADA system operation.

Our staff or agents taking water samples across the Territory require training to ensure successful sampling. We give a booklet to all water samplers with initial training and provide refresher courses. In smaller centres, the agents are often employed by the community council and are referred to as Essential Service Officers or ESOs.

Other broader skills training such as the Public Sector Management Program, Frontline Management Initiative and Service Worker Job Model related training, are also important in maintaining water quality, as they develop skills for effective management and completion of job responsibilities.

Water quality testing at the Darwin River Dam disinfection facility.

Section 8:
Community Involvement and Awareness

We seek community involvement in, and awareness of, water quality issues as a high priority. We would like the community to:

- Understand issues associated with their drinking water quality
- Help Power and Water ensure the security and integrity of their supply
- Improve their confidence in their water supply meeting their needs.

Community Awareness

We encourage the community to be aware of the quality of their drinking water supply. We produce water quality brochures to help this awareness, including a summary of water quality details for all the major centres in the Northern Territory.

This information as well as our previous Water Quality Reports can be viewed on the Power and Water website http://www.powerwater.com.au.

We encourage the community to be aware of the quality of their drinking water supply. We produce water quality brochures to help this awareness, including a summary of water quality details for all the major centres in the Northern Territory.

Community Involvement

Power and Water has continued to engage with the community in Tennant Creek about the safety of the drinking water supply. A public referendum was held in conjunction with the Tennant Creek Local Council elections in May 2004. The result of the referendum and subsequent direction from Government will mean that continuous chlorination will not be installed.

We will however continue to discuss water quality issues and risks with the community in Tennant Creek.

Parap Pipe Painting Project involving local school children.

Section 9:
Research and Development

To enhance its research and development capacity, Power and Water became a participant of the Cooperative Research Centre for Water Quality and Treatment on 1 July 2001 (CRCWQT Mark II).

The Cooperative Research Centre for Water Quality and Treatment (CRCWQT), established in 1995, undertakes national research into health risk reduction and water quality improvement.

Power and Water is an active member of the CRCWQT, and is the Program Leader for the Regional and Rural Water Supplies Program. This program aims to.

- address key issues that impact on the provision of good quality drinking water to regional and rural communities in Australia
- identify research that will provide affordable and sustainable solutions to water supply problems
- assist with representation of the regional and rural water supply areas in setting industry policy, regulation and strategic directions.

We are involved in a range of research projects that assist us in improving water quality throughout the Territory. Each of these is described below:

Power and Water is committed to the research and development of innovative and cost effective treatment and water quality management strategies.

Impacts of Recreational Access on Drinking Water Catchments

Power and Water has a closed catchment and reservoir policy for Darwin River Dam. To maintain protection of the drinking water supply this means we do not allow recreational access. This project aims to develop an understanding of the relationship between recreational activities and water quality in drinking water supply catchments in Australia for the purpose of best practice management.

Discoloured Water Project

This project aims to examine the sources of dirty water complaints that have been linked to soluble iron and manganese in treated water. The project will develop an improved understanding of how dirty water events occur and develop monitoring methods to assess the potential for discoloured water formation in distribution systems. We are currently involved in the project Steering Committee and will be further involved during the field studies. The results of this study will greatly help the water industry to effectively manage manganese and iron in drinking water.

Mutitjulu Rainwater Tank and Point of Use Treatment System Trial

This project is trialing a rainwater harvesting system and a point-of-use filtration device on a number of houses in the remote township of Mutitjulu, near Uluru. Power and Water offers support to this project and contributed water meters. The aim is to develop and provide a well designed, robust and reliable system for rainwater harvesting suitable for use in remote communities.

Mabunji Rainwater Management Program

The project draws on lessons learnt from the Mutitjulu Rainwater Tank and Point of Use Treatment System Trial and involves significant participation in the development of sustainable water supplies for the community. The aim is to develop an appropriate design, implementation and maintenance system.

Water Consumption Patterns in Remote Communities

This project, funded by Power and Water, aims to identify different Indigenous water requirements resulting from different lifestyles, values and needs. Different cultural attitudes, mobility and the remote living environments result in different attitudes to taste, health problems, uses of water, and access to services. This project will aim to pinpoint research at the household level to determine lifestyle and health requirements.

Application of HACCP for Distribution System Protection

The American Water Works Association Research Foundation (AwwaRF) awarded funding to the CRCWQT for a joint project involving the application of the Hazard Analysis and Critical Control Points (HACCP) for water quality risk management. We have developed and implemented a HACCP Plan for the Katherine distribution system and will report back to the project team on the outcomes in the coming year.

In September 2003, Water Services General Manager Darryl Day visited Dr Ingrid Chorus, Oliver Schmoll and Michael Frobel from the German Federal Environmental Agency (Umweltbundesamt or UBA) in Berlin. His visit was in response to an earlier visit to Australia by the German representatives of UBA, who were investigating the Australian approach to risk management and HACCP for water supply.

