PowerWater

Annual Drinking Water Quality Report

2020

Docker River.

PowerWater

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From the Chief Executive Officer

When you deliver essential services in some of Australia's most challenging and diverse conditions, challenges are part of your everyday reality.

However the last twelve months brought some particularly unique highs, lows and growth opportunities for Power and Water. We saw our safety culture improve, a move towards a new operating model and continued diligence applying our drinking water quality management system, which underpins our risk-based approach to the delivery of safe drinking water.

Then early 2020 brought with it the once-in-a-lifetime experience of delivering services in a global pandemic. Despite the uncertainties, our teams rallied and rose to the challenge. We took stock of the situation, considered the safety of our employees and our customers and continued our job of delivering quality essential services for all Territorians – including the provision of safe drinking water.

Power and Water is transitioning to a new Operating Model that will enable us to respond to a changing market environment driven by government policy, regulation, technologies and customer and community expectations. We are also aiming to leverage the synergies that we have available as a multi-utility service provider of gas, water and power services, by efficiently and effectively organising our business structure, improving our systems and streamlining processes to deliver value to our customers and Shareholder.

Our 'Safe Water Plan' maps out Power and Water's continuous improvement journey for drinking water using a risk based approach. Consistent with the Australian Drinking Water Guidelines, Power and Water's journey takes a risk based approach to guide the priority in which we address drinking water supply risks and ensures our focus is maintained on drinking water quality.

A key component of our water quality management system focus is disinfection as a key barrier for the provision of safe drinking water. Our program of disinfection infrastructure upgrades is part of our ongoing commitment to delivery of safe drinking water.

We are also keenly supporting a program of ongoing research and development through the Water in Northern Australia Cooperative Research Centre. We successfully secured a grant to trial membrane Capacitive Deionisation (mCDI) to help address the issues with chemical exceedances in remote communities. This critical work enables continuous improvement and innovation in our approach to water quality in remote communities.

Power and Water values the partnerships with key government organisations, especially the Department of Health that we work closely with to ensure safe supply of drinking water to urban and remote communities throughout the Northern Territory.

I am confident we are on the right path and with the right people on board to continue our journey in becoming a mature, efficient utility, providing safe drinking water across the Northern Territory.

Djuna Pollard
Chief Executive Officer

PowerWater

Drinking Water Quality Report 2019-20

The Annual Drinking Water Quality Report for 2019-20 ("the report") is a record of drinking water quality information for the five major and 14 minor centres, and 72 remote indigenous communities serviced by Power and Water Corporation during the period 1 July 2019 to 30 June 2020.

The report describes drinking water quality activities to the Northern Territory public and allows the Department of Health (DoH) to make public health assessments in a transparent way.

Section 1 explains the preventive water quality management activities undertaken in this period.

Section 2 describes the characteristics of the drinking water quality supplied to consumers, with the statistics presented in the appendices. This section is broken into two parts:

- Part A – Major and minor urban centres
- Part B – Remote communities

Operating context

Power and Water is responsible for delivering safe drinking water services to its customers in the Northern Territory (NT). This responsibility is established under the *Power and Water Corporation Act 2002*, the *Government Owned Corporations Act 2001* for urban centres and by agreement with the Northern Territory Government for remote centres.

The Power and Water Board of Directors is responsible to the Shareholding Minister for the corporation's performance and is required to provide a Statement of Corporate Intent (SCI) each financial year. The SCI sets out the organisational objectives and strategies over a four-year period.

Power and Water's strategic objectives as articulated in the SCI 2019-20 financial year were to:

- operate at least as efficiently as any comparable business
- maximise the sustainable return to the Northern Territory Government (NTG) on its investment in the corporation.

Power and Water is accountable for providing safe and reliable water and sewerage services across the Northern Territory. Services to major and minor urban centres are provided under the *Water and Sewerage Services Act 2000* and licences granted by the Utilities Commission.

Indigenous Essential Services (IES)

The delivery of water and sewerage services to remote communities is provided by Power and Water Corporation through an agreement with its wholly owned not-for-profit subsidiary Indigenous Essential Services Pty Ltd (IES). IES is funded through a Service Level Agreement with the Department of Territory Families, Housing and Communities. Through the Service Level Agreement, water is supplied to 72 communities and 57 of these communities also receive sewerage services. In addition, 15 outstations or homelands are connected and have access to water supply.

Water and sewerage related services are provided under a Service Level Agreement with IES. Funding is limited to ongoing recurrent budgets that are set by the Department of Territory Families, Housing and Communities. For additional capital projects, Power and Water's IES requests funds through the Department of Territory Families, Housing and Communities, and the Department of Treasury and Finance, which is balanced against other priorities.

COVID-19 response

Coronavirus disease 2019 (COVID-19), a contagious respiratory and vascular disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), caused an ongoing pandemic during 2020. As a response to the pandemic, an Emergency Situation in the Northern Territory was declared under the Public and *Environmental Health Act* on 18 March 2020. The Public Utilities Group was stood-up and Power and Water activated its emergency management arrangements to respond.

The key focus of Power and Water, as an essential service provider, was to ensure that all Territorians had access to safe water and reliable power services.

Power and Water responded to the challenge by developing Business Continuity Plans (BCP) for the management of operations during the COVID-19 pandemic. The BCP outlines operational and regulatory changes to business as usual activities to minimise the potential impact of COVID-19 on Power and Water's delivery of essential services to the community of the Northern Territory.

To ensure the continued safe supply of water, Power and Water undertook a number of activities including:

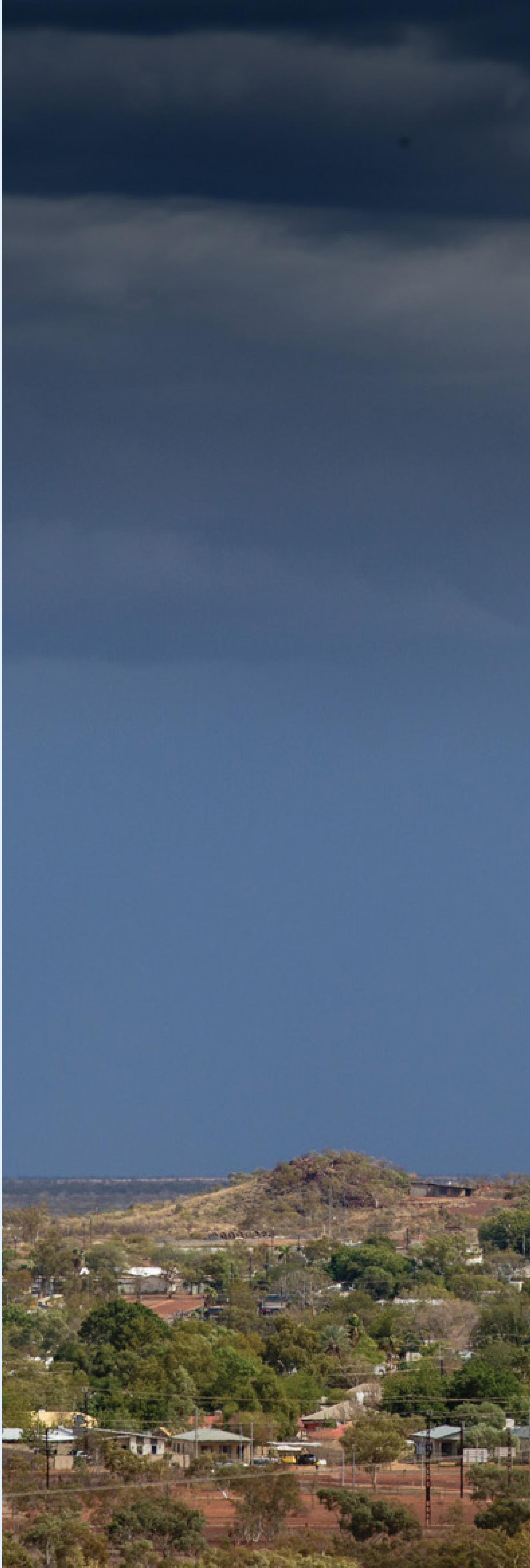
a. Developing plans for the continuation of sampling in minor centres and remote communities to ensure all microbiological samples could continue to be taken.

b. Working with laboratories to ensure they could maintain staffing during outbreak scenarios.

c. Working with Department of Chief Minister to ensure Power and Water could continue to access remote communities to provide services when biosecurity area restrictions were put in place.

d. Working with operations teams involved in sewage treatment to ensure they understood level of risk posed by wastewater contaminated with COVID-19 when compared with other contaminants from wastewater.

During the 2019/2020 financial year, Power and Water continued to maintain a high level of service to customers. Some physical/chemical samples were unable to be taken due to the biosecurity zone controls that restricted access to communities. However all microbiological sampling continued throughout the pandemic and the safe supply of drinking water continued.



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> The key focus of Power and Water, as an essential service provider, was to ensure that all Territorians had access to safe water and reliable power services.

Tennant Creek.

Section 1
Framework for Drinking Water Quality Management

Australian Drinking Water Guidelines

The Australian Drinking Water Guidelines (ADWG) provide the primary reference on drinking water quality in Australia. It is designed to provide an authoritative source of information on what defines safe, good quality drinking water, as well as how its provision can be achieved and assured. The ADWG is published by the National Health and Medical Research Council in collaboration with the Natural Resource Management Ministerial Council.

The ADWG is developed based on the best available scientific evidence regarding both the health and aesthetic aspects of drinking water quality. The ADWG are the adopted standards and provide a common benchmark for assessing the acceptability of drinking water supplied to consumers across Australia.

The ADWG describes a preventative, risk management approach that encompasses all steps in water production – from catchment to consumer. The ADWG Framework for Management of Drinking Water Quality defines this preventative, integrated approach.

The Framework outlines four general areas for ensuring the provision of safe drinking water:

- organisational commitment to drinking water quality management
- system analysis and management
- supporting requirements
- review processes for continual improvement.

Across these four areas, the framework outlines 12 elements considered good practice for the integrated management of drinking water supplies. Together, these elements comprise proactive approach for ensuring safe and reliable drinking water to the community.

There are rolling revisions to ensure the ADWG represents the latest scientific evidence on good quality drinking water. All assessments made in this report are made against version 3.5, updated in August 2018.

Donkey Camp, Katherine River.

01

Commitment to drinking water quality management

Power and Water Corporation (Power and Water) has a strong commitment to drinking water quality management, both at management level and through individual employees. This is outlined in Power and Water's Drinking Water Quality Policy, continued investment in resourcing in the area of water quality and efforts to raise the profile of the Northern Territory Water Sector within the wider community.

Power and Water's Safe Water Plan, which has been approved by the board, maps out a three year improvement journey based on the Australian Drinking Water Guidelines and using a risk based approach. The 2019/20 reporting period delivered the first year of a three year plan. The plan focuses on four key initiatives:

- Understanding customer expectations
- Safe water supply schemes
- Continuously improve the Drinking Water Quality Management System
- Reliable and sustainable operation performance

The Safe Water Plan results in an annual improvement plan which is implemented and tracked across the year, to ensure continual improvement in the water quality area.

A key outcome this year is the formalisation of reporting activities to Power and Water's Board and senior management through the introduction of a Board and Management Visibility Procedure. This enables increased and uniform visibility of water quality related events and activities across all water supply schemes serviced by Power and Water.

Following on from the reporting of incidents and events, Power and Water has developed uniform water supply risk ranking methods across all our schemes and integrated remote schemes into the framework. This is a key component of Power and Water's structural integration, which allows uniform assessment of water safety across the entire Northern Territory.

On a more general note across the organisation, important changes to our Customer, Strategy and Regulation organisational structure occurred, which support our new accountabilities and operating model and will help build stronger relationships with our customers and stakeholders. Our Corporate Affairs function ensures aligned and cohesive communications and messaging to key external stakeholders.

Through our organisational alignment, we are able to make the most of our strengths as an organisation, leverage the unique and broad-ranging skills and experience of our people, and work better together to overcome challenges and find better ways to do things.

Power and Water is working with the International Water Association (IWA) to host Health Related Water Microbiology Conference in Darwin in September 2022.


Kalkarindji.

Partnerships

Power and Water collaborates with various stakeholders for the provision of safe drinking water to all customers and the protection of public health. This is primarily achieved by building effective partnerships with multiple governmental agencies.

Power and Water has a primary responsibility for providing customers with safe drinking water in accordance with sound commercial practices, its Operating Licence through the *Water Supply and Sewerage Services Act 2000* (NT), its remote customers under the *Power and Water Corporation Act 2002* (NT) and *Indigenous Essential Services Agreement*.

Northern Territory Government Departments

The Northern Territory Government agencies partnering with Power and Water in protecting water quality are:

Department of Health (DoH)

A Memorandum of Understanding between the Department of Health and the Power and Water Corporation for drinking water (MoU), formalises the public health accountabilities and responsibilities.

DoH has important responsibilities in protecting public health under the *Public and Environmental Health Act 2011* (NT) and other relevant legislation. The MoU defines the regulatory role of the DoH for drinking water quality in the Northern Territory.

Department of Territory Families, Housing and Communities (DTFHC)

Power and Water Corporation through its subsidiary, Indigenous Essential Services (IES), work in partnership with DTFHC to provide electricity, water and sewerage services to 72 remote Aboriginal communities. IES is funded through service agreement with the DTFHC. Through the service agreement, water is supplied to 72 communities and 57 of these communities also receive sewerage services. In addition, 15 outstations or homelands are connected and have access to water supply.

Delivering safe drinking water is a key priority. Power and Water manages water quality through the Drinking Water Quality Management System. Based on risk, improvements are identified for the DTFHC to approve and fund.

Department of Environment, Parks and Water Security (DEPWS)

DEPWS performs a regulatory role to control pollution and leads the development of the NTG regulatory framework for water.

Power and Water continues to respond to the impact to public drinking water supplies from the historical use of firefighting foams.

The Department of Infrastructure, Planning and Logistics (DIPL)

DIPL protects water quality through appropriate land use planning and the regulation of private plumbing.

The Department Industry, Tourism NT Trade (DITT)

DITT-Primary Resources undertakes independent analyses of water samples in Darwin and Alice Springs laboratories.

Northern Territory PFAS response

Power and Water continues to respond to the impact to public drinking water supplies from the historical use of firefighting foams.

The Northern Territory Per- and poly-Fluorinated Alkyl Substances (PFAS) interagency working group was formed to coordinate the response across the Northern Territory. Power and Water is an active member of any response to contaminated site investigations, by helping to understand the impact on public water supplies.

Power and Water began monitoring for PFAS in customers' drinking water in October 2016. The results are reported on the Power and Water website, and to the Northern Territory and Federal Departments of Health.

The Katherine township, located 320km south east of Darwin is the Northern Territory's (NT) third largest town and home to approx.10,000 people. The Katherine township is supplied with a blend of surface water from the Katherine River and groundwater from the Tindall aquifer. As it is a critical component of the town's water supply, when the groundwater was identified as being contaminated with PFAS chemicals, it significantly impacted the community.

In response, Power and Water collaborated with the Department of Defence to deliver a 12.5 litre per second modular treatment system using world first and leading edge ion exchange technology from Maine (US) to Katherine within four months of PFAS being identified in the drinking water supply.

The plant has been in operation since October 2017 and has treated over 1 billion litres of water with zero waste streams produced.

Based on the success of the modular system, a 10 million litre per day treatment plant is now being constructed and will secure the town's water supply and meet future demand over a 30-year planning horizon.

Further information about PFAS results and investigations can be found on the following websites:

Power and Water PFAS information
https://www.powerwater.com.au/about/what-we-do/water-supply/drinking-water-quality/pfas

Australian Government Department of Health PFAS Information
http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-pfas.htm

Northern Territory Department of Health PFAS Frequently Asked Questions
http://mediareleases.nt.gov.au/api/attachment/byId/8914

Department of Defence Hotline 1800 316 813 PFAS investigations
http://www.defence.gov.au/Environment/PFAS/

The Northern Territory Per- and poly-Fluorinated Alkyl Substances Interagency Working Group
https://ntepa.nt.gov.au/your-environment/pfas

02

Assessment of the drinking water supply system

The Australian Drinking Water Guidelines emphasise a preventative, risk management approach for ensuring the safety of water supplied to consumers. In order to do this, Power and Water undertake assessments of the water supply system to identify potential risks to water safety and ensure appropriate mitigation strategies are put in place.

The Water Services Association of Australia (WSAA) Health Based Targets Manual is used by Power and Water to guide a self-assessment process to determine the water safety for each scheme. The manual looks at the source water assessment together with a water treatment assessment to determine the water safety assessment and required water safety improvement plan.

The source water assessment looks at critical activities for safe management of water supplies including understanding the vulnerability of different water sources to contamination and assessing the likelihood of contamination to water sources from activities in the catchment. Examples of contamination sources include septic tanks, cattle, rubbish dumping and mining. A sanitary survey is performed to identify those contamination sources, and a hydrogeological assessment is performed to explore the vulnerability of an aquifer to contamination. Ultimately the two assessments are combined to determine the water treatment requirements for a scheme, in order to provide safe drinking water.

In this reporting period sanitary surveys and water safety assessments occurred at the following schemes: Acacia, Larrakia, Ali Curung,Alpurrurulam, Ampilawatja, Atitjere, Belyuen, Canteen Creek, Engawala, Gapuwiak, Imangara, Kintore, Laramba, Nauiyu, Nganmarriyanga, Nturiya, Peppimenarti, Santa Teresa, Tara, Titjikala, Wadeye, Warruwi, Willowra, Wilora, Wurrumiyanga, Wutunugurra, Yirrkala, Yuelamu and Yuendumu.

Power and Water uses this information to determine improvement plans required for each scheme. Additionally, it informs an annual review of the risk assessment used to prioritise key mitigations required across all 92 schemes.

Water sources

All major and minor urban centres serviced by Power and Water are either in part, or completely reliant on groundwater for their drinking water supply. Most remote community drinking water supplies are from groundwater sources. Local subsurface aquifers at a range of depths and in a variety of geological environments are used. The groundwater is pumped to the surface through production bores.

Some drinking water sources are better protected than others, such as 'closed' catchments like Darwin River Reservoir or the artesian production bores used in Borroloola. However, even the protected water sources are still vulnerable to a broad range of potential hazards and require active management to maintain good water quality.

IES Water Source Status Report

Each year IES produce a Water Source Status Report. This report is the key planning document for assessing the sustainability of water sources in remote indigenous communities. In the 2019-20 financial year Power and Water implemented an improvement to the assessment framework to increase the certainty of water source status. Water quality deterioration can occur due to water stress in aquifers, particularly on islands and in the desert where blending of water sources is common to provide safe water while also reducing pressure on aquifers with high quality water. Ultimately provision of the best water quality to communities can be maximised through appropriate management and assessment of aquifer health.

Table 1: Summary of drinking water sources in major and minor urban centres

Centre	Type	Territory Region	Source
Adelaide River	Minor	Northern	Groundwater
Alice Springs	Major	Southern	Groundwater (Roe Creek Borefield)
Batchelor	Minor	Northern	Groundwater
Borroloola[1]	Minor	Katherine	Groundwater
Cox Peninsula	Minor	Northern	Groundwater
Daly Waters	Minor	Katherine	Groundwater
Darwin	Major	Northern	Surface water (Darwin River Reservoir) + groundwater (10%)
Elliott	Minor	Barkly	Groundwater
Gunn Point	Minor	Northern	Groundwater
Katherine	Major	Katherine	Surface water (Katherine River) + groundwater (20%)
Kings Canyon	Minor	Southern	Groundwater
Larrimah	Minor	Katherine	Groundwater
Mataranka	Minor	Katherine	Groundwater
Newcastle Waters	Minor	Barkly	Groundwater
Pine Creek	Minor	Katherine	Surface water (Copperfield Reservoir – emergency) + groundwater (100%)
Tennant Creek	Major	Barkly	Groundwater (Kelly Well, Kelly Well West and Cabbage Gum Borefields)
Timber Creek	Minor	Katherine	Groundwater
Ti Tree	Minor	Southern	Groundwater
Yulara	Major	Southern	Groundwater

1 The water source for the Borroloola town camps Garawa1 and 2 is groundwater and was separate from the Borroloola source up until April 2019. Post April 2019, Garawa1 and Garawa 2 were supplied water from the Borroloola groundwater source and therefore the Borroloola Water Treatment Plant.

Table 2 Summary of drinking water sources in remote communities

Centre	Territory Region	Source	Centre	Territory Region	Source
Acacia Larrakia	Northern	Groundwater	**Milikapiti**	Northern	Groundwater
Ali Curung	Southern	Groundwater	**Milingimbi**	Northern	Groundwater
Alpurrurulam	Southern	Groundwater	**Milyakburra**	Northern	Groundwater
Amanbidji	Katherine	Groundwater	**Minjilang**	Northern	Groundwater
Amoonguna	Southern	Groundwater	**Minyerri**	Katherine	Groundwater
Ampilatwatja	Southern	Groundwater	**Mt Liebig**	Southern	Groundwater
Angurugu	Northern	Groundwater	**Nauiyu**	Northern	Groundwater
Areyonga	Southern	Groundwater	**Nganmarriyanga**	Northern	Groundwater
Atitjere	Southern	Groundwater	**Ngukurr**	Katherine	Groundwater
Barunga	Katherine	Groundwater	**Nturiya**	Southern	Groundwater
Belyuen	Northern	Groundwater	**Numbulwar**	Northern	Groundwater
Beswick	Katherine	Groundwater	**Nyirripi**	Southern	Groundwater
Binjari	Katherine	Groundwater	**Papunya**	Southern	Groundwater
Bulla	Katherine	Surface + GW	**Peppimenarti**	Northern	Groundwater
Bulman	Katherine	Groundwater	**Pigeon Hole**	Katherine	Groundwater
Canteen Creek	Southern	Groundwater	**Pirlangimpi**	Northern	Surface + GW
Daguragu	Katherine	Groundwater	**Pmara Jutunta**	Southern	Groundwater
Engawala	Southern	Groundwater	**Ramingining**	Northern	Groundwater
Finke	Southern	Groundwater	**Rittarangu**	Katherine	Groundwater
Galiwinku	Northern	Groundwater	**Robinson River**	Katherine	Groundwater
Gapuwiyak	Northern	Groundwater	**Santa Teresa**	Southern	Groundwater
Gunbalanya	Northern	Groundwater	**Tara**	Southern	Groundwater
Gunyangara	Northern	Groundwater	**Titjikala**	Southern	Groundwater
Haasts Bluff	Southern	Groundwater	**Umbakumba**	Northern	Groundwater
Hermannsburg	Southern	Groundwater	**Wadeye**	Northern	Groundwater
Imangara	Southern	Groundwater	**Wallace Rockhole**	Southern	Groundwater
Imanpa	Southern	Groundwater	**Warruwi**	Northern	Groundwater
Jilkminggan	Katherine	Groundwater	**Weemol**	Katherine	Groundwater
Kalkarindji	Katherine	Groundwater	**Willowra**	Southern	Groundwater
Kaltukatjara	Southern	Groundwater	**Wilora**	Southern	Groundwater
Kintore	Southern	Groundwater	**Wurrumiyanga**	Northern	Groundwater
Kybrook Farm	Katherine	Groundwater	**Wutunugurra**	Southern	Groundwater
Lajamanu	Katherine	Groundwater	**Yarralin**	Katherine	Groundwater
Laramba	Southern	Groundwater	**Yirrkala**	Northern	Groundwater
Maningrida	Northern	Groundwater	**Yuelamu**	Southern	Groundwater
Manyallaluk	Katherine	Groundwater	**Yuendumu**	Southern	Groundwater