Drinking Water and Melioidosis

This project is to examine the dynamics of the organism *Burkholderia psuedomallei* that causes the disease Melioidosis and its potential to enter water supplies. The benefits from this project have included the improved diagnosis and treatment of the disease and a better understanding of the potential impact and behaviour of the organism under different levels of chlorine treatment in water supplies.

Disinfection Control within Distribution Systems

This project examines the use of chlorine demand to control chlorine dosing in a distribution system. Our involvement is to provide information and apply the disinfection tools developed to real distribution systems. This leading edge technology will benefit Power and Water and contribute to the more effective use of chlorine dosing.

Catchment Risk Management

Over the 2003-04 summer period, Power and Water supported a CRCWQT summer student to investigate risks to water quality in the Darwin River Dam catchment area using Geographic Information Systems.

In the coming year we have awarded a scholarship worth $10 000 to a student from Charles Darwin University to undertake a study on the risks to water quality in the Katherine drinking water supply catchment area. This risk assessment is expected to be finalised in June 2005.

Rural and Remote Community Water Management

As well as the above projects, Power and Water provided organisation support for a national joint initiative between the CRCWQT and the National Health and Medical Research Council (NHMRC). A workshop on Water and Public Health in Regional and Rural Australia held in August 2002, established Power and Water as a key participant in the development of more affordable solutions to water supply problems in regional, remote and rural Australia.

As a direct outcome of the workshop, the NHMRC has established a steering committee and working party to develop resource material for the application of the Framework for Drinking Water Quality Management. This project is being closely monitored by the World Health Organisation and an international workshop is proposed in mid-2005 to present the outcome from the project and case studies of the application of the framework to rural and remote water supplies.

This project is currently being developed in conjunction with Desert Knowledge CRC and focuses on applying the framework for drinking water (incorporated in the draft Australian Drinking Water Guidelines (ADWG)) in small remote Indigenous communities. In conjunction with this project the Desert Knowledge CRC is developing a similar model for applying the framework to small remote Indigenous communities.

Howard Springs Elevated Tank and Watering Point.

Section 10:
Documentation and Reporting

Recording water quality data and reporting of water quality performance is an integral component of any water quality management system.

During 2003-04 several initiatives have been undertaken to improve water quality documentation and reporting.

Water Quality Database

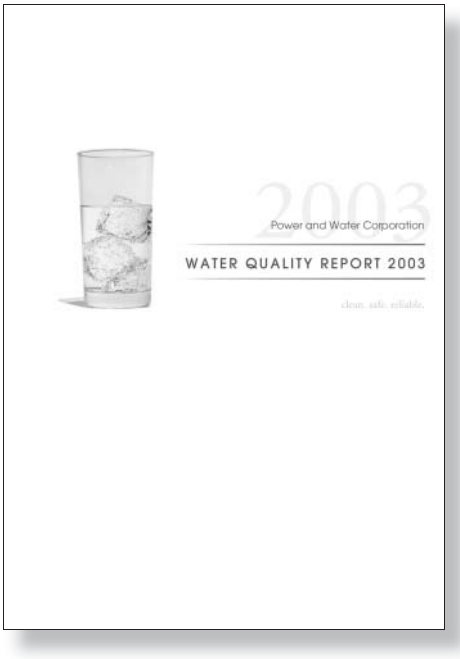
Power and Water has a water quality database, based on our Corporate Works Information Management System (WIMS). The database aims to manage collection, storage and reporting of key water quality data. The WIMS system allows automated scheduling of work orders to initiate sampling in the field by Power and Water staff, Essential Services Operators or trained contractors. It also allows tracking of individual water quality samples for audit purposes.

It is planned that a new and improved database will be established in the new year as we move to replace the corporate wide WIMS. Options for replacement are currently under review.

Reporting

This report forms an integral component of documentation required by the Department of Health and Community Services (DHCS) on water quality performance.

In addition to this water quality data is reported internally on a monthly basis, and DHCS is advised of any exeedence of water quality targets, in accordance with Power and Water's Water Quality Monitoring Program.



The 2003 Water Quality Report.

Section 11:
Evaluation and Audit

Evaluating and auditing water quality management systems is an important way to ensure the successful management of water quality data and processes.

This report is an integral part of the review and evaluation process. Audits ensure that operational procedures and processes are in place so that accurate water quality data is collected and appropriate management systems are maintained.

External Audits

No external audits on the water quality management systems or facilities were conducted during the year. An external audit of all upgrade chlorination facilities is planned in the coming year.

Internal Audits

Formal internal audits of the water supply systems were not conducted this year, rather attention was focused on investigating and addressing issues of concern identified in previous audits.