Figure 1 Drinking water supply system – Water Services

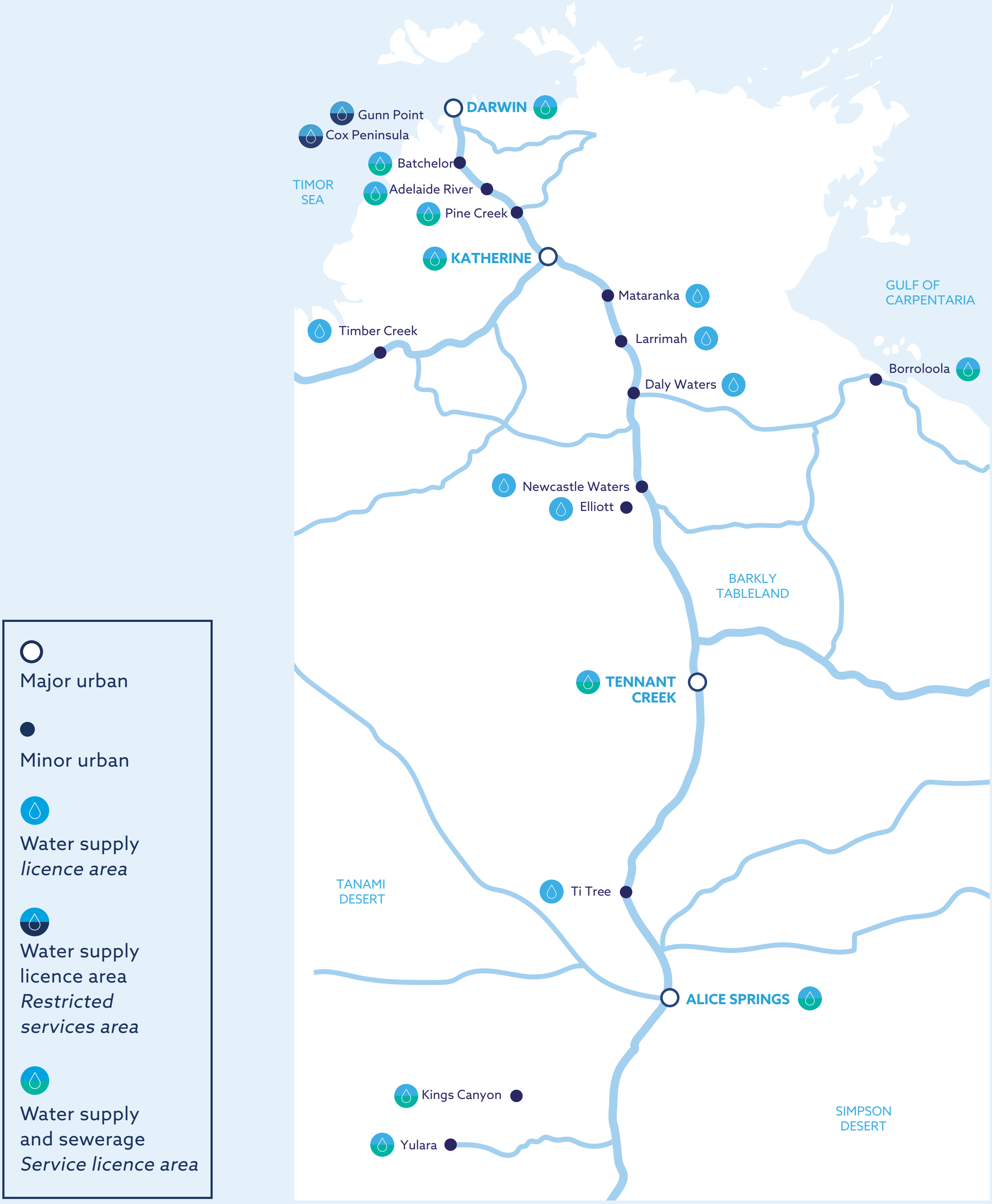
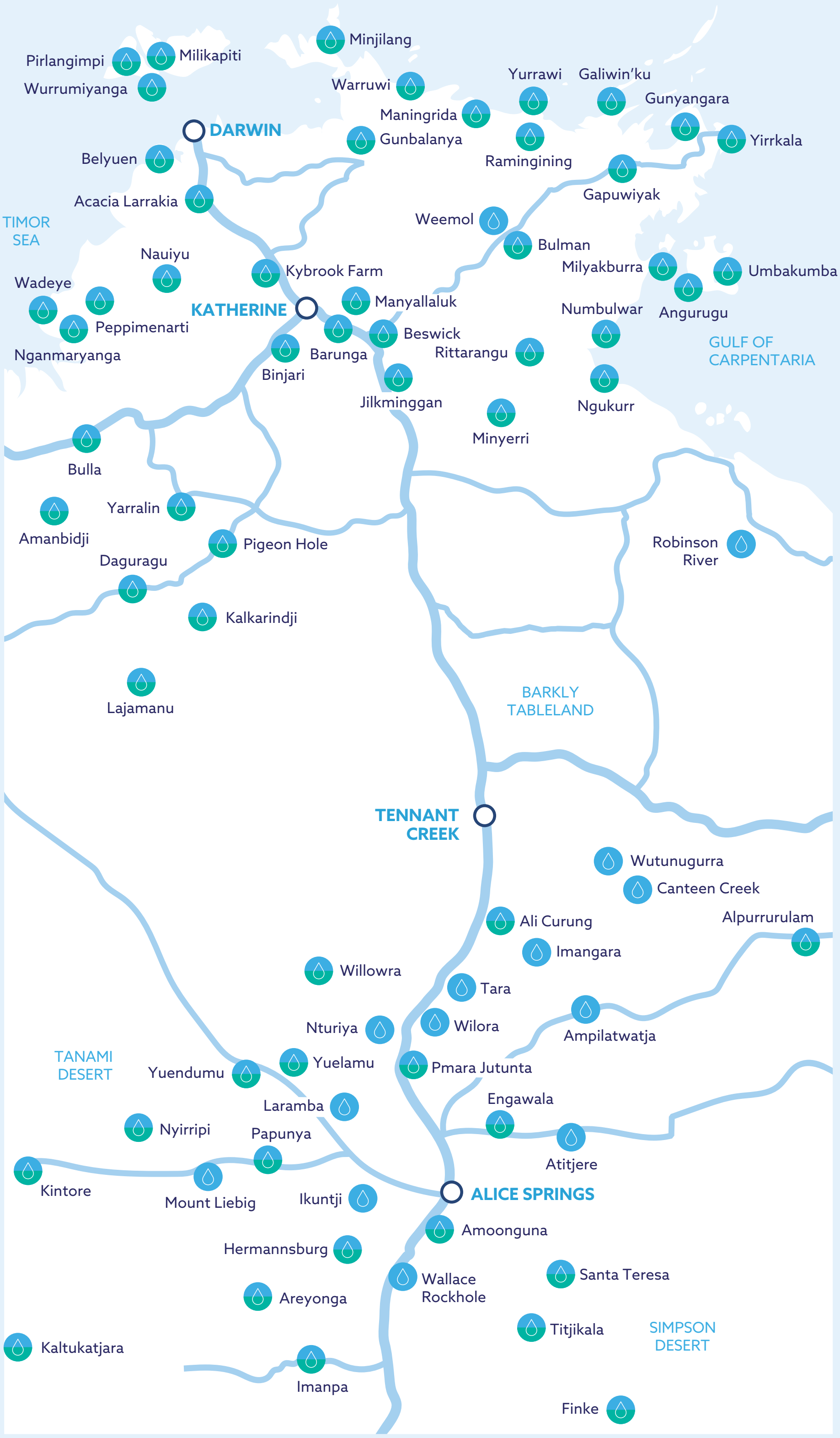


Figure 2 Drinking water supply system – Regions and Remote



Water supply *licence area*

Water supply and sewerage *Service area*

Copperfield Reservoir.

03

Preventative measures for drinking water quality management

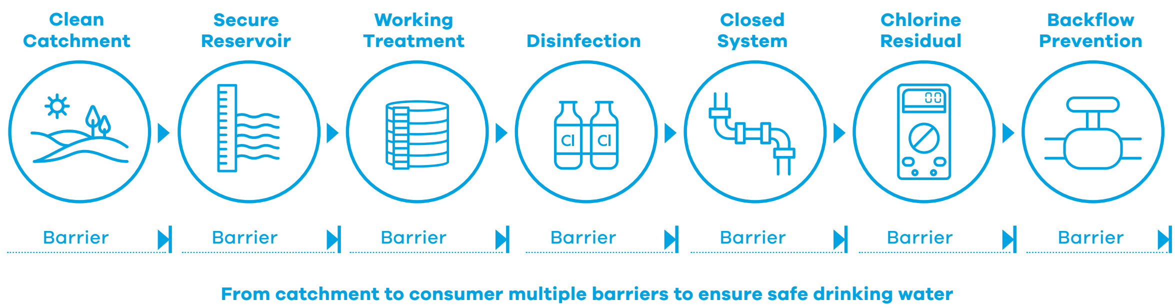
The second guiding principle in the ADWG, one of the key fundamental principles of the framework is *the drinking water system must have, and continuously maintain, robust multiple barriers appropriate to the level of potential contamination facing the raw water supply.* The ADWG recommend that robust, multiple barriers are implemented to ensure the supply of safe drinking water.

Barriers are not limited to water treatment and disinfection systems. In fact, some of the most important barriers to contaminant ingress are the water pipes and roofs on water tanks used to convey and store water prior to it reaching customer taps. Just like it is important to keep food stored appropriately prior to consuming it, maintaining appropriate system integrity ensures pathogens and chemicals do not enter water that is being supplied to consumers.

A multiple barrier approach

The ADWG recommend a 'catchment to consumer' approach for the management of water quality. The key advantage of using multiple barriers is that the failure of one barrier may be compensated for by the remaining barriers, minimising the likelihood of contaminants passing through the entire treatment system. The placement of barriers in a conventional multiple barrier system is shown in Figure 3 below.

Figure 3 Typical multiple barrier system



Tennant Creek.

Protecting the source

Keeping a clean catchment and water source is a fundamental principle of Power and Water's Drinking Water Quality Policy. Implementing effective measures to protect source waters from contamination avoids the need for expensive, complicated treatment to treat the water.

Excluding contamination from water sources is a challenge, particularly in more urbanised areas such as the Howard East Borefield Catchment, which typically supplies 10 per cent of Darwin's drinking water. Rubbish dumping and hunting are common occurrences and while signage and fencing is in place, people frequently act to circumvent these attempts to exclude people from the catchment. Power and Water continues to educate community members regarding the importance of keeping catchments clean.

> Keeping a clean catchment and water source is a fundamental principle of Power and Water's Drinking Water Quality Policy.

Standards for water assets and backflow prevention

Power and Water maintain strict standards for assets used to supply to customers. Our Developer Services team work with property developers to ensure appropriate materials and methods of construction have been used for new assets that are gifted to Power and Water, for example in a new subdivision.

In addition, water backflow is a potential area of risk for water quality. Water backflow can occur is cases where the water pressure within the premises of a customer is higher than that in the Power and Water network. Examples can include industrial settings where on-site water pumps are used, or in high-rise apartments. Normal design practice prevents cross-connections and backflow from occurring, however mistakes can happen, especially when repairs take place in older buildings or facilities. In this case, undisinfected and potentially contaminated water can re-enter our water network and be supplied to other customers. Power and Water requires the installation of backflow prevention devices to prevent this from occurring. In the 2019-20 financial year Power and Water continued to progress the implementation of backflow prevention devices on the water services of major customers.

Water treatment and disinfection

The ADWG state that the greatest risk to consumers is from pathogenic microorganisms and that protection of water sources and treatment are of paramount importance and should never be compromised.

In conjunction with other barriers to protect the water source, chlorination is a vital defence against microbiological contamination. Chlorine is the preferred disinfectant as it is very effective at killing bacteria, and reasonably effective at inactivating viruses and many protozoa. Additionally, providing a chlorine residual throughout the distribution system can provide protection against further contamination and limit regrowth problems.

Power and Water proactively guards against risks presented by opportunistic pathogens such as *Naegleria fowleri* and *Burkholderia pseudomallei* by means of maintaining a set minimum free chlorine residual of 0.5 mg/L in all supplies at all times.

The effectiveness of this control is assessed by monitoring, recording and acting on incidents where the level falls below the set targets.

In addition to potential microbiological contamination, the interaction between water stored for long periods in deep aquifers and the surrounding geology can result in a wide range of naturally occurring minerals and deposits in the water. In some communities the physical and chemical characteristics of the water can exceed the levels recommended in the ADWG.

To ensure that drinking water supply meets the ADWG in three high risk communities (Ali Curung, Kintore and Yuelamu), Power and Water operates an Advanced Water Treatment (AWT) plant at each community. The AWT reduce levels of naturally occurring nitrate, fluoride and uranium, as well as salinity and hardness.

Across the major and minor urban centres, water quality barriers in place are shown in Table 3.

Disinfection upgrades

In 2016 Power and Water conducted a comprehensive review of chlorine disinfection systems across all 92 communities in the Northern Territory and identified opportunities for improvement through the upgrading and standardisation of systems.

As a result of this review, Power and Water is in the first tranche of a three tranche improvement program to upgrade disinfection systems across the Northern Territory. For remote sites, the $12 million program is funded by the Department of Territory Families, Housing and Communities. Key deliverables for the disinfection infrastructure upgrades are:

- chlorine dosing equipment redundancy
- chlorine online monitoring equipment
- disinfection equipment connectivity to process control systems
- alarming of events outside of standard operating parameters.

Table 3 Water quality barriers in major and minor urban centres

Centre	Catchment protection	Detention reservoirs and aquifers	Borehead protection zone	Borehead integrity	Coagulation, filtration or membrane filtration	Disinfection	Storage tank integrity and Cleaning	Maintenance of positive pressure in reticulation	Back-flow prevention in reticulation	Disinfection residual to customer's meter
Adelaide River		•	•	•	•	•	•	•	•	•
Alice Springs	•	•	•	•		•	•	•	•	•
Batchelor		•	•	•		•	•	•	•	•
Borroloola		•	•	•		•	•	•	•	•
Cox Peninsula	•	•	•	•		•	•	N/A	N/A	•
Daly Waters	•	•	•	•		•	•	•	•	•
Darwin – groundwater	•	•	•	•		•	•	•	•	•
Darwin – surface water	•	•	N/A	N/A		•	•	•	•	•
Elliott		•	•	•		•	•	•	•	•
Gunn Point		•	•	•		•	•	•	•	•
Katherine – groundwater		•	•	•		•	•	•	•	•
Katherine – surface water			N/A	N/A	•	•	•	•	•	•
Kings Canyon	•	•	•	•		•	•	•	•	•
Larrimah	•	•	•	•		•	•	•	•	•
Mataranka		•	•	•		•	•	•	•	•
Newcastle Waters	•	•	•	•		•	•	•	•	•
Pine Creek – groundwater		•	•	•		•	•	•	•	•
Pine Creek – surface water			N/A	N/A		•	•	•	•	•
Tennant Creek		•	•	•		•	•	•	•	•
Timber Creek		•	•	•		•	•	•	•	•
Ti Tree	•	•	•	•		•	•	•	•	•
Yulara	•	•	•	•	•	•	•	•	•	•

Enhancing the water supply

In the 2019-20 financial year Power and Water undertook work to improve the multiple barriers in place across the major and minor centres of the Northern Territory including:

- connection of Garawa to the Borroloola Water Treatment Plant in April
- upgrade of the chlorine disinfection system and installation of a new UV disinfection system at Cox Peninsula
- installation of additional online chlorine analysers at multiple locations including within the Alice Springs and Tennant Creek distribution systems and at Mataranka
- investigative drilling at Adelaide River and Batchelor to locate new water sources
- replacement of the roof of the Casuarina high level tank and replacement of the roof vents on the McMinns 50ML ground level tank.

Within schemes managed by IES, Power and Water has installed the following additional barriers:

- Equipping of new bores at Pirlangimpi to reduce reliance on and ultimately replace the surface water source.
- Drilling of new bores at Hermannsberg to expand safe water supply capacity.
- Installation of upgraded sodium hypochlorite disinfections systems at Acacia Larrakia, Amanbidji and Lajamanu.
- Installation of new communications and disinfection containers above the flood zone at Jilkminggin, with the system to be commissioned in 2020-21.
- Installation of new water filters and sodium hypochlorite disinfection system at Bulla, with the system to be commissioned in 2020-21.

Travel restrictions associated with COVID-19 pandemic led to some delays in project delivery, particularly in remote indigenous communities. These restrictions were put in place to reduce the likelihood of transmission of COVID-19 into those communities.

Travel restrictions associated with the COVID-19 pandemic has led to some delays in project delivery, particularly in remote indigenous communities.

PowerWater

Eva Valley

04

Operational procedures and process control

The effectiveness of preventive measures is highly dependent on the design and implementation of associated process control programs. To consistently achieve a high-quality water supply it is essential to have effective control over the processes and activities that govern drinking water quality.

Periods of sudden change and sub-optimal performance in the drinking water supply system can represent a serious risk to public health. Therefore, it is vital to ensure that all operations are optimised and are continuously controlled with barriers functional at all times.

Process control programs support preventive measures by detailing the specific operational factors that ensure that all processes and activities are carried out effectively and efficiently. This includes a description of all preventive measures and their functions, together with:

- documentation of effective operational procedures, including identification of responsibilities and authorities
- establishment of a monitoring protocol for operational performance, including selection of operational parameters and criteria, and the routine review of data
- establishment of corrective actions to control excursions in operational parameters
- use and maintenance of suitable equipment
- use of approved materials and chemicals in contact with drinking water.

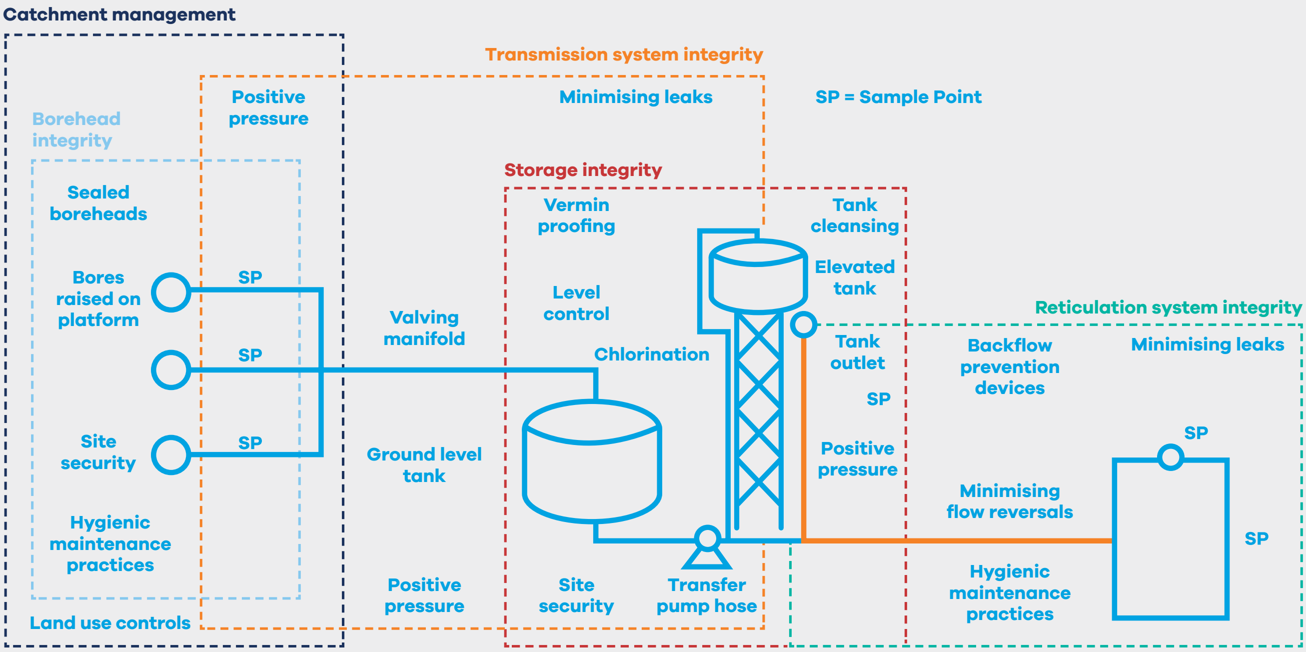
Operational monitoring for minor and remote communities can be limited by the communications infrastructure available. A major long-term improvement to telemetry and process control for remote communities is included in the upgrades to disinfection systems that are underway across the Northern Territory.

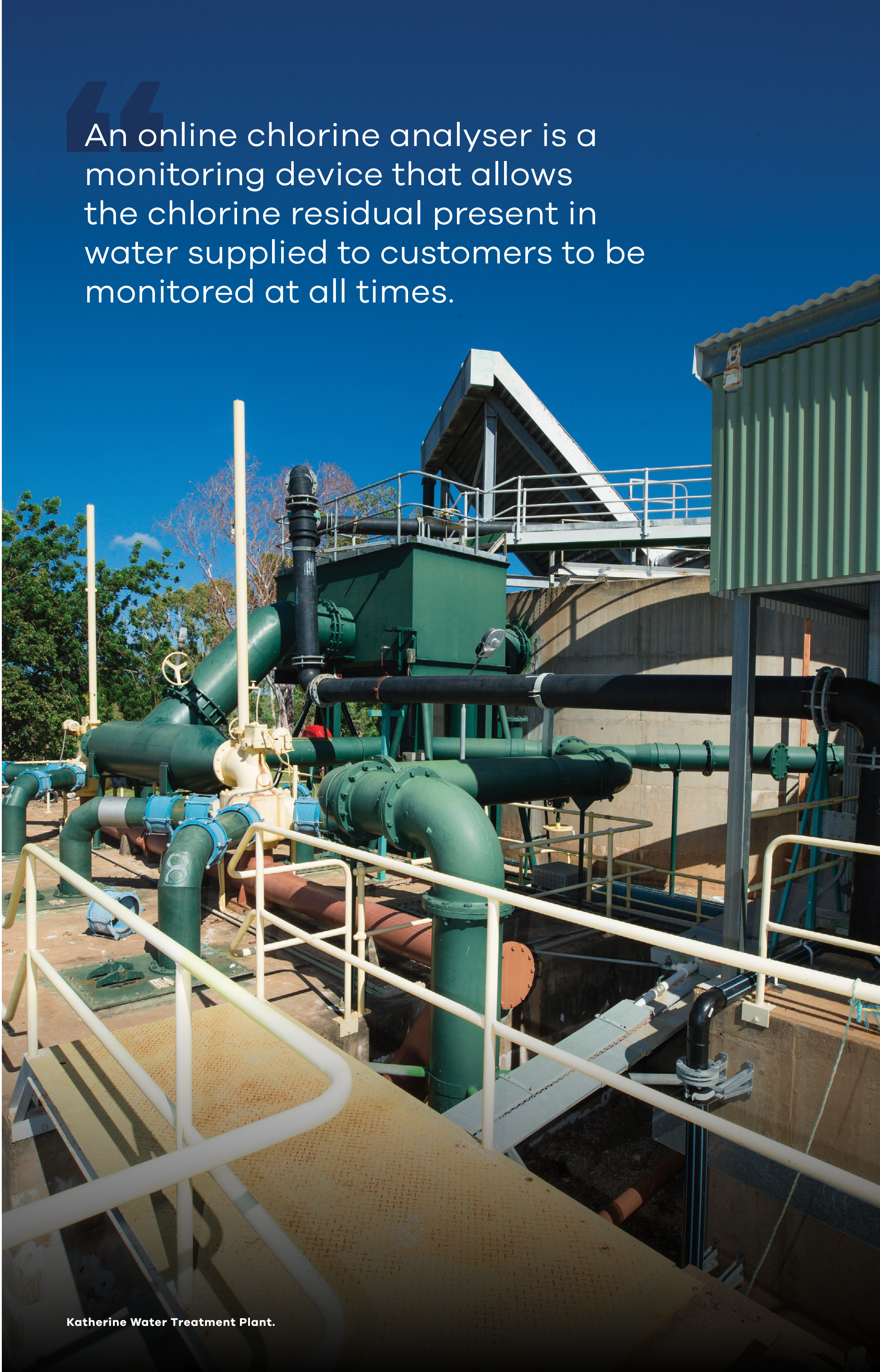
The level and complexity of operational monitoring depends on the amount of infrastructure and layout of the water supply scheme. Table 5 shows the infrastructure configuration common to most major and minor urban centres and remote communities. Figure 4 shows a typical minor urban centre and remote community water supply configuration.

Table 4 Water Infrastructure in major and minor urban centres

Water Source	Water Treatment	Water Storage	Water Distribution System
Typically, water is extracted from underground aquifers via bores. Surface water sources, such as dams, rivers and springs, are used to supply drinking water in a few communities.	Water treatment is primarily through disinfection such as sodium hypochlorite, chlorine gas and UV disinfection. Other treatment systems such as sand filters and clarifiers are used in communities that also use surface water sources, and Power and Water is investing in more advanced treatment in some communities.	The water is then stored in tanks, typically consisting of at least one large tank on the ground and a smaller tank elevated on a stand. The water is transferred from the ground level tank to the elevated tank using transfer pumps. Some communities have pressure pumps in place of elevated tanks.	Underground pipes and rising mains distribute the drinking water throughout the community to consumers' taps. Typically, these are gravity systems and are inspected through manholes and flushed using water hydrants.

Figure 4 Typical minor urban centre and remote community water supply configuration





> An online chlorine analyser is a monitoring device that allows the chlorine residual present in water supplied to customers to be monitored at all times.

Katherine Water Treatment Plant.

Water supply process control

Automated and remote control of many water supply system assets is used to improve response times and ensure data capture. In order to do this, Power and Water uses Supervisory Control and Data Acquisition (SCADA) systems. These systems consist of two, equally important parts:

- A Wide Area Network (WAN) which is extended around the water supply scheme using radio telemetry, to allow different Power and Water Assets to communicate with each other.
- A telemetry link back to the Power and Water servers in Darwin, Katherine and Alice Springs. This link is provided by either fibre-optic cable link, or satellite communications.

Operational monitoring includes a planned sequence of measurements and observation throughout the water supply system to ensure and confirm performance of preventive measures and barriers to contamination. The importance of operational monitoring to the effective maintenance of preventive barriers to contamination cannot be overstated. Power and Water's SCADA system monitors control points in water supplies using a range of online monitoring systems in each centre. Apart from monitoring the status and performance of infrastructure, this system provides continuous monitoring for specific water quality parameters such as chlorine, fluoride, conductivity, turbidity and pH levels.

In addition to online monitoring, field measurements, observational monitoring and grab sampling for laboratory analysis also provide information on system challenge and barrier performance. Target criteria is set, and corrective action is implemented if the criteria is not met.

A key outcome of the disinfection upgrade program is to extend online monitoring and SCADA communications to communities that previously did not have remote monitoring access. Online monitoring significantly reduces response times and greatly improves the ability to troubleshoot problems, which result in timely and more cost effective rectifications of excursions from critical limits.

Online Chlorine Analysers

An online chlorine analyser is a monitoring device that allows the chlorine residual present in water supplied to customers to be monitored at all times. When coupled to appropriate communications infrastructure, it gives certainty to system operators and supervisors that appropriate chlorine disinfection has occurred consistently. In a modern, best-practice water supply system the use of an online chlorine analyser, coupled with a reliable and fast communications systems is critical to continuously maintaining the supply of safe drinking water.

At Power and Water, online chlorine analysers have a long history of being used in major and minor centres to support routine checks on system performance undertaken. This has had major benefits for ensuring the safety of water supplied for those schemes. Operational challenges associated with using the technology have been overcome through the relatively close proximity to, and frequent attention of skilled employees and appropriate training.

In remote indigenous communities, online chlorine analysers have been used less successfully. Challenges with calibration, variable source water quality, less skilled Essential Services Officers and the long distances that Power and Water employees have to travel to attend site have been contributing factors.

As part of both the Structural Integration of Regions and Remote into Water Services, and the Safe Water Plan 2019-22, a major initiative is being undertaken by Power and Water to drive the introduction of online chlorine analysers and associated telemetry to all 72 remote indigenous communities operated by IES. This is consistent with the 2011 revision of the ADWG, which includes continuous monitoring where chlorination is identified as a critical control point.

Materials and chemicals

Materials used that contact potable water must normally comply with AS/NZS 4020:2005, *Testing of products for use in contact with drinking water* or other relevant standards.

Chemical suppliers are required to provide an analysis report of the chemical to be supplied. Chemicals must comply with the relevant ANSI/ AWWA standard and the management system at the site of manufacture of the chemical must be certified to ISO 9001.

05

Verification of drinking water quality

Power and Water conducts a comprehensive verification program for drinking water quality for the assessment of the overall performance of the system and to ensure the ultimate quality of drinking water supplied to consumers is safe. This entails both monitoring of drinking water quality and assessing consumer satisfaction.

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The benefits of a robust verification process is that it provides:

- a useful indication of problems within the water supply system (particularly the distribution system) and the necessity for any immediate short-term corrective actions or incident and emergency response
- confidence for consumers and regulators regarding the quality of the water supplied.

Power and Water monitor a comprehensive range of parameters including microbial, physical, chemical and radiological characteristics to ensure the water meets the ADWG and is fit for provision to customers.

Customer satisfaction

Monitoring of consumer comments and complaints can provide valuable information on potential problems that may not have been identified by performance monitoring of the water supply system. Consumer satisfaction with drinking water quality is largely based on a judgment that the aesthetic quality of tap water is 'good', which usually means that it is colourless, free from suspended solids and has no unpleasant taste or odour.

Specific water quality complaints made during the reporting period can be found in Section 2 of this report. This includes a summary of drinking water quality complaints by type (e.g. clarity/dirtiness/ particles, alleged illness, taste and other) for all major, minor and remote water supply schemes between 2015 and 2020.

Power and Water conducts customer satisfaction surveys and encourages customers to submit feedback. The information is collated and evaluated in preparation for submission to the National Performance Report.

Water quality monitoring

The Power and Water drinking water quality monitoring program is developed in consultation with the DoH and is approved by the Chief Health Officer. This document is a comprehensive description of the water quality monitoring undertaken and is inclusive of all centres. It details the locations of water sampling points, the frequency of sampling, the types of samples to be collected, specifies sample preservation techniques to be employed and sample bottles to be used, and specifies which laboratories will be used to perform water quality analysis.

The extensive monitoring program requires the collection of thousands of operational and verification samples across the Northern Territory. Water is routinely sampled at specific locations in the water supply system and then sent to laboratories for analysis.

Remote community water samples are collected by Essential Service Operators and transported back to Darwin and Alice Springs by light aircraft for testing by accredited laboratories.

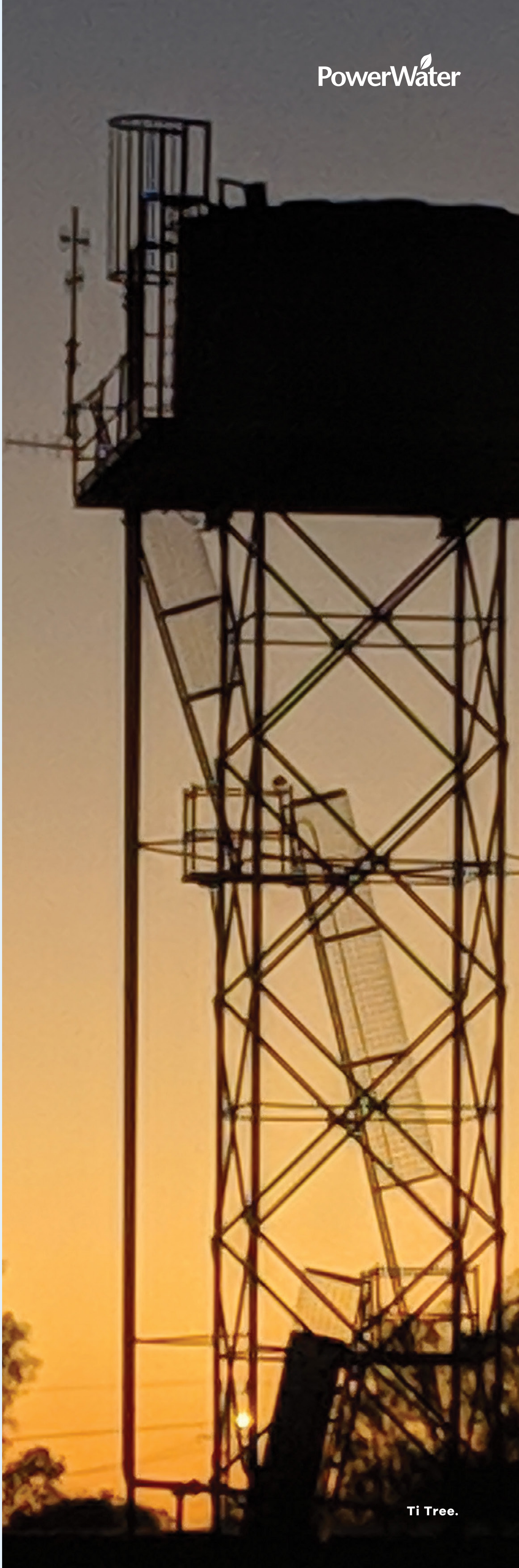
Operational monitoring

Operational monitoring is used to trigger immediate short-term corrective action or to inform long term planning or evaluations. Source water and treatment performance monitoring are important components of operational monitoring as they provide an indication of disinfection performance. Detailed studies and investigations help increase the understanding of the drinking water quality for each supply system. The extensive data and information from our operational monitoring program is used internally and is not reported here.

Verification (compliance) monitoring

Verification monitoring of water quality parameters is the final check that the barriers and preventative measures implemented to protect public health are working effectively. Verification data is used for assessing conformance with the ADWG, compliance with agreed levels of service and as a trigger for short-term corrective action if required.

Section 2 of this report provides more details and an assessment of the verification data collected for this reporting period.



Ti Tree.

Water quality indicators

Monitoring can be direct, where the characteristic of concern is monitored directly; or indirect, where surrogates or indicators are monitored. Surrogates are typically quantifiable characteristics that can serve to measure the effectiveness of processes in controlling specific hazards or groups of hazards.

Indicators are physical, chemical or microbial characteristics that are representative of a broader group of related characteristics. Indicators provide an alternative to monitoring for the possible presence of other hazardous substances that are more difficult to monitor.

An example of an indicator is Electrical Conductivity (EC), for which a change in for ground water can indicate that the groundwater is connected to surface water.

Microbiological parameters

Disease-causing organisms, or pathogens, pose an immediate risk to public health. The risk from pathogens in water supplies can vary significantly in a short period of time, therefore frequent microbiological monitoring is required for an assessment.

The analytical procedures used to detect pathogens are complex and specific for each pathogen. Indicator organisms are used to determine if contamination has occurred.

The following indicator organisms are monitored:

- *Escherichia coli (E. coli)* indicates faecal contamination from warm-blooded animals, including humans and hence, the potential for the presence of disease-causing micro-organisms
- Total coliforms indicate the range of bacteria found in many soil and aquatic environments and can provide a measure of disinfection and the cleanliness of the drinking water supply system more generally.

The ADWG performance requirements stipulate that no *E. coli* should be detected in drinking water. The guidelines also include the requirement that rigorous corrective action be undertaken and documented in response to an *E. coli* detection to prevent potential recurrences of faecal contamination.

Monitoring for the presence of *Naegleria fowleri (N. fowleri)*, a free-living amoeboflagellate found in soil and aquatic environments in the Northern Territory is continual. *N. fowleri* is almost harmless to drink and not associated with faecal contamination. This pathogen causes a rapid and usually fatal infection, primary amoebic meningoencephalitis, acquired when contaminated water is forced into the nasal passages.

A level of chlorine is maintained in all distribution systems to control *N. fowleri*. The ADWG recommends controlling *N. fowleri* by maintaining a minimum free chlorine level of 0.5 mg/L.

Power and Water has continued to investigate for the presence of the pathogen *Burkholderia pseudomallei*, the agent responsible for the disease melioidosis, and works closely with the Menzies School of Health Research to identify drinking water characteristics likely to be at risk.

The results of monitoring for these indicator organisms and pathogens are presented in Section 2.

Chemical parameters (Health)

Numerous chemical parameters are monitored to indicate the water quality supplied to customers. A wide range of measurable characteristics, compounds or constituents can be found in water and may affect its quality. The results for the typical health related chemical parameters are presented in tables in the appendices.

Organic chemicals

Organic compounds are usually present in drinking water in very low concentrations. They may occur either naturally or as a result of human activities. By-products of disinfection are the most commonly found organic contaminants in Australian drinking water supplies. The extensive use of groundwater sources in relatively sparsely populated areas in the Northern Territory means that the majority of water sources don't contain a high organic content.

Power and Water undertakes a broad range of organic chemical testing, with a number of the chemicals of interest outlined below:

Trihalomethanes

Trihalomethanes are present in drinking water principally as the result of disinfection using chlorination. Chlorine, which produces hypochlorous acid when added to water, can react with naturally occurring organic material such as humic and fulvic acids to produce trihalomethanes. The brominated trihalomethanes are produced by the oxidation of bromide present in water to form hypobromous acid, which can then react with organic matter in a similar way.

All major and minor urban centres were monitored for trihalomethanes. Results can be found in tables in the appendices.

Pesticides

Pesticide use including insecticides, herbicides and fungicides is managed by various government departments depending on the land owner or manager of a catchment. Power and Water monitor for pesticides within different catchments based on a risk assessment of the source. The pesticide monitoring program focuses on 52 commonly used pesticides including glyphosate, organochlorine, organophosphate and triazine pesticides, insecticides and acidic herbicides.

Per and Poly-Fluroalkyl Substances (PFAS)

Per- and poly-fluoroalkyl substances (PFAS) are manufactured chemicals that have numerous industrial uses. Due to PFAS persistence and mobility in the environment, they have emerged as a potential water contaminant in some situations; notably cases where fire-fighting foams have been used. Power and Water monitors for these chemicals and the results are reported in Section 2 of this Report.

Chemical and physical parameters (Aesthetic)

Aesthetic parameters are the chemical and physical characteristics of water quality that pose no threat to human health, however can affect drinking water appearance, taste, feel and odour. This includes total dissolved solids (TDS), hardness (calcium and magnesium carbonates and sulfates), colour, pH and a few common metals.

The aesthetic quality will affect the acceptance of drinking water and is usually the first change in water quality observed. Results for the annual assessment of aesthetic parameters are shown in tables in the appendices.

Radionuclides

Low levels of radioactivity are occasionally detected in drinking water supplies in the Northern Territory. The radionuclides responsible for this radioactivity are natural and a characteristic of the local hydrogeology.

Details of the radiological assessment are reported in Section 2. Results are shown in tables in the appendices.

06

Management of incidents and emergencies

Power and Water provides water supply and sewerage services to customers spread across the entire Northern Territory. Our customers are subjected to the full range of natural and weather related events, such as extreme heat, flooding and tropical cyclones. Almost every year a Power and Water operated scheme is affected by a tropical cyclone across the Top End.

Power and Water is prepared for the management of incidents that could compromise water quality.

The MoU between Power and Water and the regulator governs the response to water quality emergencies and the communication actions to the DoH as the regulator. Actions are based on ensuring rapid response to water quality incidents without impeding on regulator independence.

The nature of any event is clearly defined in the document, *Protocol for the Notification by Power and Water Corporation of Drinking Water Quality and Supply Reportable Incidents and Events to the Department of Health*. This protocol defines emergency scenarios, the communication and the established procedures to respond.

As a result of successive poor wet seasons over the past few years, a key activity has been to develop contingency plans for remote community water supplies that are experiencing water stress. Power and Water has executed this activity on behalf of IES.

The COVID-19 pandemic has created special challenges to the provision of safe drinking water across the NT, with travel restrictions and product supply delays impacting delivery of major and minor works projects and various maintenance projects. Power and Water has worked tirelessly to overcome these challenges. An Incident Management Team was stood up in response to COVID-19 in March, working with the business units to develop continuity plans to ensure the continuation of services during this challenging period.

Specific incidents and emergencies that occurred during this reporting period are discussed in Section 2 Part A for major and minor urban centres and Section 2 Part B for remote communities.

> Power and Water is prepared for the management of incidents that could compromise water quality.

Darwin Dam.

07

Employee awareness and training

Our employees are our greatest asset. Maintaining awareness of the importance of water quality and training our employees to do their jobs appropriately are key components of ensuring the supply of safe drinking water. Power and Water continues to have a focus on developing a professional, capable and accountable workforce, which includes providing a range of formal and informal training opportunities for all employees.

Organisational Development

Power and Water continues to foster employee responsibility and motivation throughout our workforce. A primary mechanism for this is through continuing to fund employees to participate in a culture and leadership program. This training aims to grow employee responsibility and motivation, and to embed a constructive and positive working culture throughout the organisation.

Industry training

In major and minor centres, Power and Water employees operate all key water supply and sewerage functions. A key part of performing these activities well is a strong commitment to ensure all operators achieve Certificate III or Certificate IV in Water Operations. This training provides operators broad training and offers the opportunity for specialisation in areas such as: water and wastewater treatment, water supply distribution (network), trade waste, catchment operations, irrigation, dam safety and operations and source protection, river groundwater diversions and licensing, and construction and maintenance.

Essential Services Operators (ESO) Competency and Compliance Framework

In each of the 72 remote aboriginal communities across the Northern Territory, Power and Water subcontract the water supply and sewerage system operations to Essential Services Officers (ESOs), who perform day-to-day tasks under the direction of Power and Water teams.

The long distances, sometimes difficult access and challenges in communicating with remote communities, means that Power and Water relies on ESOs to be the 'eyes and ears' on the ground. As a result, an ESO is relied on to provide first response and to troubleshoot many problems before a Power and Water employee can attend the site. This is an important responsibility and means ESO training and competency is of critical importance to the supply of safe drinking water in these places.

Power and Water has developed a new ESO Competency and Compliance Framework that aims to manage ESO competency. This framework has the following goals:

1. Establish a clear set of requirements that address ESO competency and compliance.
2. Monitor and improve the level of performance of ESOs.
3. Meet Power and Water's obligation to ensure assets within remote communities are being maintained and monitored to meet service and safety requirements.

This project is to be rolled out in the 2021/22 financial year.

Water in the bush

Power and Water maintains a strong presence at Water in the Bush, the Northern Territory's premier water industry event. This event brings together Northern Australia water professionals, the community and industry to share knowledge on issues affecting water. The event was held on 17 and 18 November 2019 at the Darwin convention centre. Several presentations were delivered by Power and Water employees, teams and associates.

Evaluation Of Inline Electrochlorination For Remote Communities – by David Sweeney, Senior Water Treatment Engineer, Power and Water Corporation

Development And Use Of Solar-Driven Mcdi Technology For Treatment Of Brackish Groundwaters – by Prof David Waite, Scientia Professor, University of New South Wales – this project is partly funded by Power and Water

No Fraud In Our Water Meter Reads: Benford's Law Analysis – by Charlie Fairfield, Power and Water Corporation Chair in Sustainable Engineering, Charles Darwin University

What Water Treatment Lessons Can Remote Australia Learn From The Middle East? – by Eric Vanweydeveld, Senior Project Manager, Power and Water Corporation

Keynote presentation: Water Quality – Power and Water's Journey – by Steven Porter, Executive General Manager, Power and Water Corporation

Drinking Water Treatment And Pfas – The Katherine Community Experience – by Skefos Tsoukalis, Acting Senior Manager Asset Management and Jethro Laidlaw, Manager Water Demand, Power and Water Corporation

08

Community involvement and awareness

Our customers are at the heart of everything we do and involving the community is vitally important to delivering quality drinking water. Growing community interest in water quality issues in this reporting period was met with innovative community engagement and award winning customer service by Power and Water.

This year we revamped our website with a focus on improving customer experience to help achieve our goal to be a customer centric, high-performance multi-utility. See our website at www.powerwater.com.au.

Engaging with our community

Communication

Power and Water maintains an online presence both through our website and social media to provide multiple channels for customers to contact us and to help us deliver a range of informative, educational and engaging content. Facebook, LinkedIn and twitter are the main social media platforms we use.

Making a contribution

Power and Water also supports the community through in-kind assistance.

This may include our people volunteering at events and with community organisations or providing our popular water refill stations and water bottles at community events.

We have ensured Territorians and visitors to the Northern Territory have stayed well hydrated at events including the Darwin Festival, Mindil Beach Markets, HPA's Steps Towards Capability, the Australia Day Fun Run and International Women's Day celebrations. Our support during 2020 was limited due to COVID-19 and the associated restrictions with community events.

Customer satisfaction

Power and Water has recently signed a four year research agreement with a research agency to engage with our customers and better understand what they want, need and value with their water supply. This is a major undertaking and will form the basis of customer focused strategy and other activities undertaken into the future.

Water smart programs

Through the Living Water Smart program Power and Water has been working in communities across the Northern Territory to better ensure a safe and secure water supply. Major water saving projects are ongoing in Darwin, Katherine and in many water stressed remote communities. The projects focus on best ensuring customer water demand matches water supply capacity through community behaviour change, stakeholder engagement, marketing and communications campaigns, smart water metering, network leak detection, school based education units, non-residential sector audits and through rebates.

These programs provide great outcomes for customers and allow Power and Water to reduce operational costs, better meet sustainable yield targets and improve water quality.

Highlights include:

- Delivering 3,000 Garden Tune Up audits via a team of affiliated irrigation experts. These irrigation audits helped reduce water Darwin's water demand by over 300ML/year.
- An exciting new partnership with Yolngu rapper and musician Baker Boy who fronts a new school education unit via a series of fun and engaging videos.
- The Community Leak Find and Fix program in Katherine, which in its fourth year saved more than 80 ML/yr of water.
- In the remote communities of Ngukurr, Minyerri, Amanbidji, Engawala, Galiwinku, Milingimbi, Gunbalanya, Kybrook Farm, Yuendumu, Santa Teresa, Ali Curung, Yuelamu and Epenarra smart water meters have allowed regular leak reports to be sent to customers helping keep water demand down.
- For the first time sponsoring the telecast of the Central Australian Central Desert Football Competition to help spread awareness of the need to value water in remote communities.

> These programs provide great outcomes for customers and allow Power and Water to reduce operational costs, better meet sustainable yield targets and improve water quality.

Numbulwar gas chlorination.

Research and development

The ADWG promote continued Research and Development (R&D) to maintain a water utility at the cutting-edge of knowledge related to water quality management.

This R&D can be both fundamental research on priority water quality related areas and also applied research, such as the validation of water treatment processes. In order to leverage our position in the Northern Territory, Power and Water is a member of various industry groups that undertake research work.

Water in Northern Australia (WiNA)

Power and Water is a major partner in a bid to establish a Co-operative Research Centre at Charles Darwin University named Water in Northern Australia (WiNA). WiNA seeks to facilitate indigenous lead sustainable development in northern Australia by building better ways of managing shared water resources. Water in Northern Australia CRC (WiNA CRC) will develop collaborative research programs that will fill information gaps, develop appropriate technology and improve planning and governance on shared water development.

Power and Water has committed cash and in-kind services to support the bid – the outcome will be known during the 2020-21 financial year.

Melioidosis (*Burkholderia pseudomallei*)

Power and Water has committed $187,000 to continue to support ongoing research into the prevalence of *Burkholderia pseudomallei* (the agent responsible for the disease Melioidosis) within water supply systems operated by Power and Water. This work was initiated in 2018 and is a partnership with the Menzies School of Health Research and Charles Darwin University. Outputs from the project will continue to inform Power and Water's Drinking Water Quality Management System, including the establishment of appropriate controls and informing water quality risk assessments and asset management planning cycles. On a broader scale, this research will continue to inform the whole of Northern Territory public health efforts in understanding the disease and occurrence of the bacterium.

Research into Appropriate Treatment Technology for a Remote Context

Power and Water operate four advanced water treatment plants, including one reverse osmosis (RO) and three electrodialysis reversal (EDR) plants, to meet the ADWG health guideline values including uranium, nitrates and fluoride. The three EDR plants are situated on the IES remote communities of Ali Curung, Kintore and Yuelamu, and the RO plant is located in Yulara. Given water scarcity and brine waste disposal challenges generally facing inland remote communities, EDR will remain an option to compete against RO for most inland remote communities in the Northern Territory. The success of the treatment chosen will be determined by consideration in the design for the challenges of true remote operation, and not by the technical capacity of the EDR or RO itself.