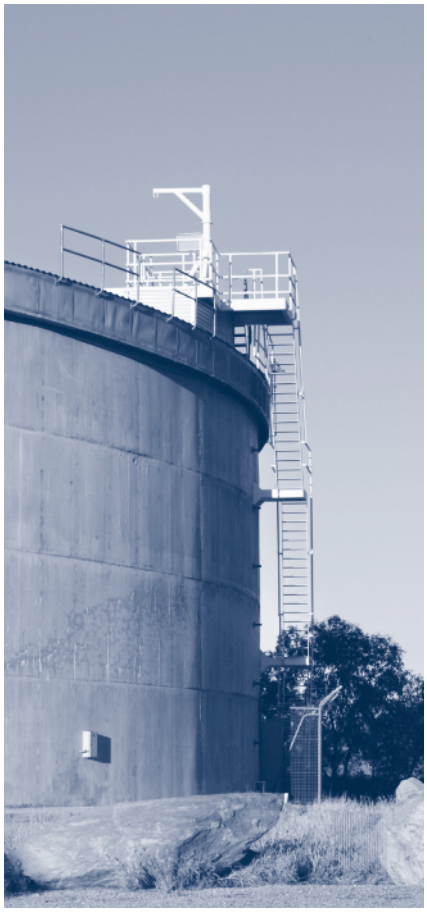
Significant focus continued to be placed on the risks associated with the potential for septic tank contamination of public water supply bores from the McMinns Borefield in the Darwin Rural Area.

Water Quality Monitoring Program

We continuously review our Water Quality Monitoring Program to evaluate the success of the program and to update it if required.

Routine modifications to the existing program during the year included:

- Reducing the frequency of radiological and pesticide sampling to account for previous results.
- Additional sampling points in Tennant Creek to enhance the ability to identify potential problems.



Alice Springs Water Tank.

Section 12:
Review and Continual Improvement

Power and Water is committed to the ongoing development and improvement of the drinking water quality management system and the safety of drinking water supplies.

Review of Drinking Water Quality System

This annual Drinking Water Quality Report is an important mechanism in identifying water quality issues and facilitating improvements.

Drinking Water Quality Improvement

Various water quality improvement works have been identified as part of the capital works program for the coming year. A summary of relevant projects is outlined in Table 4.

Table 4: Planned Water Quality Improvement Works

Location	Planned Works
Adelaide River	A new potable water supply tank is planned for relocation to another facility in the next year. In conjunction with these works, improved water treatment options are also being investigated.
Alice Springs	No major works planned.
Batchelor	No major works planned.
Borroloola	Improved water treatment options, including aeration, are being investigated.
Daly Waters	A new disinfection facility was installed in 2003-04. Remote communications equipment are planned for installation this year.
Darwin	Upgrade of the primary chlorine dosing facility for the Darwin water supply was completed during the year, located at Darwin River Dam. Upgrade of the secondary disinfection system for Darwin is planned to occur in the current financial year.
Elliott	No major works planned.
Katherine	The primary chlorination facility at the Katherine Water Treatment Plant is planned for upgrade in the next year. A dedicated chlorination building was completed in 2003-04, in which to house the new chlorination equipment.
Kings Canyon	Two new supply bores were connected during 2003-04. Investigation of improved water treatment options, including aeration is currently underway.
Larrimah	A new disinfection facility was installed in 2003-04.
Mataranka	No major works planned. However potenial for a new water supply of improved quality is being investigated.
Newcastle Waters	A replacement water supply bore is planned for construction in the coming year. This is to replace an existing bore at risk from contamination.
Pine Creek	Further pipework upgrades are planned this year at Copperfield Dam, along with connection of the new disinfection systems. This will improve the safety and security of existing supplies.
Tennant Creek	No major works planned.
Timber Creek	No major works planned.
Ti Tree	A new groundwater source has been identified and will be connected to the water supply in the coming year.
Yulara	No major works planned.

Appendices

Appendix 1: Microbiological Parameters in Major Centres 2003-2004

Parameter/ Location	Target level	Total no. of cycles required	Total no. of samples per cycle	Total no. of cycles taken	Total no. of samples	Total Exceedence (no.)	Samples passing reporting level (%)
Alice Springs							
E coli (org/100ml)	<1 in 98% samples	52	3	52	166	1	99.4%
Total coliforms (org/100ml)	<10 in 95% samples	52	3	52	166	1	99.4%
Plate Count (cfu/100ml)	<1000 in all samples	52	3	52	166	1	99.4%
Darwin							
E coli (org/100ml)	<1 in 98% samples	52	8	98	426	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	52	8	98	426	0	100.0%
Plate Count (cfu/100ml)	<1000 in all samples	52	8	98	426	14	96.7%
Katherine							
E coli (org/100ml)	<1 in 98% samples	52	3	52	169	1	99.4%
Total coliforms (org/100ml)	<10 in 95% samples	52	3	52	169	1	99.4%
Plate Count (cfu/100ml)	<1000 in all samples	52	3	52	169	3	98.2%
Tennant Creek							
E coli (org/100ml)	<1 in 98% samples	52	5	47	231	1	99.6%
Total coliforms (org/100ml)	<10 in 95% samples	52	5	47	231	7	97.0%
Plate Count (cfu/100ml)	<1000 in all samples	52	5	47	231	2	99.1%
Yulara							
E coli (org/ 100ml)	<1 in 98% samples	52	2	52	185	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	52	2	52	185	0	100.0%
Plate Count (cfu/100ml)	<1000 in all samples	52	2	52	185	2	98.9%

Note: Tennant Creek only achieved 47 of the target 52 sample cycles because of scheduling issues, which have since been resolved.