While commercially available technologies including EDR and RO achieve water treatment goals, it is possible that emerging technologies will be able to achieve the same water quality results with improved outcomes in one or some of the categories of reduced capital and ongoing operational cost, improved water recovery, lower chemical use and more robust operations. The development of new technologies for remote community drinking water are required to safeguard public health and make the drinking water palatable.

New and emerging technologies require pilot-scale research and evaluation before full-scale implementation. Participation in the early stages of development gives PWC the unique opportunity to participate in the design specifications established to ensure that new equipment will meet the intended water quality requirements and provide necessary process flexibility and controllability required for the remote conditions of the Territory. Due to the unique circumstances of remote water operations in the Northern Territory it is desirable for our experienced employees and operators to be involved in the establishment of suitable technology that will operate in a remote community context.

The two emerging technologies that Power and Water are investigating are:

1. Membrane Capacitive De-Ionisation (mCDI) trial aimed to reduce elevated Total Dissolved Solids (TDS), fluoride, hardness and potentially uranium and other heavy metals under certain operating conditions
2. Electrochemical technology trial aimed to reduce nitrates and possibly heavy metals such as uranium and arsenic.

These two technologies are being developed to provide suitable treatment options for the variable water quality found throughout the Northern Territory. The one size fits all approach is not applicable across the Territory due to insitu issues such as localised water quality attributes and wastewater discharge options.

Membrane Capacitive De-ionisation (mCDI) technology development

Power and Water has committed $203,000 in funding and in-kind support to participate in a trial of mCDI technology in partnership with the University of New South Wales. mCDI technology uses charged electrodes to achieve ion removal and potentially provides a simpler, more robust option for desalination than either EDR or RO, while consuming less electricity. The mCDI technology is well developed technology in the research area that shows promising results in the reduction of Total Dissolved Solids (TDS), nitrate, fluoride and uranium under certain operating conditions.

In 2021 Power and Water will operate a pilot system at Ali Curung alongside the fully operational EDR system to allow comparison between the two technologies.

The expected timeframe for trial project completion is September 2021.

Cooperative Research Centres Project (CRC-P) Grant – nitrate and heavy metal removal

Power and Water has committed $510,000 in funding and in-kind contributions to participate in a CRC-P grant application in partnership with Water Corporation (WA), the University of Queensland and two private sector companies: Hydro-dis Water Treatment Technology and Dematec Automation. This project seeks to develop a decentralised, autonomous and low-maintenance solar-powered electrochemical system to effectively remove nitrates and possibly heavy metals such as uranium and arsenic from water sources with elevated chemical levels.

The technology is planned to be trialled in the central community of Ti Tree.

10

Documentation and reporting

The Australian Drinking Water Guidelines emphasise that documentation provides the foundation of a robust drinking water quality management system. Power and Water, as a government-owned multi-utility achieves this outcome through the use of its Drinking Water Quality Management System, a document control framework and electronic records management system.

Operational data and process monitoring and reporting is maintained through Power and Water's data historian, with automated reporting of deviations in operating parameters to appropriate parties. Ongoing investment in improved monitoring and communications infrastructure aids this automated reporting.

Controlled Documentation

Document control and management is undertaken by a central business function at Power and Water. In this reporting period the team developed a number of tools and enhancements to streamline accessing documentation, primarily within Power and Water's intranet.

Board and Management Visibility Procedure

As mentioned in Section 1, Power and Water has developed a Board and Management Visibility procedure. This procedure provides a uniform and structured reporting regime for drinking water quality performance across the Northern Territory. This reporting process seeks to:

- provide management and the board with a strategic overview of past and present performance of drinking water schemes
- provide periodic overviews of the health of the organisation's Drinking Water Quality Management System
- provide an awareness of future risks and emerging considerations
- embed a philosophy of continuous improvement.

Such fundamental work is critical to achieving the supply of safe drinking water across the many water supplies in the Northern Territory.

In this reporting period, Power and Water tabled its Annual Report in the Northern Territory Legislative Assembly. This report is a key mechanism for informing our Shareholding Minister and the Northern Territory Parliament about our business performance as a whole.

Power and Water produces a number of drinking water-related reports for various stakeholders including:

Department of Health

- Reportable incidents or events that have the potential to effect public health
- Notifiable events for exceedances to health or aesthetic characteristics
- Monthly compliance reporting.

Department of Territory Families, Housing and Communities

- Annual water source status report
- Annual traffic light report

Bureau of Meteorology

- Groundwater reports

Department of Environment, Parks and Water Security

- Extraction licences compliance reports

Customers

- Annual drinking water quality report
- Water quality information on demand

Annual Drinking Water Quality Report

By producing an annual drinking water quality report, Power and Water provides an objective account of the quality of the drinking water supplied to customers.

Power and Water also reports on its drinking water management progress and achievements through other channels including social media.

Comprehensive and quality information is available to the public via its website or on request. This includes technical information, guides about water conservation and media releases.

Information provided in this annual drinking water quality report forms part of a national reporting obligation and provides the Northern Territory and the public with a reliable and transparent source of information on water quality.

11

Evaluation and audit

The long-term evaluation of water quality results and the use of an audit program help to determine adherence with the requirements of the Australian Drinking Water Guidelines. Power and Water has incorporated these activities within the Drinking Water Quality Management System.

A review and assessment of water quality supplied to customers has been completed, which forms the basis of Section 2 of this report.

External audit of the Drinking Water Quality Management System

The long-term evaluation of water quality results and the use of an audit program help to determine adherence with the requirements of the Australian Drinking Water Guidelines. Power and Water has incorporated these activities within the Drinking Water Quality Management System.

A review and assessment of water quality supplied to customers has been completed, which forms the basis of Section 2 of this report.

Review and continual improvement

Senior executive support, commitment and ongoing involvement are essential to the continual improvement to drinking water quality management.

During the 2019-20 financial year, through the introduction of the Board and Management Visibility Procedure Power and Water has extended and formalised management visibility across the five major and 14 minor centres and 72 remote indigenous communities serviced by Power and Water. Continuous improvement is driven through the execution of the Safe Water Plan 2019-22, which is in its second year of delivery.

A key aspect of the Drinking Water Quality Management System is the uniform introduction of Water Safety Plans (WSPs) across the five major and 14 minor centres and 72 remote indigenous communities serviced by Power and Water. Maintaining these documents is a major undertaking, and requires continuous resourcing to achieve continuous review. Power and Water has implemented a rolling review program, with WSPs for six urban schemes and 25 remote indigenous communities being completed in the 2019-20 financial year.

A review of the performance of Advanced Water Treatment (AWT) Plants used in the communities of Ali Curung, Kintore and Yuelamu is complete and determined that the AWT technology performed well in meeting the ADWG targets, production targets, availability targets and recovery targets. Chemical use was found to exceed target projections and opportunities were identified to improve the extent of technical knowledge with respect to the technology throughout the business. These recommendations will be incorporated into further business unit plans.

> Continuous improvement is driven through the execution of the Safe Water Plan 2019-21, which is in its second year of delivery.

Section 2
Drinking Water Quality and Performance

Part A: Major and minor centres

Microbiological results

Bacteria

Monitoring objective

Bacterial indicators are used for verifying the effectiveness of treatment and to assess the microbiological cleanliness of the water. Monitoring for indicator bacteria provides a useful communication tool to verify that the barriers to protect public health are working effectively.

Monitoring program

Power and Water's drinking water monitoring programs require that samples, representative of the quality of water supplied to consumers, be collected and analysed for *E. coli* at a minimum frequency. The results from this monitoring are used to demonstrate compliance and are reported as verification of the microbiological quality.

Operational monitoring for bacteria provides the detailed information needed to maintain a treatment process within defined parameters (process control). This information is not reported here.

The drinking water monitoring programs required a total of 2,471 samples to be collected for bacteriological verification assessment from 20 centres across the Northern Territory over the reporting period. A total of 2,465 samples were taken. The sample collection performance for individual urban centres for the recent period 2019-20 is presented in Table 13 and Table 14 in the appendices.

Limitations of monitoring

Microbiological verification monitoring is not intended to provide an absolute measure of safety because of the inherent sampling and analysis limitations. Samples only ever represent a small percentage of the total water consumed. Analytical methods take substantial time to produce a result, which means the water is already consumed before a result is received.

Compliance performance

Performance can be regarded as satisfactory if over the preceding 12 months:

For the 2019-20 reporting period, 99.6 per cent of scheduled samples were collected across all communities. Further information is detailed in Appendix B Table 11 and Table 12

- No *E. coli* is detected in 100 per cent of samples as per the ADWG (this excludes repeat or special purpose samples).

During the 2019-20 reporting period, the 100 per cent *E. coli* free target was achieved in all major and minor urban centres in the Northern Territory. Figure 5 and Figure 6 show the percentage of samples taken in major urban centres between 2014 and 2019 in which no *E. coli* were detected.

A summary of the incidents that occurred during the monitoring period can be found in Table 8.

Note: The following centres did not meet the required number of bacteriological samples, as shown in Table 11 and Table 12;

- Borroloola, Kings Canyon, Newcastle Waters.

The reason for this is the biosecurity access restriction requirements due to COVID-19.


PowerWater

Figure 5 Percentage of samples taken in major urban centres in which no *E. coli* was detected for monitoring program periods 2015-20

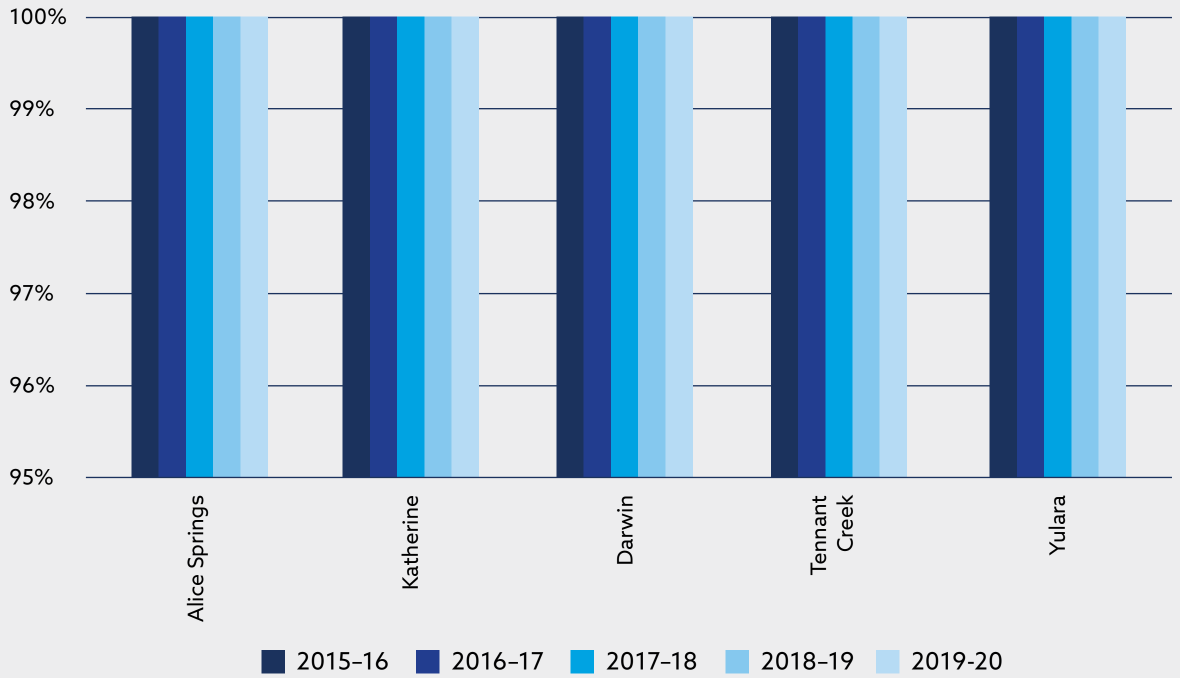
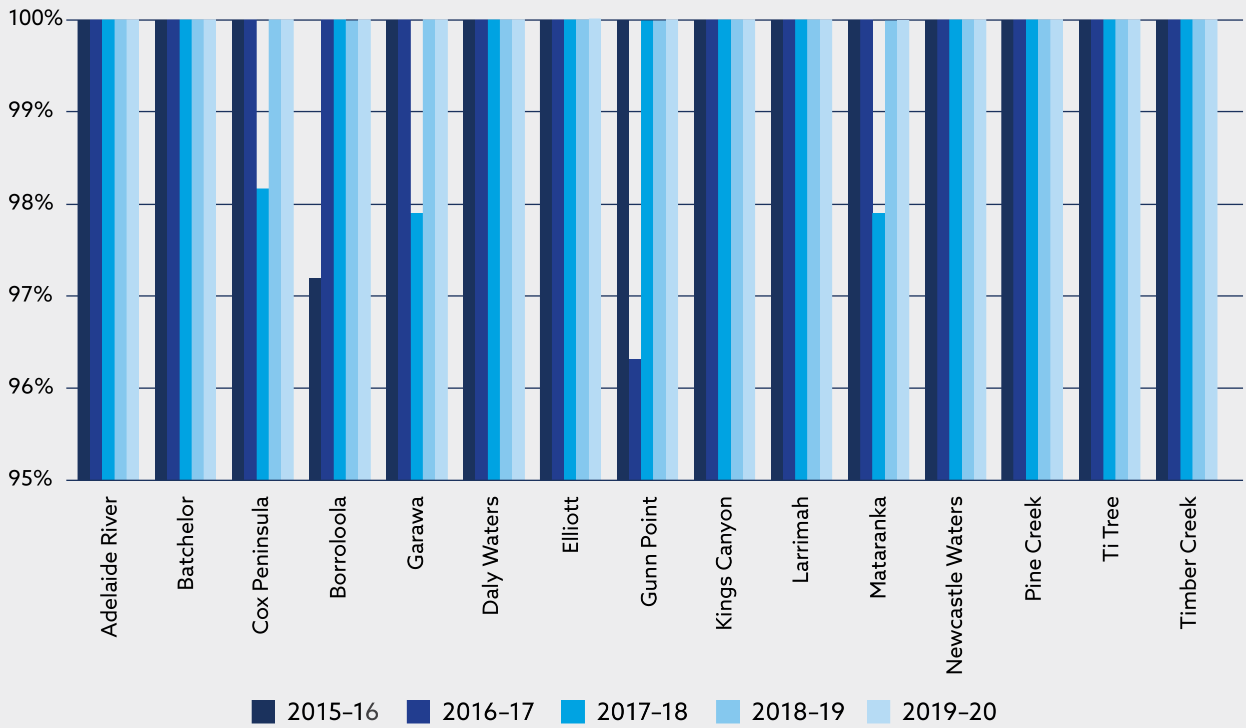


Figure 6 Percentage of samples taken in minor urban centres in which no *E. coli* was detected for monitoring program periods 2015-20



Naegleria fowleri

Investigations into and the detection of *N. fowleri* in the Darwin distribution system in 2005 prompted Power and Water to undertake extensive monitoring of water supplies and to implement procedures to controlling the hazard.

An effective chlorine residual maintained throughout the distribution system provides protection and limits the regrowth of *N. fowleri.* Free chlorine at 0.5 mg/L or higher will control *N. fowleri,* provided the disinfectant persists at that concentration throughout the water supply system. The target is to maintain a minimum free chlorine residual of not less than 0.5 mg/L throughout the entire supply.

During the reporting period, Power and Water conducted the routine *N. fowleri* monitoring program, collecting 140 samples from Darwin. Across the Northern Territory sampling for investigation also occurred at centres without previous detection or in the sediments cleaned out of the drinking water distribution tanks.

The results from the 2019-20 *N. fowleri* monitoring program can be found in Table 5.

Burkholderia pseudomallei

B. pseudomallei is the agent responsible for melioidosis and despite being ubiquitous in the tropics, the understanding in a drinking water context is developing. Appropriate chlorination controls this pathogen, with recent research helping to identify water supplies at risk of contamination.

Power and Water's drinking water monitoring programs have included *B. pseudomallei* as an investigative and research activity since its detection in Darwin rural private supplies in 2010. Power and Water works closely with the Menzies School of Health Research to identify water supplies at risk.

Table 5 Thermophilic Amoeba detections, monitored supplies and investigation 2019-20

		Amoeba total (orgs/L)	Hartmanella (orgs/L)	Naegleria – Total (orgs/L)	Naegleria Fowleri (orgs/L)	Naegleria lovaniensis (orgs/L)	Willaertia Magna (Orgs/L)
Centre routine monitoring	**Samples collected**						
Darwin Verification - Investigative Distribution System	126	8	8	0	0	1	0
Darwin Operational - Raw Water (Surface and Ground Water)	14	3	0	0	0	0	0
Total Samples	**140**						
Centre routine monitoring	**Samples collected**						
Alice Springs - Investigative Distribution System	2	0	0	0	0	0	0
Katherine - Investigative Distribution System	8	0	0	0	0	0	0
Tennant Creek Investigative	25	0	0	0	0	0	0
Gunn Point Investigative	26	2	2	0	0	0	0
Yulara Investigative	4	0	0	0	0	0	0
Total Samples	**65**						

Chemical and physical results

The results of monitoring water quality parameters are presented in this report as statistical values.

Health related parameters are reported as a 95th percentile where statistically adequate data is available. If data is limited, values are reported as the maximum value. As specified by the Australian Drinking Water Guidelines, aesthetic and other parameters are reported as a mean value.

Table 13 and Table 14 in the appendices show one year of results for the health, aesthetic and other parameters in each major and minor urban centre drinking water respectively.

Radiological results

Radioactive materials occur naturally in the environment (e.g. uranium, thorium and potassium). Some radioactive compounds arise from human activities (e.g. from medical or industrial uses of radioactivity) and some natural sources of radiation are concentrated by mining and other industrial activities.

A very low proportion of the total human exposure comes from drinking water. (Reference: Australian Drinking Water Guidelines.) Radiological contamination of drinking water can result from:

- naturally occurring concentrations of radioactive species (e.g. radionuclides of the thorium and uranium series in drinking water sources)
- technological processes involving naturally radioactive materials (e.g. the mining and processing of mineral sands or phosphate fertiliser production)
- manufactured radionuclides that might enter drinking water supplies from the medical and industrial use of radioactive materials.

All water supplies are examined to gain an initial screening level of gross alpha and gross beta activity concentrations. The Annual Radiological Dose (ARD) is calculated only for supplies that had one or more samples above the screening level.

To comply with the ADWG, the radiological data used in the calculation of the total annual radiation dose must be no more than two years outside the reporting period for groundwater supplies and no more than five years for surface water. Data covers the period: 2015-20 for surface water and 2018-20 for groundwater.

Annual assessment

All water supplies passed the annual ADWG radiological limit of 1 mSv/yr in 2019-20. As shown in Table 6, the majority of water supplies complied with the ADWG screening level, with gross alpha and gross beta radioactivity levels below 0.5 Bq/L ('PASS') during reporting periods. Results for the radiological assessment of all supplies for 2019-20 are shown in Table 13 in the appendices.

Kings Canyon's water supply has higher levels of natural occurring radionuclides than other Northern Territory water supplies and as a result is intensely monitored. Kings Canyon radiological dose passes the guideline limit during the reporting period 2019 to 2020.

Table 6 Summary of annual radiological assessments

Reporting year		2015 16	2016 17	2017 18	2018 19	2019 20
Total number of centres sampled[1]		20	20	20	20	16
Number of centres that comply to the screening level (0.5Bq/L)	Major	3	2	4	5	5
	Minor	12	12	12	14	10
Number of centres exceed the annual guideline value (1.0 mSv/year)	Major	None	None	None	None	None
	Minor	1	None	None	None	None

1 The town camps Garawa 1 and 2 are provided emergency support and monitoring.

Chemical Health parameters

Trihalomethanes (THMs)

During the 2019-20 monitoring period, all urban water supplies were assessed for THMs. The concentration of THMs for water supplies ranged during the period from <0.004 to 0.080mg/L, all well below ADWG health guideline limit of 0.25 mg/L, Table 13 in the appendices.

THM levels remain similar to those measured in previous years. The low levels of THMs measured in the water supplies is due to the low level of total organic carbon, the precursors of THMs, in Northern Territory waters.

Pesticides

The pesticide monitoring program focuses on 46 commonly used pesticides, including organochlorine, organophosphate and triazine pesticides, insecticides and acidic herbicides.

Although monitored for several years, pesticides have rarely been detected in Northern Territory water supplies, despite use in some areas. Due to these results, pesticide monitoring during 2019-20 was restricted to Darwin and Katherine water supplies. These supplies are considered potentially vulnerable to pesticide contamination with agricultural activities and rubbish dumping close to production bores and surface water sources.

Good management of surface water sources and bores reduces the risk of drinking water becoming contaminated with pesticides. Bores are required to be constructed to standards that ensure bore head integrity and prevent surface water (potentially containing pesticides) from entering the bore. Pesticide use is strictly controlled in catchments for surface waters, such as reservoirs and rivers.

PFAS monitoring

PFAS are a class of manufactured chemicals that have been used since the 1950s to make products that resist heat, stains, grease and water. PFAS has been identified as an emerging contaminant and investigations are underway in all Australian jurisdictions.

In response to a request from Department of Health in 2017, PFAS was included as part of our water quality testing program. In August 2018, PFAS guidelines were included in the Australian Drinking Water Guidelines, Version 3.5.

PFAS is included in the Annual Drinking Water Quality report for the first time in 2019-20. Previously Power and Water referred to the rolling average published on our website powerwater.com.au/about/what-we-do/water-supply/drinking-water-quality/pfas.

PFAS in Katherine

Since being notified by the Department of Defence of the detection of per- and poly-fluoroalkys substances (PFAS) in the environment near RAAF Base Tindal, Power and Water has taken a positive approach to ensure safe drinking water continues to be delivered to the community of Katherine.

An interim PFAS treatment plant installed in October 2017 has been successfully treating 1 million litres of groundwater a day. The pilot treatment system was designed and fabricated in the United States and is also being used successfully at the Williamtown and Oakey RAAF bases.

Power and Water is progressing work on a long-term solution for effectively managing the impacts of PFAS and securing a safe water supply to cater for Katherine's future growth. For this ECT2 – Emerging Compounds Treatment Technologies – which provided the pilot plant and has also been engaged to deliver the new and significantly larger plant designed to meet future water demand over a 30-year planning horizon. Commissioning of the larger PFAS plant is planned for the 2021 calendar year.

Nitrate

Nitrate concentrations in the Northern Territory groundwater come from a variety of natural sources. Termite mounds, nitrogen fixing bacteria and plants contribute to the soil nitrate levels.

The ADWG recommends that nitrate concentrations between 50-100 mg/L are a health consideration for infants younger than three months, although levels up to 100 mg/L can be safely consumed by adults.

Ti Tree drinking water typically has nitrate levels on or around 50 mg/L and less than 100 mg/L. The DoH gives regular advice to Ti Tree customers who are bottle feeding infants that the water should not be used.

Lead

The presence of lead in household plumbing is a problem worldwide, as any lead in brass fittings is dissolved into the water. Lead is not found in the source water used for public water supplies. Instead, lead can enter tap water when plumbing materials containing lead start to corrode.

Lead was not detected from most of the water samples taken in the Territory and where detected it did not exceed the ADWG health guideline value of 0.01mg/L. Corrosion of sample site plumbing can result in lead detections.

Customer satisfaction

Water quality customer complaints

Complaints from consumers concerning the quality of their drinking water mostly focus on the aesthetic aspects of appearance, taste and odour. Like other Australian drinking water providers, Power and Water records all water quality complaints made by its customers and reports them to the National Water Commission.

Number of complaints

Table 7 shows the total number of complaints specific to water quality made by customers between 2015 and 2020. A decrease in the number of water quality complaints has occurred in the 2019-20 reporting period.

A month by month breakdown of Darwin water quality complaints is shown in Figure 7 and reflects a discernible pattern between complaints in water quality and seasonality. The main water complaint was discoloured water such as clarity and particles. Seasonal changes to temperature and wind cause water quality changes in Darwin River Reservoir and flow changes in the distribution.

As with many water supply reservoirs, Darwin River Reservoir is subject to seasonal water quality changes. Stratification is the development of distinct layers of water of different temperature or density at various depths in a water body. Stratification develops when the upper layers of the reservoir are heated faster than the heat can disperse into the lower depths of the reservoir. The differences between the layers limit circulation between them and leads to significantly different aesthetic water qualities.

Once the reservoir has stratified, a large amount of energy is required to disrupt the layered structure and mix the reservoir again. Destratification occurs once the surface temperature cools during a monsoonal event or when the dry season trade wind and cool nights arrive. The layers mix to produce discoloured water throughout the reservoir. Low quality anoxic water from the depths of the reservoir mix in with the surface water and it is drawn into the supply.

Iron and manganese entering the distribution system oxidise and will precipitate out of solution, creating discoloured water. This pattern corresponds with the comparatively high number of complaints received in the early dry season shown in Figure 7.

Power and Water strives to minimise the impact of these seasonal variations. If a customer reports discoloured water, the mains supplying the customer's residence is flushed. In addition, water quality is monitored at a number of locations in the Darwin water supply to gauge the extent of discoloured water and determine when widespread flushing is required.

Table 7 Water quality complaints

Region	Properties (2019-2020)	2015-16	2016-17	2017 18	2018 19	2019 20
Adelaide River	96	0	0	0	1	0
Alice Springs	12,502	4	0	9	6	16
Darwin	60,757	212	117	127	71	61
Katherine	2,242	4	0	3	5	2
Tennant Creek	1,228	0	0	0	0	0
Borroloola	255	0	0	0	1	0
Total	**77,080**	**220**	**117**	**139**	**84**	**79**
Complaints per 1,000 properties (for the water supply system specified)	Properties based on number of meters	2.93	1.56	1.81	1.09	1.02

Figure 7 monthly drinking water quality complaints received for the Darwin water supply in 2019-20

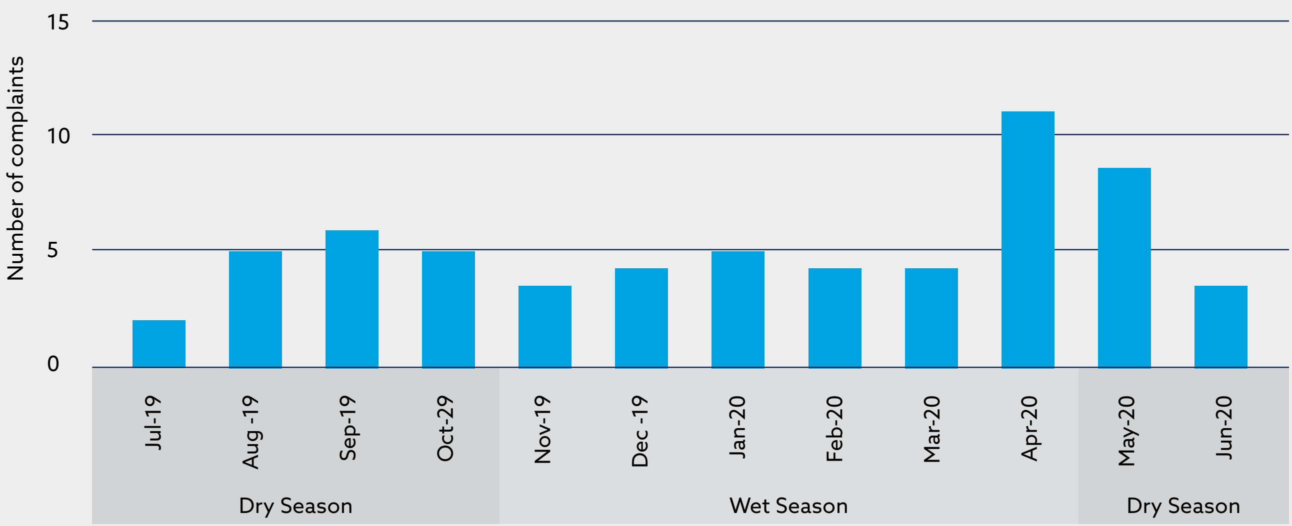
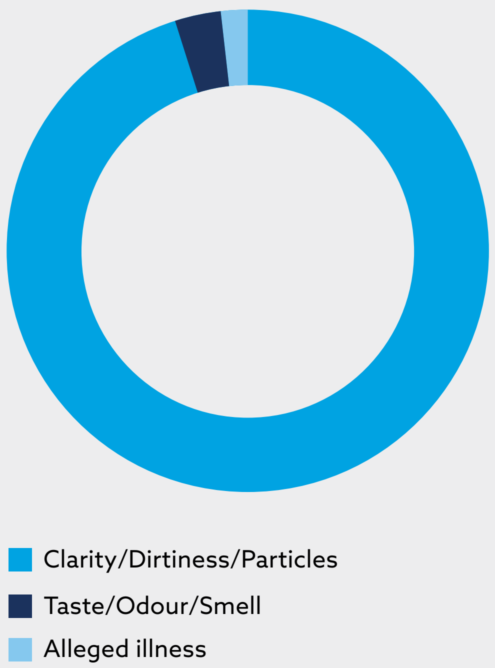


Figure 8 Customer complaints for Darwin 2019-20 by complaint type



Types of complaints

Ninety five per cent of Darwin's customer complaints related to discoloured water. The majority of discoloured water is normally a destratification event at the reservoir or flow changes dislodging sediments in the distribution pipes.

Milkiness or cloudiness is most commonly due to the re-pressurising of water pipes. This causes trapped air to dissolve in the water and minute air bubbles form when the tap is turned on, creating a milky appearance, which clears if the water is left to stand.

Customer complaints about odour are attributable to free chlorine residuals. Chlorine is maintained at a minimum of 0.5 mg/L and at this level it can be objectionable to some customers. This level is required as a response to the detection of *N. fowleri* in some Northern Territory water supplies.

If there is doubt as to the cause of a water quality problem, an investigation is carried out and when necessary, water samples are taken and analysed.

Recorded emergencies/incidents

During the 2019-20 reporting period the following incidents occurred:

- One backflow event was detected in the Darwin region, in Knuckey Lagoon.

For this water quality incident the remedial actions were given priority and the DoH was notified to help determine the most effective corrective actions. An investigation was conducted to determine the likely causes and identified preventive corrective actions.

E. coli detections

During the reporting period, no *E. coli* was recorded from verification water samples, see Table 12.

Backflow detections

Backflow is the unwanted reverse flow of water from a customer's premises to the water supply system. Under normal conditions, water flows from the pressurised water supply system to a property. It is possible for water to flow in the reverse direction if pressure changes. This backflow has the potential to contaminate drinking supply.

Prevention of backflow is usually achieved by the use of Backflow Prevention Devices (BPD) located at strategic points like the water meter as part of a multi barrier approach to minimise the risk of contamination of the water supply.

To protect the potable water supply from backflow contamination, backflow prevention devices must be installed at the property boundary (containment protection).

A program of checking backflow prevention devices is used to identify situations where backflow may have occurred. Additionally, smart meter logging services are used to detect negative flows indicating backflow is occurring. See Table 8 for details.

For this water quality incident, smart meters were used to detect backflow from a property in Knuckey Lagoon. Further investigation on site found a cross connection from an internal dual supply with no appropriate backflow prevention at the boundary. To rectify the situation an appropriate backflow prevention device was installed at the property boundary.

Table 8 Incidents during the drinking water quality monitoring program period 2019-20

Supply	Incident	Detection date	Location
Darwin	Backflow	9 September 2019	Thorak Road, Knuckey Lagoon

Part B: Remote communities

Water quality data compiled in Appendix B for the 2019-20 reporting period have been processed according to the ADWG recommendations for the long term evaluation of health and aesthetic parameters:

- one year of data be used
- for health related parameters, the maximum value (or 95th percentile where there are greater than 30 data points) and significant figure should be used for the reporting period
- for aesthetic parameters, the average value for data in the reporting period should be reported
- for radiological analysis, two years of data should be used for ground water sources, and five years of data for surface water sources. The reported value should be the maximum result for the reporting period.

Microbiological parameters

Monitoring objective

Bacterial indicators are used for verifying the effectiveness of treatment and to assess the microbiological cleanliness of the water. Monitoring for indicator bacteria provides a useful communication tool to verify that the barriers to protect public health are working effectively.

Monitoring program

Power and Water's drinking water monitoring programs require that samples, representative of the quality of water supplied to consumers, be collected and analysed for *E. coli* at a minimum frequency. The results from this monitoring are used to demonstrate compliance and are reported as verification of the microbiological quality.

Operational monitoring for bacteria provides the detailed information needed to maintain a treatment process within defined parameters (process control). This information is not reported here.

The sample collection performance for individual Remote centres for the recent period 2019-20 is presented in Table 15 to Table 17 in the appendices.

Limitations of monitoring

Microbiological verification monitoring is not intended to provide an absolute measure of safety because of the inherent sampling and analysis limitations. Samples only ever represent a small percentage of the total water consumed. Analytical methods take substantial time to produce a result, which means the water is already consumed before a result is received.

Compliance performance

Performance can be regarded as satisfactory if over the preceding 12 months:

- at least the minimum number of programmed samples has been tested for *E. coli*
- samples tested are representative of the quality of water supplied to consumers
- one sample had an *E. coli* detections.
- for 99 per cent of samples, no *E. coli* were detected. (This excludes repeat or special purpose samples).

For the 2019-20 reporting period, 97 per cent of scheduled samples were collected across all remote communities. Further information is detailed in appendix B Tables 15 to18.

- During the 2019-20 one sample from Kalkarinji had *E. coli* detected in the drinking water samples. This was due to the sample tap in an unserviceable state. Further details are available in the recorded emergencies/incidents section.

> Microbiological verification monitoring is not intended to provide an absolute measure of safety because of the inherent sampling and analysis limitations.

Chemical and physical parameters

The results of monitoring water quality parameters are presented in this report as statistical values.

Health related parameters are reported as a 95th percentile where statistically adequate data is available. If data is limited, values are reported as the maximum value. As specified by the Australian Drinking Water Guidelines, aesthetic and other parameters are reported as a mean value.

Tables 20 to 27 in the appendices show the results of the health, aesthetic and other parameters for all remote communities.

Note: A number of communities were not sampled for chemical and physical parameters due to biosecurity access restriction requirements due to COVID-19. For these communities, previous results have been included in the tables and have been marked with an asterix*.

Radiological results

All water supplies are examined to gain an initial screening level of radioactivity. Communities that had one or more samples above the screening level have the annual radiological dose (ARD) calculated.

To comply with the ADWG, the radiological data used in the calculation of the total annual radiation dose should be no more than two years outside the reporting period for ground water supplies, and no more than five years for surface water.

As shown in Table 9, all water supplies passed the annual guideline limit of 1 mSv/yr in 2019-20. The majority of water supplies pass the ADWG screening level during reporting periods.

The radiation dose is calculated only for supplies that had one or more samples above the screening level. Results for the radiological assessment of all supplies for 2019-20 are shown in Table 19, 21, 23 and 25 in the appendices.

Please note: Due to lack of access during COVID-19 travel restrictions, most Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

Table 9 Summary of annual radiological assessments

Reporting year		2019 20
Total number of centres sampled		45
Number of centres that comply to the screening level (0.5Bq/L)	Northern Region	23
	Katherine Region	19
	Barkly Region	0
	Southern Region	3
Number of centres exceed the annual guideline value (1.0 mSv/year)		None

Please note: Due to lack of access during COVID-19 travel restrictions, most Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

Health parameters

With a few exceptions (e.g. nitrate, copper, sulfate, fluoride), all health-related guideline values relate to lifetime exposure. An assessment of the data for this reporting period can be found in the a.

Antimony concentrations in drinking water are recommended by the ADWG to not exceed 0.003 mg/L.

For this reporting period antimony concentrations ranged between <0.002 mg/L and 0.008 mg/L in Beswick's water supply. Samples are collected on a quarterly basis to monitor the levels. Antimony occurs naturally in the ground and through the dissolution of minerals and ores in the water.

Arsenic concentrations in drinking water are recommended by the ADWG to not exceed 0.01 mg/L. Arsenic occurs naturally in groundwater through the dissolution of minerals and ores.

Elevated levels of arsenic are known in some groundwater sources, particularly in the Katherine Region. Drinking water in this region is monitored on a regular basis to ensure water supplied does not exceed ADWG. For this reporting period there were no exceedances of arsenic.

Barium concentrations in drinking water are recommended by ADWG to not exceed 2 mg/L. Barium occurs naturally in the ground and through the dissolution of minerals and ores in the water.

For this reporting period barium levels ranged between 3 mg/L and 11 mg/L in Bulla's water supply. Samples are collected on a monthly basis to monitor the levels of barium present in the water at Bulla.

Fluoride concentrations in drinking water are recommended by ADWG to not exceed 1.5 mg/L.

Fluoride is one of the most abundant elements in the Earth's crust. It naturally occurs in groundwater supplies and is present in most food and beverage products and toothpaste.

The concentration of natural fluoride in Territory groundwater supplies depends on the type of soil and rock that the water comes into contact with. Generally, surface water sources have low natural fluoride concentrations (around <0.1 to 0.5 mg/L) whereas groundwater sources may have relatively high levels (range from 1.0 to 10 mg/L).

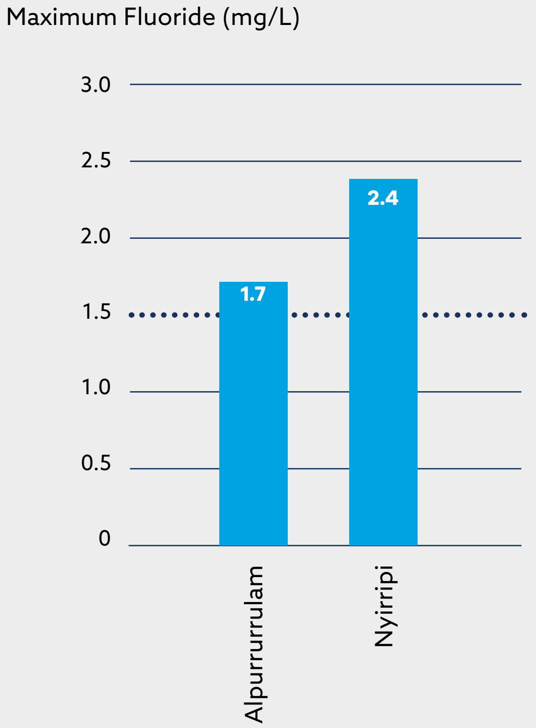
In the correct amounts, fluoride in drinking water helps build strong, healthy teeth that resist decay. Power and Water operate five fluoride optimisation systems in remote communities including Angurugu, Maningrida, Nguiu, Umbakumba, and Wadeye. The minimum fluoride for protection against dental caries is about 0.5 mg/L, although about 1.0 mg/L is optimal in temperate climates.

The majority of communities in the Barkly and Southern regions have fluoride levels between 0.5 mg/L and 1.5 mg/L. Maximum fluoride values recorded of 1.7mg/L, 2.4mg/L at Alpurrurulam and Nyirripi respectively for the 2019-20 reporting year (Figure 9).

In contrast, most water supplies in the Northern and Katherine regions have naturally low fluoride levels due to the nature of the shallow groundwater supplies and use of surface water supplies in some communities.

Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for Fluoride in 2019/20.

Figure 9 Communities with maximum fluoride levels greater than 1.5 mg/L



Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

Manganese should not exceed 0.1mg/L based on aesthetic considerations, or 0.5mg/L based on health considerations, according to the ADWG.

Warruwi had a Manganese level of 0.9mg/L measured in the community.

For the community of Warruwi, Aquifer Storage and Recovery (ASR) was proposed to provide additional water storage to supplement dry season supply and improve water security. The Warruwi ASR stores a portion of available groundwater from the shallow unconfined aquifer in the deeper confined aquifer.

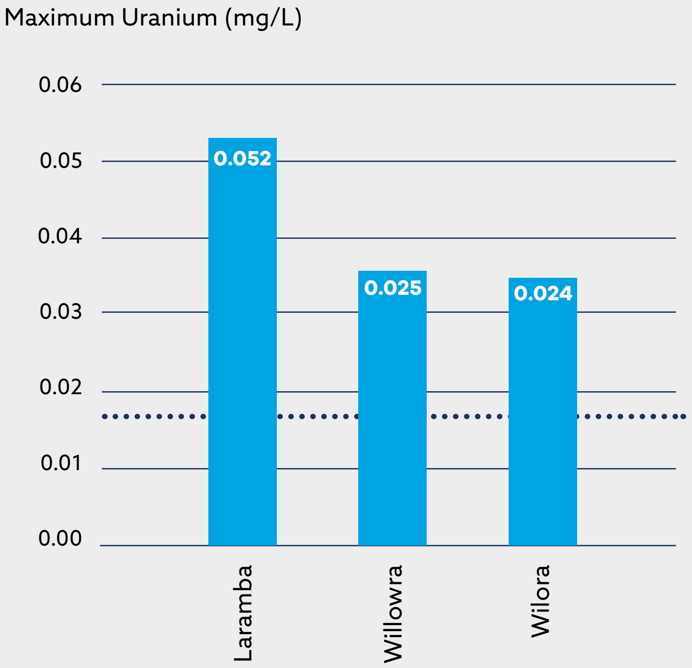
Operation of the ASR scheme has predominantly been by injection mode. From November 2019 to January 2020, 12 ML of recovery was required due to water shortages caused by below average rainfall over two successive wet seasons. In the period November 2019 to January 2020, final water quality was impacted by the water recovery made throughout the trial period. Water quality issues resulted in discolouration of the water supply which persisted throughout the reticulated water supply. Further investigation is ongoing to ensure the community has security in supply without water quality implications.

Nitrate levels in Territory drinking water supplies have been partially attributed to nitrogen fixing by native vegetation and cyanobacteria crusts on soils. Termite mounds appear to be a significant nitrate source, possibly due to the presence of nitrogen-fixing bacteria in many termite species and the nitrogen-rich secretions used to build mounds.

The ADWG recommends that nitrate levels between 50–100 mg/L are a health consideration for infants younger than three months, although levels up to 100 mg/L can be safely consumed by adults.

Power and Water has installed Advanced Water Treatment systems at Ali Curung, Yuelamu and Kintore to reduce nitrate levels to below the guideline of 50mg/L. Centres that typically have elevated levels of Nitrate from long term data assessments, include Pmara Jutunta (which has the same water source as Ti Tree) and Nturiya, however these were not sampled this year due to COVID-19 restrictions. The DoH gives regular advice to customers about the suitability of the water when bottle feeding infants.

Figure 10 Communities with maximum uranium levels greater than 0.0017 mg/L



Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

Uranium is widely distributed in geological formations, where it is found in groundwater aquifers surrounded by granite rocks and in sedimentary rock, like sandstone.

Uranium is present in the southern communities of Willowra, Wilora and Laramba at concentrations above 17mg/L. Power and Water has investigated the natural uranium occurrence in the surrounding groundwater sources and there are no nearby options for new water sources without uranium.

The two emerging technologies that Power and Water are investigating are for future water treatment options include:

1. membrane Capacitive De-Ionisation (mCDI) trial aimed to reduce elevated Total Dissolved Solids (TDS), fluoride, hardness and potentially uranium and other heavy metals under certain operating conditions
2. Electrochemical technology trial aimed to reduce nitrates and possibly heavy metals such as uranium and arsenic.

Please refer to Research into Appropriate Treatment Technology for a Remote Context for further information.

Darwin Dam.

Aesthetic parameters

Aesthetic parameters are characteristics associated with the acceptability of water to the consumer in terms of appearance, taste and odour of the water.

Please note: Due to lack of access during COVID-19 biosecurity restrictions, several Southern and Barkly Region communities were not able to be sampled for aesthetic parameters in 2019/20.

Chloride is recommended by ADWG to not exceed 250 mg/L to avoid salty tasting water. The taste threshold of chloride is in the range 200–300 mg/L. The chloride content of water can affect corrosion of pipes and fittings.

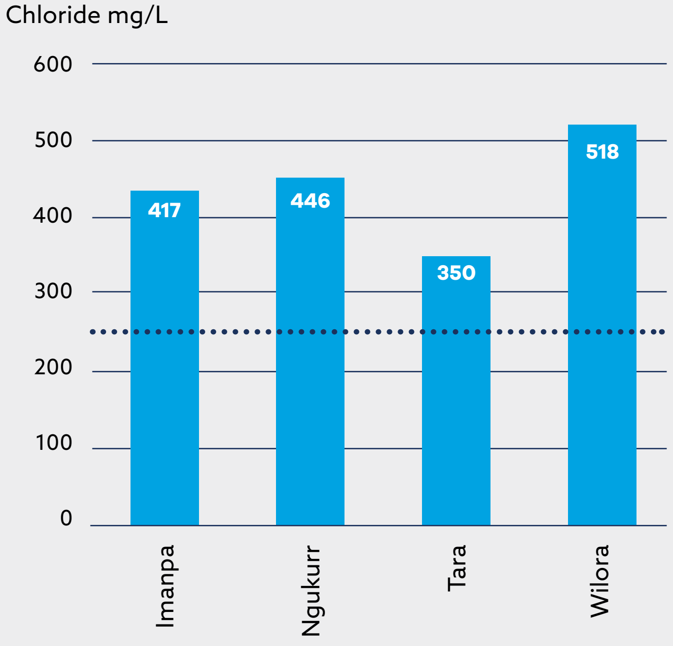
Values depend to a large extent on local groundwater geological conditions, with concentrations of 150 mg/L not uncommon in some areas. Chloride is present in natural waters from the dissolution of salt deposits in soil and rock.

Communities with elevated levels of chloride in the water supply recorded during the reporting period are shown in Figure 10.

Chlorine is used as disinfectants for drinking water supplies. Based on health considerations, the guideline value for total chlorine in drinking water is 5mg/L. Free chlorine has an odour threshold in drinking water about 0.6mg/L, however some people are particularly sensitive and can detect amount as low as 0.2mg/L. At some points in a water supply the odour threshold value of 0.6mg/L is exceeded, in order to maintain an effective disinfectant residual within other parts of the supply.

Hardness is primarily the amount of calcium and magnesium ions in water and is expressed as a calcium carbonate ($CaCO_3$) equivalent. High hardness requires more soap to achieve lather and may lead to excessive scaling in hot water pipes and fittings.

Figure 11 Communities with average chloride greater than 250 mg/L taste threshold



Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

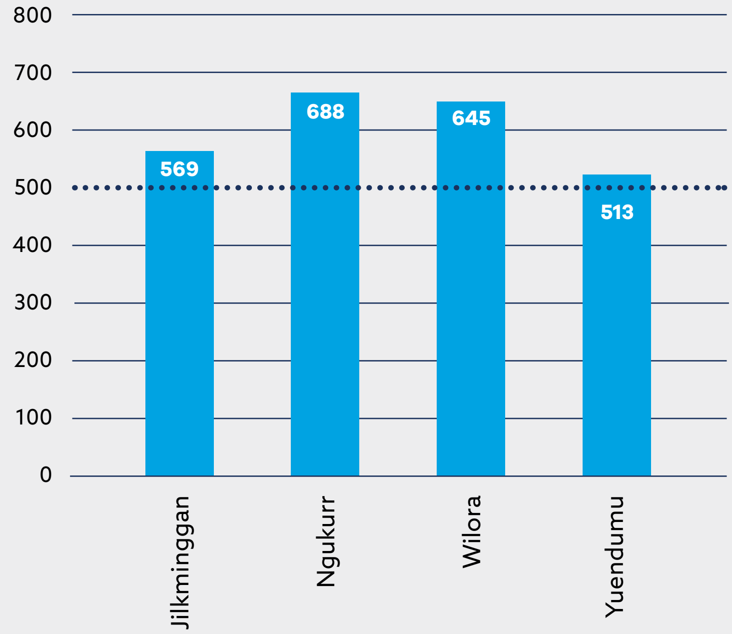
Soft water or water low in total calcium and magnesium ions, may also cause corrosion in pipes, although this will depend on other physical and chemical characteristics such as pH, alkalinity and dissolved oxygen. The ADWG recommends hardness levels below 200 mg/L to minimise scaling in hot water systems.