Appendix 2: Microbiological Parameters in Minor Centres 2003-2004

Parameter/ Location	Target level	Total no. of cycles required	Total no. of samples per cycle	Total no. of cycles taken	Total no. of samples	Total Exceedence (no.)	Samples passing reporting level (%)
Adelaide River							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	36	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	36	0	100.0%
Plate Count (cfu/ 100ml)	<1000 in all samples	12	1	12	36	0	100.0%
Batchelor							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	36	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	36	0	100.0%
Plate Count (cfu/ 100ml)	<1000 in all samples	12	1	12	36	0	100.0%
Borroloola							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	37	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	37	1	97.3%
Plate Count (cfu/ 100ml)	<1000 in all samples	12	1	12	37	1	97.3%
Daly Waters							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	46	4	91.3%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	48	6	87.5%
Plate Count (cfu/ 100ml)	<1000 in all samples	12	1	12	48	3	93.8%
Elliott							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	48	3	93.8%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	48	3	93.8%
Plate Count (cfu/ 100ml)	<1000 in all samples	12	1	12	48	3	93.8%
Kings Canyon							
E coli (org/ 100ml)	<1 in 98% samples	12	1	10	30	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	10	30	0	100.0%
Plate Count (cfu/ 100ml)	<1000 in all samples	12	1	10	30	0	100.0%

Parameter/ Location	Target level	Total no. of cycles required	Total no. of samples per cycle	Total no. of cycles taken	Total no. of samples	Total Exceedence (no.)	Samples passing reporting level (%)
Larrimah							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	36	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	36	0	100.0%
Plate Count (cfu/100ml)	<1000 in all samples	12	1	12	36	0	100.0%
Mataranka							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	47	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	47	0	100.0%
Plate Count (cfu/100ml)	<1000 in all samples	12	1	12	36	0	100.0%
Newcastle Waters							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	45	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	45	0	100.0%
Plate Count (cfu/100ml)	<1000 in all samples	12	1	12	45	3	93.3%
Pine Creek							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	61	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	61	2	96.7%
Plate Count (cfu/100ml)	<1000 in all samples	12	1	12	61	10	83.6%
Timber Creek							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	36	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	36	0	100.0%
Plate Count (cfu/100ml)	<1000 in all samples	12	1	12	36	1	97.2%
Ti Tree							
E coli (org/ 100ml)	<1 in 98% samples	12	1	12	48	0	100.0%
Total coliforms (org/100ml)	<10 in 95% samples	12	1	12	48	1	97.9%
Plate Count (cfu/100ml)	<1000 in all samples	12	1	12	48	2	95.8%

Appendix 3: Health, Aesthetic and Other Parameters in Major Centres 2002-2004

Drinking Water Quality in Alice Springs

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.001
Barium	0.7	mg/L	0.1
Boron	4	mg/L	0.13
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.003
Fluoride	1.5	mg/L	0.5
Iodide	0.1	mg/L	0.1
Lead	0.01	mg/L	0.006
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.003
Nickel	0.02	mg/L	0.003
Nitrate	50	mg/L	7
Nitrite[3]	3	mg/L	DNA
Radiological [4]	0.5	mSv/year	0.15
Selenium	0.01	mg/L	0.004
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.002
Uranium	0.02	mg/L	0.01
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.02
Chloride	250	mg/L	74
Copper	1	mg/L	0.11
Hardness	200	mg/L	210
Iron	0.3	mg/L	0.11
Manganese	0.1	mg/L	0.02
pH	6.5 - 8.5	pH units	7.6
Sodium	180	mg/L	80
Sulphate	500	mg/L	65
TDS	800	mg/L	460
Zinc	3	mg/L	0.07
Other Parameters[5]			
Alkalinity	*	mg/L	260
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.5
Calcium	*	mg/L	45
Electrical Conductivity	*	µS/cm	810
Magnesium	*	mg/L	25
Potassium	*	mg/L	7
Silica	*	mg/L	18
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Alice Springs for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Darwin