Hard water or water with calcium carbonate levels above 500mg/L (Figure 12) may lead to excessive scaling of pipes and fittings, which can impact on infrastructure service life and indirectly impact health through impeding access to water.

Typically across the Northern Territory groundwater supplies close to the coast are described as 'soft', as the water is drawn from relatively shallow aquifers with naturally low pH and hardness levels. Inland water supplies are often described as 'hard', as the water is stored for longer periods in deeper aquifers resulting in water with higher levels of minerals.

Figure 12 Communities with average hardness levels greater than 500 mg/L

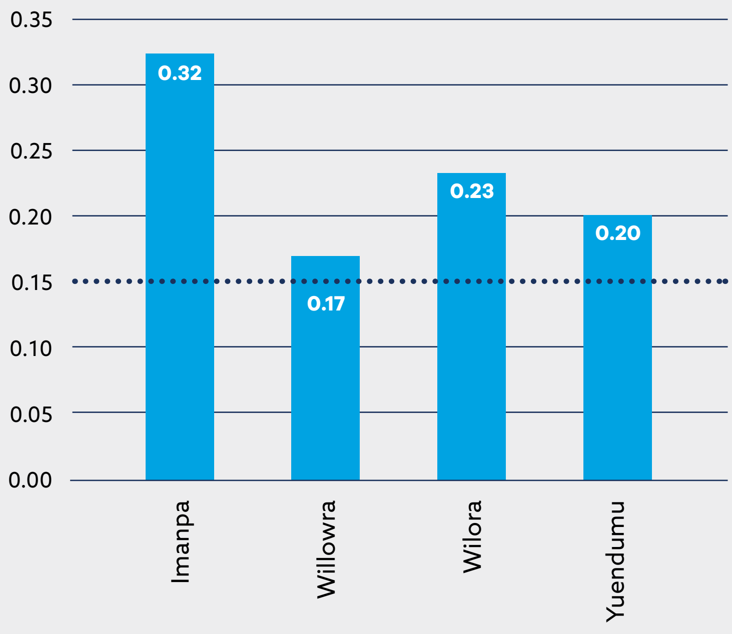
Hardness (as $CaCO_3$) (mg/L $CaCO_3$)



Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

Figure 13 Communities with average iodine greater than 0.15 mg/L taste threshold

Iodine mg/L



Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

Iodine has a taste threshold of 0.15 mg/L in water. The element iodine is present naturally in seawater, nitrate minerals and seaweed, mostly in the form of iodide salts. It may be present in water due to leaching from salt and mineral deposits. It is considered as an essential trace element for humans.

Four communities exceeded the Iodine aesthetic guide line value; Imanpa, Willowra, Wilora and Yuendamu. See Figure 13 Communities with average iodine greater than 0.15 mg/L taste threshold for further details.

Iron has a taste threshold of about 0.3 mg/L in water and becomes objectionable above 3 mg/L.

High iron concentrations give water a rust-brown appearance and can cause staining of laundry and plumbing fittings. The concentration of iron at the tap can also be influenced by factors that affect the water flow through pipes and tanks to stir up settled iron.

Economically viable options to reduce iron levels are being investigated. Some options include infrastructure changes to maximise iron oxidation and settling, altering the operation of the production bores to maximise the use of those with reduced iron levels, and also preliminary assessments of water treatment plants. Peppimenarti and Numbulwar have both had infrastructure installed within the ground level storage tanks that maximise iron fallout, therefore providing cleaner water within the community.

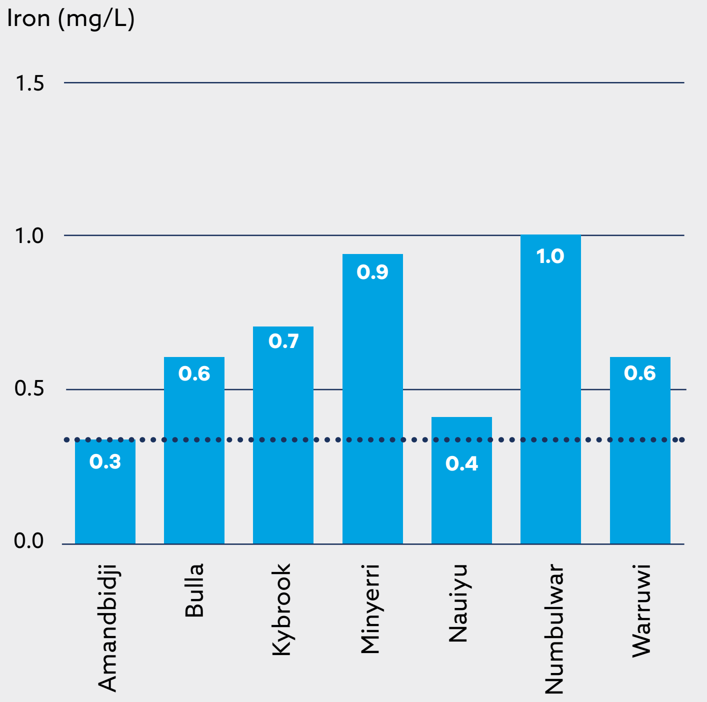
Communities regularly monitored for iron levels above 0.3 mg/L can be seen in Figure 14.

Manganese imparts an undesirable taste to water and stains plumbing fixtures and laundry. The ADWG recommends concentrations not exceed 0.5 mg/L for health considerations and 0.1 mg/L for aesthetic considerations.

Manganese occurs naturally in the ground and through the dissolution of minerals and ores in the groundwater.

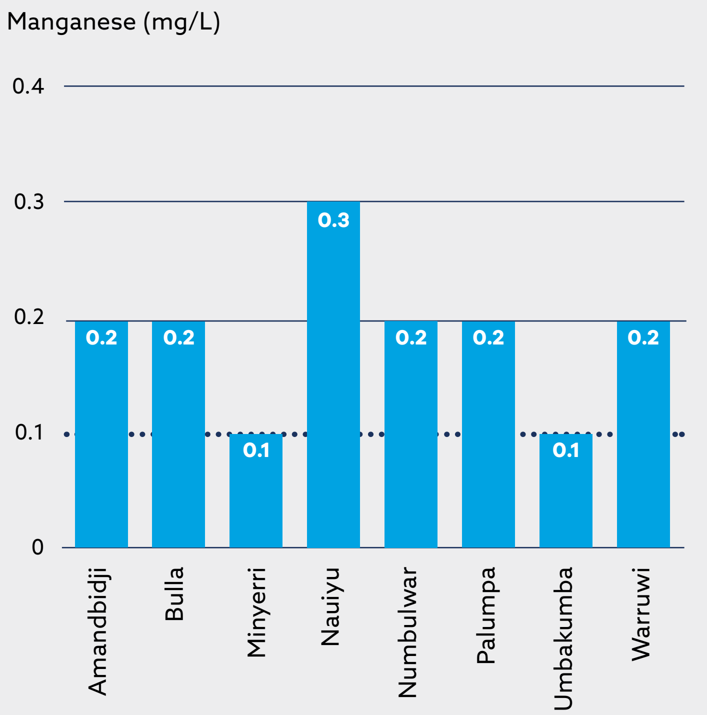
For the 2019-20 reporting year, elevated aesthetic manganese levels are shown in Figure 15.

Figure 14 Communities with average iron concentration greater than 0.3 mg/L



Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

Figure 15 Communities with average manganese concentration greater than 0.1 mg/L



Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

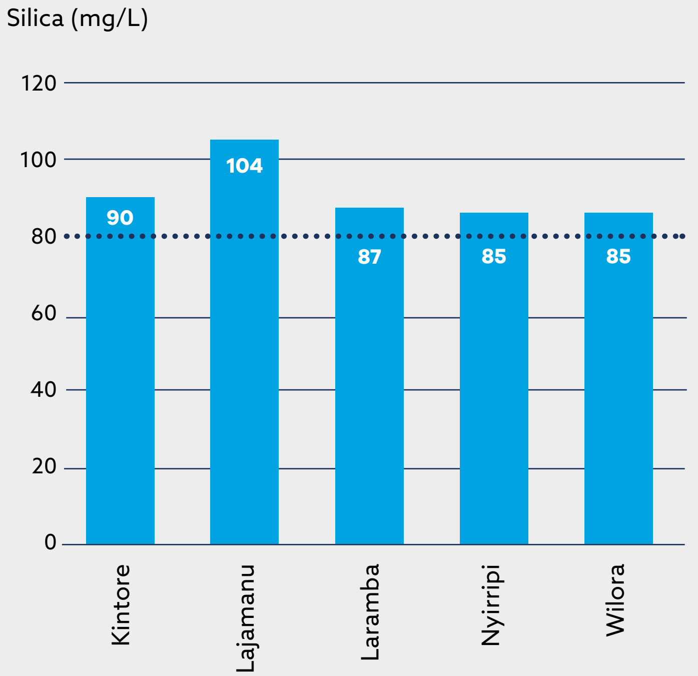
pH levels below 6.5 are likely to cause corrosion of pipes and fittings while levels above 8.5 can cause scaling, particularly on hot water systems. The ADWG recommend pH levels in drinking water should be between 6.5 and 8.5.

Typically, Northern Territory communities that rely on groundwater supplies near the coast are described as 'corrosive', as the water is drawn from relatively shallow aquifers and has naturally low pH and hardness levels.

Silica forms scale on surfaces, the ADWG recommend not exceeding 80 mg/L. Elevated silica levels have been identified in Kintore, Lajamanu, Laramba, Nyirripi and Wilora as shown in Figure 16.

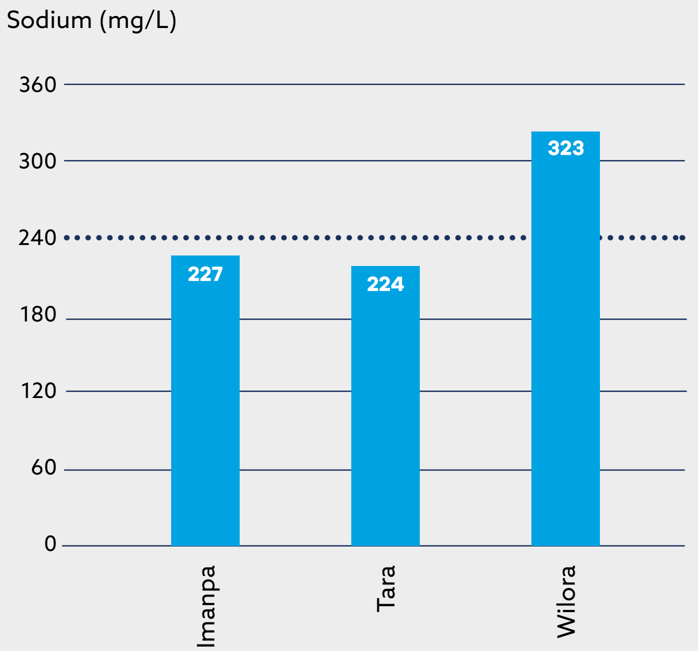
Sodium is recommended by ADWG to not exceed180 mg/L to avoid salty tasting water. The sodium ion is widespread in water due to the high solubility of sodium salts and the abundance of mineral deposits. Elevated Sodium levels have been identified in Imanpa, Tara and Wilora as shown in Figure 17.

Figure 16 Communities with average silica level greater than 80 mg/L



Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

Figure 17 Communities with average sodium greater than 180 mg/L taste threshold



Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

Total dissolved solids (TDS) affect how the water tastes. TDS comprise sodium, potassium, calcium, magnesium, chloride, sulphate, bicarbonate, carbonate, silica, organic matter, fluoride, iron, manganese, nitrate and phosphate.

Water with low TDS can taste flat, while water with TDS above 500 mg/L could cause scaling in taps, pipes and hot water systems. Levels greater than 900 mg/L significantly affect taste and may also cause moderate to severe scaling.

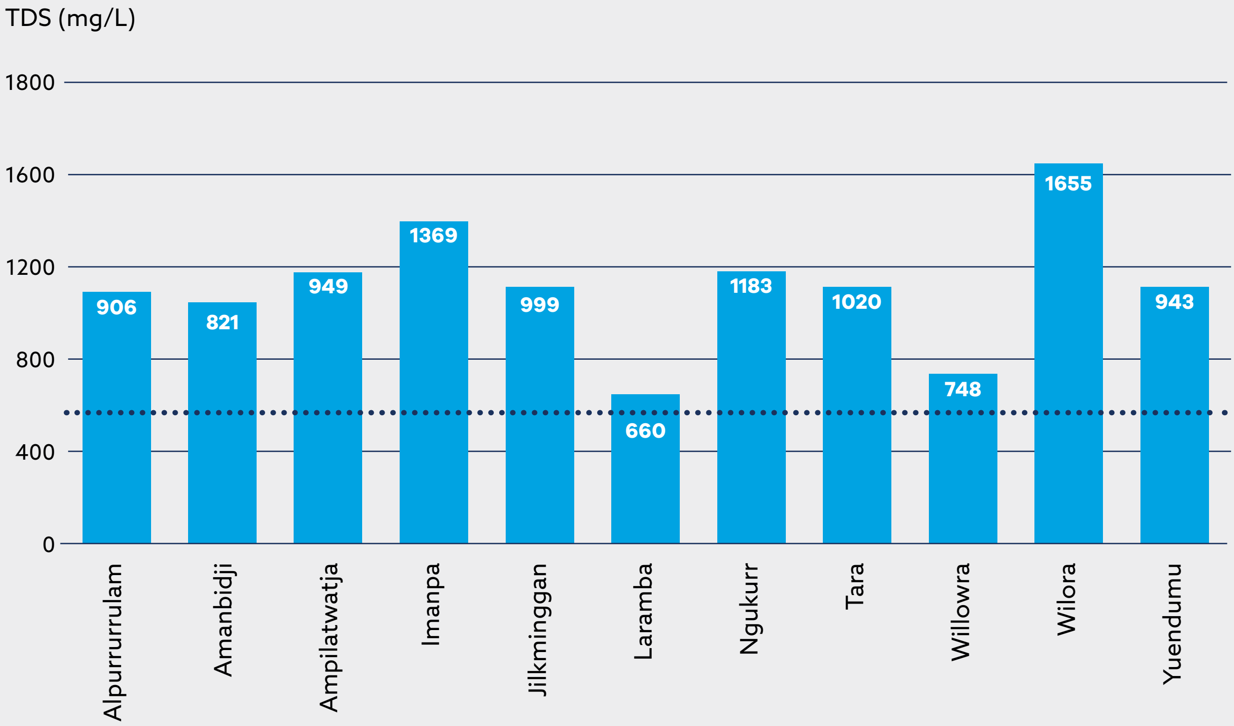
Based on taste, the ADWG recommend TDS levels below 600 mg/L. Figure 18 shows communities with elevated TDS levels.

More information is also available from the Power and Water website:

https://www.powerwater.com.au/about/what-we-do/water-supply

The results of water quality testing for each of the communities are provided in the tables Appendix B.

Figure 18 Communities with levels of TDS greater than 600 mg/L threshold



Please note: Due to lack of access during COVID-19 travel restrictions, several Southern and Barkly Region communities were not sampled for this analyte in 2019/20.

Recorded emergencies/incidents

Power and Water responds immediately to emergencies or incidents, with the primary response being to ensure adequate disinfection of the water supply, followed by reporting to the regulator to help determine the most effective corrective actions. Investigations were conducted to determine the likely cause and the effect of the corrective actions. During the 2019-20 reporting period one incident occurred.

E. coli detections

E. coli was detected on one occasions over the 2019-20 reporting period. Immediate action was taken including a Water Quality Specialist attending both communities to confirm the treatment system performance and to undertake resampling. The Department of Health did not have to issue any public advice due to *E. coli* detections.

The *E. coli* detection at Kalkarindji was identified to be caused by the sample point in an unserviceable state. A new valve and sample spigot was installed and flushing was conducted. Follow up samples confirmed the issue was resolved.

Precautionary boil water alerts

A precautionary boil water alert was issued by DoH for Kalkarindji in April 2020.

Table 10 *E. coli* incidents during the drinking water quality monitoring program period 2019-20

Year	Supply	Samples with *E. coli* detections	Collection date	Number of *E. coli* detected in sample (MPN/10mL)
2019-20	Kalkarindji	1	21 April 2020	41

Glossary of acronyms

ADWG	Australian Drinking Water Guidelines 2011
ANSI	American National Standards Institute
ARD	Annual Radiological Dose
AS/NZS	Australian/New Zealand Standards
AWA	Australian Water Association
AWT	Advance Water Treatment
AWWA	American Water Works Association
DENR	Department of Environment and Natural Resources
DIPL	Department of Infrastructure, Planning and Logistics
DoH	Department of Health
DPIR	Department of Primary Industry and Resources
DWQMS	Drinking Water Quality Management System
EDR	Electrodialysis Reversal
ESO	Essential Service Operator
FC/TC	Free chlorine/Total chlorine ratio
FIS	Facilities Information System
GOC	Government Owned Corporation
IBM	International Business Machines
ICS	Industrial Control System
IES	Indigenous Essential Services
ISO	International Organisation for Standardisation
MoU	Memorandum of understanding
MSHR	Menzies School of Health Research
N/A	Not applicable
NHMRC	National Health and Medical Research Council
NPR	National Performance Report
NT	Northern Territory
NTG	Northern Territory Government
PAM	Primary amoebic meningoencephalitis
PI System	Process information system
PWC	Power and Water Corporation
RM8	Record Manager 8
SA	South Australia
SCADA	Supervisory control and data acquisition
TDS	Total dissolved solids
THMs	Trihalomethanes
UV	Ultraviolet
WIMS	Work Information Management System
WIOA	Water Industry Operators Association
WaterRA	Water Research Australia

Units of measurement

Bq/L	becquerels per litre
mg/L	milligrams per litre
MPN/100mL	most probable number per 100 millilitre
mSv/yr	millisieverts per year
ML	mega litres
µS/cm	micro Siemens per centimetre
HU / CU	Hazen unit/ colour unit

Legend: Results table (Appendices A and B)

Health parameters	Assessments are reported as the 95th percentile for large data sets (30 or more samples) and maximum value for small data sets. Data covers the period 2019-20. Exceedances are shown bold.
Aesthetic parameters	Assessments are reported as the mean. Data covers the period 2019-20. Exceedances are shown bold.
Other parameters	Assessments are reported as the mean. Data covers the period 2019-20. Exceedances are shown bold. No guideline value applicable
<	All values reported proceeded by “<” indicate the value is below the level of detection of the analytical method.

Appendix A
Drinking Water Quality: Major and minor centres

Table 11 Bacteriological monitoring in major centres 2019-20

Centre	Parameter (MPN/100mL)	Target Level	Total No. Samples Required	Total No. Samples Collected	% Samples Collected of Samples Required	Total Exceedances	Samples Passing Reporting Level (%)
Alice Springs	*E. coli*	No *E. coli* in 100% samples	187	191	102%	0	100%
Katherine	*E. coli*	No *E. coli* in 100% samples	182	183	101%	0	100%
Darwin	*E. coli*	No *E. coli* in 100% samples	637	637	100%	0	100%
Tennant Creek	*E. coli*	No *E. coli* in 100% samples	208	212	102%	0	100%
Yulara	*E. coli*	No *E. coli* in 100% samples	52	52	100%	0	100%

Table 12 Bacteriological monitoring in minor centres 2019-20

Centre	Parameter (MPN/100mL)	Target Level	Total No. Samples Required	Total No. Samples Collected	% Samples Collected of Samples Required	Total Exceedances	Samples Passing Reporting Level (%)
Adelaide River	*E. coli*	No *E. coli* in 100% samples	104	106	102%	0	100%
Batchelor	*E. coli*	No *E. coli* in 100% samples	104	106	102%	0	100%
Cox Peninsula	*E. coli*	No *E. coli* in 100% samples	52	52	100%	0	100%
Borroloola	*E. coli*	No *E. coli* in 100% samples	156	141	**90%**	0	100%
Garawa[1]	*E. coli*	No *E. coli* in 100% samples	82	81	**99%**	0	100%
Daly Waters	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Elliott	*E. coli*	No *E. coli* in 100% samples	156	159	102%	0	100%
Gunn Point	*E. coli*	No *E. coli* in 100% samples	26	26	100%	0	100%
Kings Canyon	*E. coli*	No *E. coli* in 100% samples	129	123	**95%**	0	100%
Larrimah	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Mataranka	*E. coli*	No *E. coli* in 100% samples	48	48	100%	0	100%
Newcastle Waters	*E. coli*	No *E. coli* in 100% samples	36	35	**97%**	0	100%
Pine Creek	*E. coli*	No *E. coli* in 100% samples	156	156	100%	0	100%
Ti Tree	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Timber Creek	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%

[1] Water Services support Mabunji in providing emergency support and operation of the Garawa system.

Garawa was connected to the Borroloola reticulation system on 1 April 2020 and will not be reported separately as of 2020/21.

Table 13 Health parameters in major and minor centres 2019-20

	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chlorine (Total)	Chromium	Copper	Fluoride
ADWG Units	**0.003 mg/L**	**0.01 mg/L**	**2 mg/L**	**0.06 mg/L**	**4 mg/L**	**0.002 mg/L**	**5 mg/L**	**0.05 mg/L**	**2 mg/L**	**1.5 mg/L**
Community	Health parameters – 95th percentile or maximum values									
Alice Springs	<0.0002	<0.0005	0.10	<0.001	0.2	<0.0002	1.2	<0.005	0.05	0.5
No. samples collected	8	8	8	8	8	8	181	8	8	8
Darwin	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	2.1	<0.005	0.08	0.9
No. samples collected	17	17	17	17	17	17	629	17	17	39
Katherine	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	1.6	<0.005	0.08	0.6
No. samples collected	8	8	8	8	8	8	183	8	8	54
Tennant Creek	<0.0002	0.002	0.05	<0.001	0.5	<0.0002	1.3	<0.005	0.01	1.4
No. samples collected	4	4	4	4	4	4	204	4	4	60
Yulara	<0.0002	<0.0005	<0.05	<0.001	0.9	<0.0002	1.2	<0.005	0.01	0.2
No. samples collected	8	8	8	8	8	8	52	8	8	8
Adelaide River	0.0004	0.01	<0.05	<0.001	0.04	<0.0002	1.5	<0.005	0.1	0.4
No. samples collected	35	35	35	35	35	35	103	35	35	6
Batchelor	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	1.7	<0.005	0.03	<0.1
No. samples collected	6	6	6	6	6	6	103	6	6	6
Borroloola	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	1.6	<0.005	0.1	<0.1
No. samples collected	10	10	10	10	10	10	131	10	10	6
Garawa	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	2.3	<0.005	0.03	<0.1
No. samples collected	4	4	4	4	4	4	75	4	4	4
Cox Peninsula	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	2.6	<0.005	0.02	<0.1
No. samples collected	4	4	4	4	4	4	51	4	4	4
Daly Waters	<0.0002	0.0005	0.1	<0.001	0.4	<0.0002	1.6	0.01	0.3	0.2
No. samples collected	8	8	8	8	8	8	36	8	8	8
Elliott	<0.0002	<0.0005	0.2	<0.001	0.3	<0.0002	1.5	<0.005	0.02	0.8
No. samples collected	6	6	6	6	6	6	147	6	6	6
Gunn Point	0.0008	0.001	0.1	<0.001	<0.02	**0.004**	1.9	0.0050	0.01	0.4
No. samples collected	6	6	6	6	6	6	21	6	6	4
Kings Canyon	<0.0002	0.001	<0.05	<0.001	0.3	<0.0002	1.4	<0.005	0.08	0.5
No. samples collected	4	4	4	4	4	4	122	4	4	4
Larrimah	<0.0002	<0.0005	0.05	<0.001	0.2	<0.0002	1.7	<0.005	0.02	0.2
No. samples collected	4	4	4	4	4	4	36	4	4	4
Mataranka	<0.0002	<0.0005	0.1	<0.001	0.06	<0.0002	1.5	<0.005	0.01	0.2
No. samples collected	4	4	4	4	4	4	46	4	4	4
Newcastle Waters	<0.0002	0.001	0.3	<0.001	0.3	<0.0002	1.4	<0.005	0.05	0.9
No. samples collected	6	6	6	6	6	6	34	6	6	6
Pine Creek	<0.0002	0.008	<0.05	<0.001	0.02	<0.0002	1.6	<0.005	0.1	0.5
No. samples collected	36	36	36	36	36	36	159	36	36	6
Ti Tree	<0.0002	0.002	0.1	<0.001	0.5	<0.0002	1.5	<0.005	0.03	0.9
No. samples collected	6	6	6	6	6	6	31	6	6	37
Timber Creek	<0.0002	0.001	1.5	<0.001	0.2	<0.0002	1.5	<0.005	0.1	1.5
No. samples collected	9	9	9	9	9	9	32	9	9	12

Numbers in bold exceed the guideline value.

Lead	Manganese	Mercury	Molybdenum	Nickel	Nitrate	Sum (PFHxS + PFOS)	Perfluorooctanoic acid (PFOA)	Radiological	Selenium	Silver	Thms	Uranium
0.01 mg/L	**0.5 mg/L**	**0.001 mg/L**	**0.05 mg/L**	**0.02 mg/L**	**50 mg/L**	**0.07 ug/L**	**0.56 ug/L**	**1 mSv/yr**	**0.01 mg/L**	**0.1 mg/L**	**0.25 mg/L**	**0.017 mg/L**
<0.001	0.005	<0.0001	<0.005	<0.002	7.7	<0.001	<0.001	0.2	0.0010	<0.01	<0.004	0.007
8	8	8	8	8	8	1	1	15	8	8	4	8
0.001	0.03	<0.0001	<0.005	<0.002	0.6	<0.001	<0.001	0.06	<0.001	<0.01	0.085	0.00003
17	17	17	17	17	18	1	1	10	17	17	11	17
<0.001	<0.005	<0.0001	<0.005	<0.002	0.7	<0.001	<0.001	0.2	<0.001	<0.01	0.052	0.00003
8	8	8	8	8	4	237	237	2	8	8	6	8
<0.001	<0.005	<0.0001	<0.005	<0.002	40	<0.001	<0.001	0.08	0.0030	<0.01	0.016	0.008
4	4	4	4	4	8	2	2	13	4	4	2	4
<0.001	<0.005	<0.0001	<0.005	<0.002	38	<0.001	<0.001	0.1	<0.001	<0.01	0.011	0.0002
8	8	8	8	8	8	1	1	6	8	8	2	8
0.01	0.4	<0.0001	<0.005	<0.002	0.6	0.018	0.018	0.09	<0.001	<0.01	0.020	0.0001
35	35	35	35	35	6	155	155	7	35	35	2	35
<0.001	<0.005	<0.0001	<0.005	<0.002	1.4	0.018	0.018	0.06	<0.001	<0.01	<0.004	0.0003
6	6	6	6	6	6	154	154	2	6	6	3	6
<0.001	0.01	<0.0001	<0.005	<0.002	0.7	<0.001	<0.001	0.2	<0.001	<0.01	<0.004	0.0004
10	10	10	10	10	8	1	1	4	10	10	3	10
0.003	0.2	<0.0001	<0.005	0.002	0.6	<0.001	<0.001	0.06	<0.001	<0.01	<0.004	0.0003
4	4	4	4	4	8	1	1	3	4	4	2	4
<0.001	<0.005	<0.0001	<0.005	<0.002	0.8	<0.001	<0.001	0.2	<0.001	<0.01	<0.004	0.00003
4	4	4	4	4	8	1	1	2	4	4	1	4
<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	12	<0.001	<0.001	0.2	<0.0002	<0.0002	<0.004	<0.0002
8	8	8	8	8	8	1	1	4	8	8	2	8
0.001	<0.005	<0.0001	<0.005	<0.002	13	<0.001	<0.001	0.1	0.00	<0.01	<0.004	0.006
6	6	6	6	6	6	1	1	1	6	6	3	6
0.005	0.07	<0.0001	<0.005	0.006	<0.1	<0.001	<0.001	0.06	<0.001	<0.01	0.006	0.0003
6	6	6	6	6	4	1	1	1	6	6	1	6
0.002	<0.005	0.0003	<0.005	0.01	4.2	<0.001	<0.001	1	0.002	<0.01	N/A	0.002
4	4	4	4	4	4	1	1	94	4	4	0	4
<0.001	<0.005	<0.0001	<0.005	<0.002	2.8	<0.001	<0.001	0.1	0.002	<0.01	0.006	0.002
4	4	4	4	4	4	1	1	3	4	4	2	4
<0.001	<0.005	<0.0001	<0.005	<0.002	0.4	<0.001	<0.001	0.08	<0.001	<0.01	0.004	0.001
4	4	4	4	4	4	1	1	2	4	4	2	4
0.002	<0.005	<0.0001	<0.005	<0.002	8.9	<0.001	<0.001	0.08	<0.001	<0.01	<0.004	0.005
6	6	6	6	6	6	1	1	3	6	6	3	6
0.002	0.07	<0.0001	<0.005	<0.002	0.6	0.004	<0.001	0.1	<0.001	<0.01	<0.004	0.0001
36	36	36	36	36	6	12	12	12	36	36	3	36
<0.001	<0.005	<0.0001	<0.005	0.004	**55**	<0.001	<0.001	0.09	0.002	<0.01	0.004	0.007
6	6	6	6	6	36	1	1	4	6	6	2	6
0.001	<0.005	<0.0001	<0.005	<0.002	1.9	<0.001	<0.001	0.1	<0.001	<0.01	0.01	0.003
9	9	9	9	9	12	1	1	4	9	9	2	9

Table 14 Aesthetic and other parameters in major and minor centres 2019-20

	Aluminium	Chloride	Chlorine (Free)	Copper	Colour (True)	Hardness as CaCO3	Iron	Manganese	pH	Silica
ADWG Units	**0.2 mg/L**	**250 mg/L**	**0.6 mg/L**	**1 mg/L**	**15 mg/L**	**200 mg/L**	**0.3 mg/L**	**0.1 mg/L**	**6.5-8.5 pH unit**	**80 mg/L**
Community	Aesthetic parameters – mean values									
Alice Springs	0.02	70	**0.9**	0.03	1	200	0.02	0.01	7.6	17
No. samples collected	8	8	183	8	8	8	8	8	10	8
Darwin	<0.02	7	**1.2**	<0.01	2	30	0.06	0.02	7.4	11
No. samples collected	17	18	629	17	18	18	17	17	25	18
Katherine	0.03	5	**1.2**	0.03	<2	60	<0.02	<0.005	7.4	15
No. samples collected	8	4	190	8	8	4	8	8	4	4
Tennant Creek	<0.02	110	**1.0**	<0.01	<2	190	<0.02	<0.005	7.8	**86**
No. samples collected	4	8	204	4	9	8	4	4	8	8
Yulara	<0.02	95	**0.9**	<0.01	<2	70	<0.02	<0.005	7.6	15
No. samples collected	8	8	52	8	8	8	7	8	8	8
Adelaide River	<0.02	26	**1.2**	0.02	2	110	0.3	0.10	8.0	27
No. samples collected	35	6	103	35	6	6	33	35	4	6
Batchelor	<0.02	7	**1.2**	0.02	<2	180	<0.02	<0.005	7.4	18
No. samples collected	6	6	103	6	6	6	8	6	6	6
Borroloola	<0.02	10	**1.3**	0.04	<2	70	<0.02	<0.005	7.9	14
No. samples collected	10	6	131	10	6	6	10	10	6	6
Garawa	0.05	12	**1.4**	0.01	<2	40	0.5	0.05	7.1	14
No. samples collected	4	4	78	4	4	4	4	4	4	4
Cox Peninsula	<0.02	8	**2.0**	0.01	<2	3	0.09	<0.005	6.5	21
No. samples collected	4	4	51	4	4	4	4	4	4	4
Daly Waters	<0.02	**310**	**1.1**	<0.01	<2	**560**	<0.02	<0.005	7.4	33
No. samples collected	8	8	36	8	8	8	7	8	8	8
Elliott	<0.02	140	**1.1**	0.01	<2	**440**	<0.02	<0.005	7.7	48
No. samples collected	6	6	147	6	6	6	6	6	6	6
Gunn Point	0.04	7	**1.1**	<0.01	<2	60	0.3	0.04	6.7	10
No. samples collected	6	4	25	6	4	4	5	6	4	4
Kings Canyon	<0.02	**250**	**0.9**	0.03	<2	**370**	0.06	<0.005	7.0	20
No. samples collected	4	4	122	4	4	4	4	4	4	4
Larrimah	<0.02	210	**1.4**	0.01	<2	**520**	0.06	<0.005	7.6	41
No. samples collected	4	4	36	4	4	4	4	4	4	4
Mataranka	<0.02	20	**1.2**	<0.01	<2	**330**	<0.02	<0.005	7.6	29
No. samples collected	4	4	46	4	4	4	4	4	4	4
Newcastle Waters	<0.02	40	**1.2**	0.02	<2	**320**	<0.02	<0.005	7.7	55
No. samples collected	6	6	34	6	6	6	6	6	6	6
Pine Creek	<0.02	6	**1.3**	0.05	<2	95	0.04	0.02	6.9	50
No. samples collected	36	6	159	36	6	6	36	36	6	6
Ti Tree	<0.02	70	**1.2**	<0.01	<2	**230**	<0.02	<0.005	8.0	**91**
No. samples collected	6	37	33	6	37	37	6	6	37	37
Timber Creek	<0.02	40	**1.3**	0.03	<2	**440**	<0.02	<0.005	7.2	22
No. samples collected	9	12	32	9	12	12	9	9	12	12

Numbers in bold exceed the guideline value.

Sodium 180 mg/L	Sulfate 250 mg/L	TDS 600 mg/L	Turbidity 5 NTU	Zinc 3 mg/L	Alkalinity as CaC03 mg/L	Bromine mg/L	Calcium mg/L	Electrical conductivity µs/cm	Iodine 0.15 mg/L	Magnesium mg/L	Potassium mg/L	Tin mg/L
Other parameters – mean values												
72	39	420	0.5	0.01	220	0.19	45	810	0.04	21	5	0.01
8	8	10	10	8	8	8	8	8	8	8	8	8
3	<0.3	60	0.9	<0.01	30	0.04	5	80	<0.01	5	0.4	<0.01
18	18	25	25	17	17	17	18	18	17	19	19	17
9	3	100	0.3	<0.01	70	0.02	16	200	<0.01	6	1	<0.01
4	10	4	4	8	4	8	4	4	8	4	4	8
120	24	**650**	0.3	<0.01	270	0.37	31	1070	0.11	29	30	<0.01
8	8	8	8	4	8	4	8	8	4	4	4	4
69	44	300	0.3	<0.01	30	0.27	17	580	0.03	7	8	<0.01
8	8	8	8	8	8	8	8	8	8	8	8	8
36	<0.3	250	0.7	0.01	170	0.08	17	420	<0.01	18	1	<0.01
6	6	4	4	35	6	35	6	6	35	3	4	35
5	<0.3	180	0.4	0.01	180	0.01	15	380	<0.01	34	0.3	<0.01
6	6	6	6	6	6	6	6	6	6	6	6	6
5	<0.3	100	0.5	<0.01	70	0.02	26	180	<0.01	1	1	<0.01
6	6	6	6	10	6	10	6	6	10	6	6	10
7	<0.3	73	0.5	<0.01	<20	0.02	14	130	<0.01	1	1	<0.01
4	4	4	4	4	4	4	4	4	4	4	4	4
5	<0.3	34	0.4	0.03	<20	0.01	1	43	<0.01	0.2	1	<0.01
4	4	4	4	4	4	4	4	4	4	4	4	4
180	135	**1190**	3.7	<0.01	410	<0.002	137	2090	<0.01	54	20	<0.01
8	8	8	8	8	8	8	8	8	8	8	8	8
78	21	**730**	0.4	<0.01	380	0.47	104	1300	0.03	43	20	<0.01
6	6	6	6	6	6	6	6	6	6	6	6	6
5	<0.3	100	**8.1**	2	90	0.01	12	160	<0.01	8	1	<0.01
4	4	4	4	5	4	6	4	4	6	4	4	6
110	148	**810**	0.6	0.04	130	0.86	77	1500	0.10	43	21	<0.01
4	4	4	4	4	4	4	4	4	4	4	4	4
130	92	**970**	0.5	<0.01	430	0.46	121	1700	0.04	52	12	<0.01
4	4	4	4	4	4	4	4	4	4	4	4	4
15	<0.3	400	0.3	<0.01	330	0.06	82	660	<0.01	31	5	<0.01
4	4	4	4	4	4	4	4	4	4	4	4	4
45	2	540	0.4	<0.01	380	0.19	75	920	0.03	32	26	<0.01
6	6	6	6	6	6	6	6	6	6	6	6	6
23	2	190	0.5	0.01	130	0.04	12	310	<0.01	16	1	<0.01
6	6	6	6	36	6	36	6	6	36	6	6	36
65	26	530	0.3	0.03	220	0.27	52	850	0.08	22	18	<0.01
37	37	37	37	6	37	6	37	37	6	36	36	6
22	<0.3	480	0.4	<0.01	440	0.12	68	970	0.01	64	6	<0.01
12	12	12	12	9	12	9	12	12	9	12	12	9

Appendix B
Drinking Water Quality: Remote communities

Table 15 Bacteriological monitoring in Northern region communities 2019-20

Centre	Parameter (MPN/100mL)	Target Level	Total No. Samples Required	Total No. Samples Collected	% Samples Collected of Samples Required	Total Exeedances	Samples Passing Reporting Level (%)
Acacia Larrakia	*E. coli*	No *E. coli* in 100% samples	36	33	**92%**	0	100%
Angurugu	*E. coli*	No *E. coli* in 100% samples	150	144	**96%**	0	100%
Belyuen	*E. coli*	No *E. coli* in 100% samples	36	33	**92%**	0	100%
Galiwinku	*E. coli*	No *E. coli* in 100% samples	204	204	100%	0	100%
Gapuwiyak	*E. coli*	No *E. coli* in 100% samples	153	153	100%	0	100%
Gunbalanya	*E. coli*	No *E. coli* in 100% samples	153	153	100%	0	100%
Gunyangara	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Maningrida	*E. coli*	No *E. coli* in 100% samples	255	254	100%	0	100%
Milikapiti	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Milingimbi	*E. coli*	No *E. coli* in 100% samples	153	150	**98%**	0	100%
Milyakburra	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Minjilang	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Nauiyu	*E. coli*	No *E. coli* in 100% samples	48	48	100%	0	100%
Nganmarriyanga	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Numbulwar	*E. coli*	No *E. coli* in 100% samples	150	144	**96%**	0	100%
Peppimenarti	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Pirlangimpi	*E. coli*	No *E. coli* in 100% samples	36	39	108%	0	100%
Ramingining	*E. coli*	No *E. coli* in 100% samples	204	204	100%	0	100%
Umbakumba	*E. coli*	No *E. coli* in 100% samples	36	34	**94%**	0	100%
Wadeye	*E. coli*	No *E. coli* in 100% samples	250	250	100%	0	100%
Wurrumiyanga	*E. coli*	No *E. coli* in 100% samples	150	150	100%	0	100%
Warruwi	*E. coli*	No *E. coli* in 100% samples	36	37	103%	0	100%
Yirrkala	*E. coli*	No *E. coli* in 100% samples	153	153	100%	0	100%

*Numbers in bold indicate fewer than required samples collected in the monitoring program

PowerWater

Table 16 Bacteriological monitoring in Katherine region communities 2019-20

Centre	Parameter (MPN/100mL)	Target Level	Total No. Samples Required	Total No. Samples Collected	% Samples Collected of Samples Required	Total Exeedances	Samples Passing Reporting Level (%)
Amanbidji	*E. coli*	No *E. coli* in 100% samples	36	27	**75%**	0	100%
Barunga	*E. coli*	No *E. coli* in 100% samples	36	32	**89%**	0	100%
Beswick	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Binjari	*E. coli*	No *E. coli* in 100% samples	36	24	**67%**	0	100%
Bulla	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Bulman	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Daguragu	*E. coli*	No *E. coli* in 100% samples	24	24	100%	0	100%
Jilkminggan	*E. coli*	No *E. coli* in 100% samples	36	35	**97%**	0	100%
Kalkarindji	*E. coli*	No *E. coli* in 100% samples	36	41	114%	2	94%
Kybrook Farm	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Lajamanu	*E. coli*	No *E. coli* in 100% samples	36	33	**92%**	0	100%
Manyallaluk	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Minyerri	*E. coli*	No *E. coli* in 100% samples	36	35	**97%**	0	100%
Ngukurr	*E. coli*	No *E. coli* in 100% samples	147	144	**98%**	0	100%
Pigeon Hole	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Rittarangu	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Robinson River	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Weemol	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Yarralin	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%

*Number in bold letter indicate samples collected less than required in the monitoring program

**Sampling error, see Table 10 *E. coli* incidents during the drinking water quality monitoring program period 2019-20

Table 17 Bacteriological monitoring in Barkly region communities 2019-20

Centre	Parameter (MPN/100mL)	Target Level	Total No. Samples Required	Total No. Samples Collected	% Samples Collected of Samples Required	Total Exeedances	Samples Passing Reporting Level (%)
Ali Curung	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Alpurrurulam	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Canteen Creek	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Imangara	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Nturiya	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Tara	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Willowra	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Wilora	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Wutunugurra	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%

*Numbers in bold indicate fewer than required samples collected in the monitoring program

PowerWater

Table 18 Bacteriological monitoring in Southern region communities 2019-20

Centre	Parameter (MPN/100mL)	Target Level	Total No. Samples Required	Total No. Samples Collected	% Samples Collected of Samples Required	Total Exeedances	Samples Passing Reporting Level (%)
Amoonguna	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Ampilatwatja	*E. coli*	No *E. coli* in 100% samples	36	33	**92%**	0	100%
Areyonga	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Atitjere	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Engawala	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Finke	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Haasts Bluff	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Hermannsburg	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Imanpa	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	94%
Kaltukatjara	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Kintore	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Laramba	*E. coli*	No *E. coli* in 100% samples	36	35	**97%**	0	100%
Mt Liebig	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Nyirripi	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Papunya	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Pmara Jutunta	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Santa Teresa	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Titjikala	*E. coli*	No *E. coli* in 100% samples	36	27	**75%**	0	100%
Wallace Rockhole	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Yuelamu	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%
Yuendumu	*E. coli*	No *E. coli* in 100% samples	36	36	100%	0	100%

*Numbers in bold indicate fewer than required samples collected in the monitoring program

Table 19 Health Parameters in Northern region communities 2019-20

	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Copper	Fluoride
ADWG Units	**0.003 mg/L**	**0.01 mg/L**	**2 mg/L**	**0.06 mg/L**	**4 mg/L**	**0.002 mg/L**	**0.05 mg/L**	**2 mg/L**	**1.5 mg/L**
Community	Health parameters – 95th percentile or maximum values								
Acacia Larrakia	<0.0002	0.001	<0.05	<0.001	<0.02	<0.0002	<0.005	<0.01	0.14
No. samples collected	2	2	22	2	2	2	2	2	3
Angurugu	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.02	0.82
No. samples collected	2	2	2	2	2	2	2	2	98
Belyuen*	<0.0002	0.003	<0.05	<0.001	0.02	<0.0002	<0.005	<0.01	0.50
No. samples collected	2	2	2	2	2	2	2	2	2
Galiwinku	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.03	<0.1
No. samples collected	2	2	2	2	2	2	2	2	2
Gapuwiyak	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.04	<0.1
No. samples collected	2	2	2	2	2	2	2	2	2
Gunbaylanya	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.03	<0.1
No. samples collected	2	2	2	2	2	2	2	2	2
Gunyangara	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	<0.01	<0.1
No. samples collected	2	2	2	2	2	2	2	2	2
Maningrida	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	0.02	0.8
No. samples collected	2	2	2	2	2	2	2	2	101
Milikapiti	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	0.02	0.15
No. samples collected	2	2	2	2	2	2	2	2	2
Milingimbi	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	0.02	<0.1
No. samples collected	2	2	2	2	2	2	2	2	2
Milyakburra	<0.0002	<0.0005	<0.05	<0.001	0.06	<0.0002	<0.005	0.04	<0.1
No. samples collected	2	2	2	2	2	2	2	2	2
Minjaling	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	<0.01	<0.1
No. samples collected	2	2	2	2	2	2	2	2	2
Nauiyu	0.0004	0.006	<0.05	<0.001	0.04	<0.0002	<0.005	0.6	0.39
No. samples collected	12	12	12	12	12	12	12	12	12
Nganmarriyanga	<0.0002	0.002	0.3	<0.001	0.02	<0.0002	<0.005	<0.01	0.24
No. samples collected	2	2	2	2	2	2	2	2	2
Numbulwar	<0.0002	0.002	0.3	<0.001	0.06	<0.0002	<0.005	0.03	0.15
No. samples collected	8	8	8	8	8	8	8	8	8
Peppimenarti	<0.0002	<0.0005	0.1	<0.001	0.04	<0.0002	<0.005	0.02	0.58
No. samples collected	8	8	8	8	8	8	8	8	8
Pirlangimpi	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	<0.01	<0.1
No. samples collected	2	2	2	2	2	2	2	2	2
Ramingining	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	0.02	<0.1
No. samples collected	6	6	6	6	6	6	6	6	3
Umbakumba	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	<0.005	0.02	0.55
No. samples collected	4	4	4	4	4	4	4	4	20
Wadeye	<0.0002	<0.0005	0.1	<0.001	0.02	<0.0002	<0.005	0.04	0.77
No. samples collected	3	3	3	3	3	3	3	3	99
Wurrumiyanga	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.04	0.85
No. samples collected	2	2	2	2	2	2	2	2	103
Warruwi	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	0.03	<0.1
No. samples collected	2	2	2	2	2	2	2	2	2
Yirrkala	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.01	<0.1
No. samples collected	2	2	2	2	2	2	2	2	2

Numbers in bold exceed the guideline value.
* 2019 data used as no samples taken due to COVID-19 restrictions.