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.001
Arsenic	0.007	mg/L	0.0004
Barium	0.7	mg/L	0.03
Boron	4	mg/L	0.01
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.003
Fluoride	1.5	mg/L	0.5
Iodide	0.1	mg/L	0.02
Lead	0.01	mg/L	0.0011
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.003
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	0.60
Nitrite[3]	3	mg/L	DNA
Radiological [4]	0.5	mSv/year	0.02
Selenium	0.01	mg/L	0.0005
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.07
Uranium	0.02	mg/L	0
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.02
Chloride	250	mg/L	3
Copper	1	mg/L	0.02
Hardness (total)	200	mg/L	35
Iron	0.3	mg/L	0.14
Manganese	0.1	mg/L	0.03
pH	6.5 - 8.5	pH units	7
Sodium	180	mg/L	2
Sulphate	500	mg/L	1
TDS	800	mg/L	50
Zinc	3	mg/L	0.013
Other Parameters[5]			
Alkalinity	*	mg/L	30
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.04
Calcium	*	mg/L	7
Electrical Conductivity	*	µS/cm	80
Magnesium	*	mg/L	4
Potassium	*	mg/L	1
Silica	*	mg/L	7
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Darwin for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Katherine

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.0004
Barium	0.7	mg/L	0.03
Boron	4	mg/L	0.01
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	0.4
Iodide	0.1	mg/L	0.03
Lead	0.01	mg/L	0.0008
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.04
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	0.7
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.11
Selenium	0.01	mg/L	0.0005
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.04
Uranium	0.02	mg/L	0.0002
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.02
Chloride	250	mg/L	4
Copper	1	mg/L	0.02
Hardness	200	mg/L	80
Iron	0.3	mg/L	0.03
Manganese	0.1	mg/L	0.002
pH	6.5 - 8.5	pH units	7.2
Sodium	180	mg/L	7.4
Sulphate	500	mg/L	7.4
TDS	800	mg/L	110
Zinc	3	mg/L	0.2
Other Parameters[5]			
Alkalinity	*	mg/L	90
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.4
Calcium	*	mg/L	20
Electrical Conductivity	*	µS/cm	190
Magnesium	*	mg/L	9
Potassium	*	mg/L	1
Silica	*	mg/L	11
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Katherine for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Tennant Creek

Parameter/Location	Trigger levl[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.002
Barium	0.7	mg/L	0.07
Boron	4	mg/L	0.4
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	1.4
Iodide	0.1	mg/L	0.2
Lead	0.01	mg/L	0.005
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	35
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.05
Selenium	0.01	mg/L	0.006
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	N/A
Uranium	0.02	mg/L	0.009
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	100
Copper	1	mg/L	0.008
Hardness	200	mg/L	170
Iron	0.3	mg/L	0.02
Manganese	0.1	mg/L	0.002
pH	6.5 - 8.5	pH units	7.9
Sodium	180	mg/L	80
Sulphate	500	mg/L	60
TDS	800	mg/L	630
Zinc	3	mg/L	0.008
Other Parameters[5]			
Alkalinity	*	mg/L	280
Beryllium	*	mg/L	0.002
Bromide	*	mg/L	0.9
Calcium	*	mg/L	30
Electrical Conductivity	*	µS/cm	980
Magnesium	*	mg/L	30
Potassium	*	mg/L	30
Silica	*	mg/L	35
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Tennant Creek for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Yulara

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.001
Arsenic	0.007	mg/L	0.002
Barium	0.7	mg/L	0.03
Boron	4	mg/L	0.6
Cadmium	0.002	mg/L	0
Chromium	0.05	mg/L	0.0008
Fluoride	1.5	mg/L	0.06
Iodide	0.1	mg/L	0.02
Lead	0.01	mg/L	0.0005
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.0025
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	15
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.02
Selenium	0.01	mg/L	0.001
Silver	0.1	mg/L	0.05
Total THMs	0.25	mg/L	0.03
Uranium	0.02	mg/L	0.0001
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.02
Chloride	250	mg/L	44
Copper	1	mg/L	0.1
Hardness	200	mg/L	15
Iron	0.3	mg/L	0.16
Manganese	0.1	mg/L	0.003
pH	6.5 - 8.5	pH units	6.5
Sodium	180	mg/L	30
Sulphate	500	mg/L	15
TDS	500	mg/L	135
Zinc	3	mg/L	0.02
Other Parameters[5]			
Alkalinity	*	mg/L	14
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.3
Calcium	*	mg/L	6
Electrical Conductivity	*	µS/cm	250
Magnesium	*	mg/L	2
Potassium	*	mg/L	4
Silica	*	mg/L	4
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Yulara for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Appendix 4: Health, Aesthetic and Other Parameters in Minor Centres 2002-2004

Drinking Water Quality in Adelaide River

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.003
Barium	0.7	mg/L	0.03
Boron	4	mg/L	0.02
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	0.2
Iodide	0.1	mg/L	0.007
Lead	0.01	mg/L	0.002
Mercury	0.001	mg/L	0.0005
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	0.5
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.17
Selenium	0.01	mg/L	0.005
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.002
Uranium	0.02	mg/L	0
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	20
Copper	1	mg/L	0.3
Hardness	200	mg/L CaCO3	75
Iron	0.3	mg/L	0.4
Manganese	0.1	mg/L	0.07
pH	6.5 - 8.5	pH units	6.8
Sodium	180	mg/L	17
Sulphate	500	mg/L	6
TDS	800	mg/L	180
Zinc	3	mg/L	0.06
Other Parameters[5]			
Alkalinity	*	mg/L	90
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.07
Calcium	*	mg/L	13
Electrical Conductivity	*	µS/cm	230
Magnesium	*	mg/L	10
Potassium	*	mg/L	1
Silica	*	mg/L	25
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Adelaide River for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Batchelor

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.0003
Barium	0.7	mg/L	0.025
Boron	4	mg/L	0.01
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	0.2
Iodide	0.1	mg/L	0.005
Lead	0.01	mg/L	0.0005
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	0.9
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.11
Selenium	0.01	mg/L	0.0005
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.002
Uranium	0.02	mg/L	0.0002
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	5
Copper	1	mg/L	0.005
Hardness (total)	200	mg/L	190
Iron	0.3	mg/L	0.15
Manganese	0.1	mg/L	0.002
pH	6.5 - 8.5	pH units	7.1
Sodium	180	mg/L	6
Sulphate	500	mg/L	10
TDS	800	mg/L	240
Zinc	3	mg/L	0.05
Other Parameters[5]			
Alkalinity	*	mg/L	200
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.02
Calcium	*	mg/L	30
Electrical Conductivity	*	µS/cm	390
Magnesium	*	mg/L	30
Potassium	*	mg/L	1
Silica	*	mg/L	20
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Batchelor for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Borroloola

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0004
Arsenic	0.007	mg/L	0.0005
Barium	0.7	mg/L	0.02
Boron	4	mg/L	0.04
Cadmium	0.002	mg/L	0.0004
Chromium	0.05	mg/L	0.003
Fluoride	1.5	mg/L	0.05
Iodide	0.1	mg/L	0.02
Lead	0.01	mg/L	0.002
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	0.67
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.2
Selenium	0.01	mg/L	0.0005
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.01
Uranium	0.02	mg/L	0.0002
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	9
Copper	1	mg/L	0.05
Hardness	200	mg/L	35
Iron	0.3	mg/L	0.2
Manganese	0.1	mg/L	0.11
pH	6.5 - 8.5	pH units	6.3
Sodium	180	mg/L	5
Sulphate	500	mg/L	1
TDS	800	mg/L	70
Zinc	3	mg/L	0.7
Other Parameters[5]			
Alkalinity	*	mg/L	34
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.07
Calcium	*	mg/L	11
Electrical Conductivity	*	µS/cm	100
Magnesium	*	mg/L	1
Potassium	*	mg/L	1
Silica	*	mg/L	11
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Borroloola for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Daly Waters

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.002
Barium	0.7	mg/L	0.04
Boron	4	mg/L	0.4
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	0.3
Iodide	0.1	mg/L	0.2
Lead	0.01	mg/L	0.0005
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.003
Nitrate	50	mg/L	7.1
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.05
Selenium	0.01	mg/L	0.01
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.002
Uranium	0.02	mg/L	0.008
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	350
Copper	1	mg/L	0.005
Hardness	200	mg/L	550
Iron	0.3	mg/L	0.2
Manganese	0.1	mg/L	0.003
pH	6.5 - 8.5	pH units	7.5
Sodium	180	mg/L	230
Sulphate	500	mg/L	230
TDS	800	mg/L	1280
Zinc	3	mg/L	0.01
Other Parameters[5]			
Alkalinity	*	mg/L	430
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	1.6
Calcium	*	mg/L	120
Electrical Conductivity	*	µS/cm	2100
Magnesium	*	mg/L	65
Potassium	*	mg/L	30
Silica	*	mg/L	22
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Daly Waters for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Elliott

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.001
Barium	0.7	mg/L	0.2
Boron	4	mg/L	0.3
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	0.8
Iodide	0.1	mg/L	0.09
Lead	0.01	mg/L	0.0005
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.005
Nitrate	50	mg/L	14
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.04
Selenium	0.01	mg/L	0.007
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.008
Uranium	0.02	mg/L	0.006
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	160
Copper	1	mg/L	0.011
Hardness	200	mg/L	380
Iron	0.3	mg/L	0.08
Manganese	0.1	mg/L	0.002
pH	6.5 - 8.5	pH units	7.6
Sodium	180	mg/L	75
Sulphate	500	mg/L	70
TDS	800	mg/L	725
Zinc	3	mg/L	0.03
Other Parameters[5]			
Alkalinity	*	mg/L	540
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	1
Calcium	*	mg/L	80
Electrical Conductivity	*	µS/cm	1220
Magnesium	*	mg/L	46
Potassium	*	mg/L	24
Silica	*	mg/L	26
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Elliot for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Kings Canyon

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0002
Arsenic	0.007	mg/L	0.003
Barium	0.7	mg/L	0.02
Boron	4	mg/L	0.3
Cadmium	0.002	mg/L	0.0002
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	0.3
Iodide	0.1	mg/L	DNA
Lead	0.01	mg/L	0.0001
Mercury	0.001	mg/L	0.0003
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.01
Nitrate	50	mg/L	8
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.7
Selenium	0.01	mg/L	0.015
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	DNA
Uranium	0.02	mg/L	0.002
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	220
Copper	1	mg/L	0.1
Hardness	200	mg/L	300
Iron	0.3	mg/L	0.08
Manganese	0.1	mg/L	0.002
pH	6.5 - 8.5	pH units	7.0
Sodium	180	mg/L	168
Sulphate	500	mg/L	168
TDS	800	mg/L	730
Zinc	3	mg/L	0.6
Other Parameters[5]			
Alkalinity	*	mg/L	100
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	1.5
Calcium	*	mg/L	60
Electrical Conductivity	*	µS/cm	1230
Magnesium	*	mg/L	40
Potassium	*	mg/L	23
Silica	*	mg/L	20
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Kings Canyon for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Larrimah

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.002
Barium	0.7	mg/L	0.05
Boron	4	mg/L	0.2
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	0.2
Iodide	0.1	mg/L	0.1
Lead	0.01	mg/L	0.0005
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.004
Nitrate	50	mg/L	4
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.05
Selenium	0.01	mg/L	0.007
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.005
Uranium	0.02	mg/L	0.002
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.02
Chloride	250	mg/L	180
Copper	1	mg/L	0.007
Hardness	200	mg/L	500
Iron	0.3	mg/L	0.1
Manganese	0.1	mg/L	0.002
pH	6.5 - 8.5	pH units	7.4
Sodium	180	mg/L	120
Sulphate	500	mg/L	130
TDS	800	mg/L	890
Zinc	3	mg/L	0.03
Other Parameters[5]			
Alkalinity	*	mg/L	440
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	1.2
Calcium	*	mg/L	110
Electrical Conductivity	*	µS/cm	1500
Magnesium	*	mg/L	54
Potassium	*	mg/L	12
Silica	*	mg/L	23
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Larrimah for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Mataranka

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameter			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.002
Barium	0.7	mg/L	0.07
Boron	4	mg/L	0.3
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.003
Fluoride	1.5	mg/L	0.3
Iodide	0.1	mg/L	0.1
Lead	0.01	mg/L	0.002
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.006
Nitrate	50	mg/L	3
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.07
Selenium	0.01	mg/L	0.01
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.002
Uranium	0.02	mg/L	0.004
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	190
Copper	1	mg/L	0.02
Hardness	200	mg/L	500
Iron	0.3	mg/L	0.6
Manganese	0.1	mg/L	0.003
pH	6.5 - 8.5	pH units	7.5
Sodium	180	mg/L	150
Sulphate	500	mg/L	160
TDS	800	mg/L	970
Zinc	3	mg/L	0.2
Other Parameters[5]			
Alkalinity	*	mg/L	460
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	1.5
Calcium	*	mg/L	110
Electrical Conductivity	*	µS/cm	1640
Magnesium	*	mg/L	60
Potassium	*	mg/L	20
Silica	*	mg/L	24
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Mataranka for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Newcastle Waters

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.001
Barium	0.7	mg/L	0.01
Boron	4	mg/L	0.3
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	0.9
Iodide	0.1	mg/L	0.08
Lead	0.01	mg/L	0.0005
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	6
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.05
Selenium	0.01	mg/L	0.006
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.006
Uranium	0.02	mg/L	0.004
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	120
Copper	1	mg/L	0.02
Hardness	200	mg/L	360
Iron	0.3	mg/L	0.05
Manganese	0.1	mg/L	0.002
pH	6.5 - 8.5	pH units	7.3
Sodium	180	mg/L	50
Sulphate	500	mg/L	50
TDS	800	mg/L	660
Zinc	3	mg/L	0.02
Other Parameters[5]			
Alkalinity	*	mg/L	360
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.8
Calcium	*	mg/L	80
Electrical Conductivity	*	µS/cm	1120
Magnesium	*	mg/L	40
Potassium	*	mg/L	25
Silica	*	mg/L	26
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Newcastle Waters for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Pine Creek

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.005
Barium	0.7	mg/L	0.025
Boron	4	mg/L	0.01
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	0.44
Iodide	0.1	mg/L	0.02
Lead	0.01	mg/L	0.0005
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	0.8
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.07
Selenium	0.01	mg/L	0.0005
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.007
Uranium	0.02	mg/L	0.0001
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	7
Copper	1	mg/L	0.005
Hardness	200	mg/L	100
Iron	0.3	mg/L	0.25
Manganese	0.1	mg/L	0.01
pH	6.5 - 8.5	pH units	7.5
Sodium	180	mg/L	30
Sulphate	500	mg/L	8
TDS	800	mg/L	200
Zinc	3	mg/L	0.02
Other Parameters[5]			
Alkalinity	*	mg/L	150
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.04
Calcium	*	mg/L	14
Electrical Conductivity	*	µS/cm	300
Magnesium	*	mg/L	15
Potassium	*	mg/L	2
Silica	*	mg/L	25
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Pine Creek for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Timber Creek

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.001
Barium	0.7	mg/L	1.2
Boron	4	mg/L	0.2
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	1.4
Iodide	0.1	mg/L	0.02
Lead	0.01	mg/L	0.002
Mercury	0.001	mg/L	0.0001
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	1
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	0.12
Selenium	0.01	mg/L	0.0005
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	0.002
Uranium	0.02	mg/L	0.002
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.01
Chloride	250	mg/L	25
Copper	1	mg/L	0.04
Hardness	200	mg/L	420
Iron	0.3	mg/L	0.06
Manganese	0.1	mg/L	0.002
pH	6.5 - 8.5	pH units	7.6
Sodium	180	mg/L	20
Sulphate	500	mg/L	20
TDS	800	mg/L	470
Zinc	3	mg/L	0.02
Other Parameters[5]			
Alkalinity	*	mg/L	450
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.11
Calcium	*	mg/L	60
Electrical Conductivity	*	µS/cm	850
Magnesium	*	mg/L	70
Potassium	*	mg/L	7
Silica	*	mg/L	15
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Timber Creek for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Drinking Water Quality in Ti Tree

Parameter/Location	Trigger level[1]	Units	Actual level[2]
Health Parameters			
Antimony	0.003	mg/L	0.0001
Arsenic	0.007	mg/L	0.002
Barium	0.7	mg/L	0.1
Boron	4	mg/L	0.4
Cadmium	0.002	mg/L	0.0001
Chromium	0.05	mg/L	0.002
Fluoride	1.5	mg/L	0.8
Iodide	0.1	mg/L	0.2
Lead	0.01	mg/L	0.0005
Mercury	0.001	mg/L	0.00005
Molybdenum	0.05	mg/L	0.002
Nickel	0.02	mg/L	0.001
Nitrate	50	mg/L	7
Nitrite[3]	3	mg/L	DNA
Radiological[4]	0.5	mSv/year	DNA
Selenium	0.01	mg/L	0.006
Silver	0.1	mg/L	0.005
Total THMs	0.25	mg/L	DNA
Uranium	0.02	mg/L	0.04
Aesthetic Parameters			
Aluminium	0.2	mg/L	0.001
Chloride	250	mg/L	80
Copper	1	mg/L	0.005
Hardness	200	mg/L	230
Iron	0.3	mg/L	0.01
Manganese	0.1	mg/L	0.04
pH	6.5 - 8.5	pH units	7.8
Sodium	180	mg/L	150
Sulphate	500	mg/L	65
TDS	800	mg/L	700
Zinc	3	mg/L	0.007
Other Parameters[5]			
Alkalinity	*	mg/L	350
Beryllium	*	mg/L	0.0005
Bromide	*	mg/L	0.1
Calcium	*	mg/L	45
Electrical Conductivity	*	µS/cm	1030
Magnesium	*	mg/L	22
Potassium	*	mg/L	21
Silica	*	mg/L	50
Tin	*	mg/L	0.005

Legend

N/A	Not applicable	*	No guideline value applicable
DNA	Data not available	µS/cm	Microsiemens per centimetre
mg/L	Milligrams per litre	mSv/year	Millisieverts per year

[1] Australian Drinking Water Guideline (ADWG 1996) values for health and aesthetic parameters. TDS guideline value set by DHCS.
[2] Actual level is the average of results obtained from samples collected in the reticulation system in Ti Tree for 2002-2004.
[3] Readily oxidises to Nitrate and therefore not tested.
[4] Total annual radiological dose per year.
[5] With the exception of Beryllium and Tin all other parameters are not included in the ADWG and tests are conducted for analytical purposes and to assist in providing a complete set of water quality results.

Glossary of Terms

ADWG	Australian Drinking Water Guidelines
AwwaRF	American Water Works Association Research Foundation
CRC	Cooperative Research Centre
DBIRD	Department of Business, Industry and Resource Development
DHCS	Department of Health and Community Services
ESO	Essential Services Officer
HACCP	Hazard Analysis and Critical Control Point
mg/L	milligrams per Litre
mSv	millisieverts
ML	megalitres (one million litres)
NT	Northern Territory
SCADA	Supervisory Control and Data Acquisition
TDS	Total Dissolved Solids
THMs	Trihalomethanes
WIMS	Work Information Management System
µg/L	micrograms per Litre

Notes

Notes

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