Lead	Manganese	Mercury	Molybdenum	Nickel	Nitrate	Radiological	Selenium	Silver	Uranium
0.01 mg/L	**0.5 mg/L**	**0.001 mg/L**	**0.05 mg/L**	**0.02 mg/L**	**50 mg/L**	**1 mSv/yr**	**0.01 mg/L**	**0.1 mg/L**	**0.017 mg/L**
<0.001	0.02	<0.0001	<0.005	<0.002	3.2	0.03	<0.001	<0.01	0.0005
2	2	2	2	2	3	1	2	2	2
<0.001	0.01	<0.0001	<0.005	<0.002	0.8	0.02	<0.001	<0.01	0.00004
2	2	2	2	2	2	3	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.1	0.1	<0.001	<0.01	0.0015
2	2	2	2	2	2	7	2	2	2
0.001	<0.005	<0.0001	<0.005	<0.002	0.7	0.05	<0.001	<0.01	0.00005
2	2	2	2	2	2	6	2	2	2
0.005	0.01	<0.0001	<0.005	<0.002	3	0.02	<0.001	<0.01	0.00002
2	2	2	2	2	2	3	2	2	2
<0.001	0.01	<0.0001	<0.005	<0.002	0.6	0.03	<0.001	<0.01	0.00002
2	2	2	2	2	2	13	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.2	0.03	<0.001	<0.01	<0.00001
2	2	2	2	2	2	2	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.3	0.02	<0.001	<0.01	0.00006
2	2	2	2	2	2	7	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.7	0.03	<0.001	<0.01	<0.00001
2	2	2	2	2	2	5	2	2	2
0.003	0.03	<0.0001	<0.005	0.002	2	0.08	<0.001	<0.01	0.00026
2	2	2	2	2	2	4	2	2	2
0.001	0.01	<0.0001	<0.005	<0.002	0.3	0.02	<0.001	<0.01	0.00003
2	2	2	2	2	2	2	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	1	0.03	<0.001	<0.01	0.00009
2	2	2	2	2	2	3	2	2	2
<0.001	**0.6**	<0.0001	0.03	<0.002	0.2	0.09	<0.001	<0.01	0.00006
12	11	12	12	12	12	4	12	12	12
<0.001	0.2	<0.0001	<0.005	<0.002	0.2	0.02	<0.001	<0.01	<0.00001
2	1	2	2	2	2	2	2	2	2
<0.001	0.4	<0.0001	<0.005	<0.002	0.4	0.1	<0.001	<0.01	0.00009
8	8	8	8	8	8	19	8	8	8
<0.001	0.1	<0.0001	<0.005	<0.002	2	0.02	<0.001	<0.01	0.00011
8	8	8	8	8	8	3	8	8	8
<0.001	<0.005	<0.0001	<0.005	<0.002	0.4	0.02	<0.001	<0.01	<0.00001
2	2	2	2	2	2	2	2	2	2
0.002	<0.005	<0.0001	<0.005	<0.002	0.9	0.02	<0.001	<0.01	0.00003
6	6	6	6	6	3	3	6	6	6
0.001	0.3	<0.0001	<0.005	<0.002	0.8	0.05	<0.001	<0.01	0.00005
4	4	4	4	4	2	7	4	4	4
0.003	0.03	<0.0001	<0.005	0.004	0.1	0.03	<0.001	<0.01	0.00018
3	3	3	3	3	3	6	3	3	3
<0.001	0.00	<0.0001	<0.005	<0.002	0.2	0.09	<0.001	<0.01	<0.00001
2	0	2	2	2	2	9	2	2	2
0.001	**0.9**	<0.0001	<0.005	<0.002	0.6	0.2	<0.001	<0.01	0.00005
2	16	2	2	2	2	10	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.3	0.03	<0.001	<0.01	0.00009
2	2	2	2	2	2	2	2	2	2

Table 20 Aesthetic Parameters in Northern region communities 2019-20

	Aluminium	Chloride	Free Chlorine (Odour threshold)	Copper	Colour (True)	Hardness (as CaCO3)	Iron	Manganese	pH	Silica
ADWG	**0.2**	**250**	**0.6**	**1**	**15**	**200**	**0.3**	**0.1**	**6.5-8.5**	**80**
Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**CU**	**mg/L**	**mg/L**	**mg/L**	**pH unit**	**mg/L**
Community	Aesthetic parameters – mean values									
Acacia Larrakia	<0.02	7	**1.2**	<0.01	<2	**239**	0.02	0.009	7.9	21
No. samples collected	2	3	27	2	3	3	2	2	3	3
Angurugu	<0.02	12	**1.1**	0.01	<2	4	0.03	<0.005	**5.0**	13
No. samples collected	2	2	140	2	2	2	2	2	2	2
Belyuen*	<0.02	5	**1.3**	<0.01	2	6	0.05	<0.005	6.6	43
No. samples collected	2	2	33	2	2	2	2	2	2	2
Galiwinku	<0.02	10	**1.3**	0.03	<2	3	<0.02	<0.005	**4.9**	13
No. samples collected	2	2	204	2	2	2	2	2	2	2
Gapuwiyak	<0.02	11	**1.4**	0.02	3	4	0.3	<0.005	**5.9**	12
No. samples collected	2	2	141	2	2	2	2	2	2	2
Gunbaylanya	0.05	5	**1.2**	0.02	2	3	0.1	<0.005	**5.4**	12
No. samples collected	2	2	147	2	2	2	2	2	2	2
Gunyangara	<0.02	12	**1.3**	<0.01	<2	5	0.09	<0.005	7.1	12
No. samples collected	2	2	35	2	2	2	2	2	2	2
Maningrida	<0.02	9	**1.2**	0.01	<2	3	<0.02	<0.005	**5.5**	15
No. samples collected	2	2	251	2	2	2	2	2	2	2
Milikapiti	<0.02	12	**1.1**	0.01	2	5	0.03	<0.005	**6.3**	13
No. samples collected	2	2	36	2	2	2	2	2	2	2
Milingimbi	0.09	34	**1.0**	0.02	<2	10	<0.02	0.014	**4.8**	17
No. samples collected	2	2	144	2	2	2	2	2	2	2
Milyakburra	<0.02	76	**1.0**	0.04	2.5	18	0.06	0.008	**5.7**	16
No. samples collected	2	2	33	2	2	2	2	2	2	2
Minjaling	0.12	18	**1.0**	<0.01	<2	3	<0.02	<0.005	**4.7**	13
No. samples collected	2	2	33	2	2	2	2	2	2	2
Nauiyu	0.05	5	**1.2**	0.06	<2	114	**0.4**	**0.3**	7.5	33
No. samples collected	12	12	48	12	12	12	12	11	12	12
Nganmarriyanga	<0.02	28	**1.1**	<0.01	<2	87	0.3	**0.2**	7.8	42
No. samples collected	2	2	33	2	2	2	2	1	2	2
Numbulwar	<0.02	42	**1.4**	<0.01	<2	**311**	**1**	**0.2**	7.8	18
No. samples collected	8	8	143	8	8	8	8	8	8	8
Peppimenarti	<0.02	14	**1.2**	<0.01	<2	64	0.2	0.03	7.2	31
No. samples collected	8	8	36	8	8	8	8	8	8	8
Pirlangimpi	0.03	8	**1.5**	<0.01	3	2	0.03	<0.005	6.7	11
No. samples collected	2	2	38	2	2	2	2	2	2	2
Ramingining	<0.02	8	**1.2**	0.01	<2	3	0.04	<0.005	**5.7**	15
No. samples collected	6	3	201	6	3	3	6	6	3	3
Umbakumba	<0.02	40	**3.2**	0.01	<2	14	0.3	0.1	**5.3**	12
No. samples collected	4	2	36	4	2	2	4	4	2	2
Wadeye	<0.02	6	**1.1**	0.02	<2	2	<0.02	<0.005	**5.0**	16
No. samples collected	3	3	246	3	3	3	3	3	3	3
Wurrumiyanga	<0.02	7	**1.3**	0.04	<2	<1	<0.02	0	**4.8**	14
No. samples collected	2	2	150	2	2	2	2	0	2	2
Warruwi	0.06	40	**1.3**	0.02	2	17	<0.02	**0.2**	**5.0**	12
No. samples collected	2	2	33	2	2	2	2	16	2	2
Yirrkala	<0.02	12	**1.3**	<0.01	<2	5	<0.02	<0.005	**5.6**	13
No. samples collected	2	2	153	2	2	2	2	2	2	2

Numbers in bold exceed the guideline value.
* 2019 data used as no samples taken due to COVID-19 restrictions.

Sodium	Sulfate	TDS	Turbidity	Zinc	Alkalinity (as CaCO3)	Bromine	Calcium	Electrical conductivity	Iodine (taste threshold)	Potassium	tin
180 mg/L	250 mg/L	600 mg/L	5 NTU	3 mg/L	mg/L	mg/L	mg/L	µS/cm	0.15 mg/L	mg/L	mg/L
					Other parameters – mean values						
5	<0.3	237	1	<0.01	227	0.05	49	480	<0.01	1.4	<0.01
3	3	3	3	2	3	2	3	3	2	3	2
6	0.4	33	0.3	<0.01	<20	0.02	0.5	56	<0.01	0.2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
10	<0.3	59	0.7	0.015	26	0.005	1.4	69	<0.01	3.1	<0.01
2	2	2	1	2	2	2	2	2	2	2	2
6	0.6	34	0.4	<0.01	<20	0.02	0.06	48	<0.01	0.3	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
8	<0.3	39	0.5	0.2	<20	0.03	0.4	56	<0.01	0.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
2	<0.3	20	1	<0.01	<20	0.02	0.2	23	<0.01	0.2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
7	<0.3	42	0.6	<0.01	<20	0.02	1.4	57	<0.01	0.2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
5	<0.3	30	0.3	<0.01	<20	0.01	0.2	45	<0.01	1.3	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
16	1	57	0.4	<0.01	20	0.03	0.8	84	<0.01	1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
18	1	75	0.3	0.02	<20	0.07	1.6	140	<0.01	0.2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
54	1	148	0.5	0.02	<20	0.1	3.1	305	0.03	0.3	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
14	3	67	0.3	0.05	<20	0.08	0.2	88	<0.01	0.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
16	<0.3	176	**7**	<0.01	144	0.02	25	311	0.02	0.9	<0.01
12	12	12	12	12	12	12	12	12	12	12	12
46	14	241	15	<0.01	140	0.08	25	410	<0.01	5.4	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
24	136	459	4	<0.01	160	0.2	96	770	<0.01	2.7	<0.01
8	8	8	8	8	8	8	8	8	8	8	8
15	<0.3	129	1.2	<0.01	82	0.02	15	226	<0.01	4.6	<0.01
8	8	8	8	8	8	8	8	8	8	8	8
7	<0.3	31	0.7	<0.01	<20	0.01	0.7	38	<0.01	0.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
6	<0.3	37	0.3	0.01	<20	0.01	0.4	43	<0.01	0.2	<0.01
3	3	3	3	6	3	6	3	3	6	3	6
21	2	89	0.6	0.01	<20	0.09	1.5	180	<0.01	0.6	<0.01
2	2	2	2	4	2	4	2	2	4	2	4
4	<0.3	26	0.5	0.02	<20	0.01	0.07	34	<0.01	0.1	<0.01
3	3	3	3	3	3	3	3	3	3	3	3
5	<0.3	25	0.4	<0.01	<20	0.01	<0.03	37	<0.01	<0.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
23	5	96	0.3	0.01	<20	0.09	1.1	170	<0.01	0.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
7	0.8	41	0.5	<0.01	<20	0.02	1.1	60	<0.01	0.4	<0.01
2	2	2	2	2	2	2	2	2	2	2	2

Table 21 Health Parameters in Katherine region communities 2019-20

	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Copper	Fluoride
ADWG Units	**0.003 mg/L**	**0.01 mg/L**	**2 mg/L**	**0.06 mg/L**	**4 mg/L**	**0.002 mg/L**	**0.05 mg/L**	**2 mg/L**	**1.5 mg/L**
Community	Health parameters – 95th percentile or maximum values								
Amanbidji	0.0002	0.002	0.2	<0.001	0.56	<0.0002	<0.005	0.01	0.3
No. Samples	2	2	2	2	2	2	2	2	2
Barunga	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Beswick	**0.008**	0.008	0.2	<0.001	0.04	<0.0002	<0.005	0.38	0.1
No. Samples	8	8	8	8	8	8	8	8	8
Binjari	0.0008	0.002	0.2	<0.001	0.02	<0.0002	0.02	0.26	0.4
No. Samples	4	4	4	4	4	4	4	4	2
Bulla	<0.0002	0.002	**11**	<0.001	0.26	<0.0002	<0.005	<0.01	1.2
No. Samples	22	22	22	22	22	22	22	22	8
Bulman	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	<0.01	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Daguragu	<0.0002	0.002	0.1	<0.001	0.10	<0.0002	<0.005	0.14	0.2
No. Samples	2	2	2	2	2	2	2	2	2
Jilkminggan	<0.0002	<0.0005	<0.05	<0.001	0.32	<0.0002	<0.005	0.03	0.5
No. Samples	2	2	2	2	2	2	2	2	2
Kalkarindji	<0.0002	0.001	0.1	<0.001	0.12	<0.0002	<0.005	0.02	0.3
No. Samples	2	2	2	2	2	2	2	2	2
Kybrook Farm	<0.0002	0.004	<0.05	<0.001	0.04	<0.0002	<0.005	0.02	0.7
No. Samples	6	6	6	6	6	6	6	6	4
Lajamanu	<0.0002	<0.0005	0.1	<0.001	0.18	<0.0002	<0.005	0.04	0.3
No. Samples	2	2	2	2	2	2	2	2	2
Manyallaluk*	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.03	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Minyerri	<0.0002	0.003	0.4	<0.001	0.26	<0.0002	<0.005	0.03	0.3
No. Samples	9	9	9	9	9	9	9	9	8
Ngukurr	0.001	<0.0005	0.8	<0.001	0.08	<0.0002	<0.005	0.01	0.2
No. Samples	8	8	8	8	8	8	8	8	8
Pigeon Hole	<0.0002	<0.0005	<0.05	<0.001	0.08	<0.0002	<0.005	<0.01	0.3
No. Samples	2	2	2	2	2	2	2	2	2
Rittarangu	<0.0002	<0.0005	0.3	<0.001	0.04	<0.0002	<0.005	<0.01	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Robinson River	<0.0002	<0.0005	1.1	<0.001	0.16	<0.0002	<0.005	<0.01	1.0
No. Samples	8	8	8	8	8	8	8	8	8
Weemol	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	<0.005	<0.01	0.1
No. Samples	2	2	2	2	2	2	2	2	2
Yarralin	<0.0002	0.001	0.4	<0.001	0.06	<0.0002	<0.005	<0.01	0.1
No. Samples	2	2	2	2	2	2	2	2	2

Numbers in bold exceed the guideline value.
* 2019 data used as no samples taken due to COVID-19 restrictions.

	Lead	Manganese	Mercury	Molybdenum	Nickel	Nitrate	Radiological	Selenium	Silver	Uranium
	0.01 mg/L	0.5 mg/L	0.001 mg/L	0.05 mg/L	0.02 mg/L	50 mg/L	1 mSv/yr	0.01 mg/L	0.1 mg/L	0.017 mg/L
	<0.001	0.4	<0.0001	<0.005	0.002	4.1	0.05	<0.001	<0.01	0.0011
	2	2	2	2	2	2	6	2	2	2
	<0.001	<0.005	<0.0001	<0.005	<0.002	0.6	0.02	<0.001	<0.01	0.0001
	2	2	2	2	2	2	3	2	2	2
	<0.001	0.01	0.0001	<0.005	<0.002	0.7	0.03	<0.001	<0.01	0.0002
	8	8	8	8	8	8	2	8	8	8
	0.001	<0.005	<0.0001	<0.005	0.008	0.3	0.9	<0.001	<0.01	0.0013
	4	4	4	4	4	2	2	4	4	4
	0.003	0.5	<0.0001	<0.005	<0.002	0.1	0.4	<0.001	<0.01	0.0002
	22	22	22	22	22	8	3	22	22	22
	<0.001	<0.005	<0.0001	<0.005	<0.002	0.8	0.02	<0.001	<0.01	0.0003
	2	2	2	2	2	2	2	2	2	2
	0.008	<0.005	<0.0001	<0.005	<0.002	3.3	0.08	<0.001	<0.01	0.0018
	2	2	2	2	2	2	1	2	2	2
	<0.001	0.02	<0.0001	<0.005	<0.002	0.6	0.1	<0.001	<0.01	0.0079
	2	2	2	2	2	2	3	2	2	2
	<0.001	<0.005	<0.0001	<0.005	<0.002	5.5	0.1	<0.001	<0.01	0.0017
	2	2	2	2	2	2	2	2	2	2
	0.007	0.1	<0.0001	<0.005	<0.002	0.2	0.03	<0.001	<0.01	0.0005
	6	6	6	6	6	4	3	6	6	6
	<0.001	<0.005	<0.0001	<0.005	<0.002	4.9	0.03	<0.001	<0.01	0.0011
	2	2	2	2	2	2	4	2	2	2
	0.006	<0.005	<0.0001	<0.005	<0.002	0.4	0.02	<0.001	<0.01	0.000070
	2	2	2	2	2	2	2	2	2	2
	0.001	0.3	<0.0001	<0.005	<0.002	1.0	0.03	<0.001	<0.01	<0.00001
	9	9	9	9	9	8	4	9	9	9
	0.001	0.005	<0.0001	<0.005	<0.002	2.3	0.06	<0.001	<0.01	0.0008
	8	8	8	8	8	8	5	8	8	8
	<0.001	<0.005	<0.0001	<0.005	<0.002	16	0.06	<0.001	<0.01	0.0018
	2	2	2	2	2	2	2	2	2	2
	<0.001	<0.005	<0.0001	<0.005	<0.002	1.8	0.03	<0.001	<0.01	0.0004
	2	2	2	2	2	2	4	2	2	2
	<0.001	0.06	<0.0001	<0.005	<0.002	16	0.05	<0.001	<0.01	0.0027
	8	8	8	8	8	8	5	8	8	8
	<0.001	<0.005	<0.0001	<0.005	<0.002	0.8	0.03	<0.001	<0.01	0.0003
	2	2	2	2	2	2	2	2	2	2
	<0.001	<0.005	<0.0001	<0.005	<0.002	11	0.06	<0.001	<0.01	0.0030
	2	2	2	2	2	2	6	2	2	2

Table 22 Aesthetic Parameters in Katherine region communities 2019-20

	Aluminium	Chloride	Free Chlorine (Odour threshold)	Copper	Colour (True)	Hardness (as CaCO3)	Iron	Manganese	pH	Silica
ADWG Units	**0.2 mg/L**	**250 mg/L**	**0.6 mg/L**	**1 mg/L**	**15 CU**	**200 mg/L**	**0.3 mg/L**	**0.1 mg/L**	**6.5-8.5 pH unit**	**80 mg/L**
Community	Aesthetic parameters – mean values									
Amanbidji	<0.02	120	**1.0**	0.01	<2	**335**	0.3	**0.2**	7.9	32
No. Samples	2	2	27	2	2	2	2	2	2	2
Barunga	0.08	6	**1.2**	0.01	5.5	6	0.2	<0.005	5.5	18
No. Samples	2	2	29	2	2	2	2	2	2	2
Beswick	<0.02	6	**1.1**	0.16	<2	**318**	<0.02	<0.005	7.6	23
No. Samples	8	8	36	8	8	8	8	8	8	8
Binjari	<0.02	11	**1.1**	0.09	2.5	**263**	0.06	<0.005	7.4	29
No. Samples	4	2	23	4	2	2	4	4	2	2
Bulla	<0.02	42	**1.1**	<0.01	2	**211**	**0.6**	**0.2**	8.2	18
No. Samples	22	8	36	22	8	8	22	22	8	8
Bulman	0.04	8	**1.0**	<0.01	<2	**302**	<0.02	<0.005	7.7	25
No. Samples	2	2	36	2	2	2	2	2	2	2
Daguragu	<0.02	19	**1.0**	0.07	<2	**245**	<0.02	<0.005	8.0	29
No. Samples	2	2	24	2	2	2	2	2	2	2
Jilkminggan	<0.02	190	**1.2**	0.02	<2	**569**	0.03	0.02	7.3	51
No. Samples	2	2	30	2	2	2	2	2	2	2
Kalkarindji	<0.02	27	**1.0**	0.01	<2	**227**	<0.02	<0.005	7.9	25
No. Samples	2	2	36	2	2	2	2	2	2	2
Kybrook Farm	<0.02	7	**0.9**	0.01	<2	149	**0.7**	0.04	7.4	40
No. Samples	6	4	36	6	4	4	6	6	4	4
Lajamanu	<0.02	43	**1.3**	0.02	<2	168	<0.02	<0.005	7.9	**104**
No. Samples	2	2	12	2	2	2	2	2	2	2
Manyallaluk*	<0.02	5	**1.1**	0.03	<2	2	0.3	<0.005	**5.2**	21
No. Samples	2	2	36	2	2	2	2	2	2	2
Minyerri	<0.02	16	**1.0**	<0.01	3	109	**0.9**	0.1	7.4	33
No. Samples	9	8	36	9	8	8	9	9	8	8
Ngukurr	<0.02	**446**	**1.0**	<0.01	<2	**688**	0.1	<0.005	7.6	24
No. Samples	8	8	140	8	8	8	8	8	8	8
Pigeon Hole	<0.02	16	**1.1**	<0.01	<2	**291**	<0.02	<0.005	7.6	59
No. Samples	2	2	36	2	2	2	2	2	2	2
Rittarangu	<0.02	24	**1.0**	<0.01	<2	**250**	<0.02	<0.005	7.6	23
No. Samples	2	32	36	2	2	2	2	2	2	2
Robinson River	<0.02	32	**1.2**	<0.01	<2	**388**	<0.02	0.01	7.8	37
No. Samples	8	8	36	8	8	8	8	8	8	8
Weemol	0.05	9	**1.0**	<0.01	<2	**357**	<0.02	<0.005	7.6	34
No. Samples	2	2	36	2	2	2	2	2	2	2
Yarralin	<0.02	12	**1.3**	<0.01	<2	**305**	<0.02	<0.005	7.7	37
No. Samples	2	2	35	2	2	2	2	2	2	2

Numbers in bold exceed the guideline value.
* 2019 data used as no samples taken due to COVID-19 restrictions.

Sodium	Sulfate	TDS	Turbidity	Zinc	Alkalinity (as CaCO3)	Bromine	Calcium	Electrical conductivity	Iodine (taste threshold)	Potassium	tin
180 mg/L	250 mg/L	600 mg/L	5 NTU	3 mg/L	mg/L	mg/L	mg/L	µS/cm	0.15 mg/L	mg/L	mg/L
					Other parameters – mean values						
166	133	**821**	**6.1**	0.02	450	0.3	51	1500	0.01	4	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
6	0.36	34	1.4	0.03	<20	0.01	1	37	<0.01	1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
5	<0.3	327	0.4	0.04	320	0.02	64	649	<0.01	2	<0.01
8	8	8	8	8	8	8	8	8	8	8	8
13	<0.3	365	0.5	0.07	315	0.02	59	640	<0.01	3	<0.01
2	2	2	2	4	2	4	2	2	4	2	4
26	<0.3	307	2.3	0.01	226	0.2	42	579	<0.01	5	<0.01
8	8	8	8	22	8	22	8	8	22	8	22
8	<0.3	348	0.5	0.01	330	0.02	59	645	<0.01	2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
31	<0.3	351	0.3	0.09	310	0.09	46	675	<0.01	3	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
130	138	**999**	0.5	0.05	500	0.7	105	1800	0.13	19	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
31	<0.3	341	0.3	<0.01	275	0.1	46	650	0.015	4	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
46	<0.3	280	1.0	0.02	245	0.03	26	505	<0.01	2	<0.01
4	4	4	4	6	4	6	4	4	6	4	6
53	<0.3	362	0.3	<0.01	220	0.2	27	615	0.06	6	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
5.4	<0.3	43	0.4	0.05	<20	0.02	0.15	33	<0.01	0.4	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
23	9.2	213	**6.8**	0.02	126	0.04	24	353	<0.01	5	<0.01
8	8	8	8	9	8	9	8	8	9	8	9
137	18.3	**1183**	1.3	0.03	321	1.2	115	2225	0.015	8	<0.01
8	8	8	8	8	8	8	8	8	8	8	8
28	<0.3	437	0.3	<0.01	360	0.06	62	760	<0.01	2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
14	<0.3	324	0.4	<0.01	270	0.05	46	580	<0.01	2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
17	<0.3	441	0.6	<0.01	391	0.13	43	856	0.011	3	<0.01
8	8	8	8	8	8	8	8	8	8	8	8
10	<0.3	400	0.4	<0.01	390	0.01	66	760	<0.01	2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
14	<0.3	397	0.4	0.02	340	0.07	65	720	<0.01	2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2

Table 23 Health Parameters in Barkly region communities 2019-20

	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Copper	Fluoride
ADWG Units	**0.003 mg/L**	**0.01 mg/L**	**2 mg/L**	**0.06 mg/L**	**4 mg/L**	**0.002 mg/L**	**0.05 mg/L**	**2 mg/L**	**1.5 mg/L**
Community	Health parameters – 95th percentile or maximum values								
Ali Curung	<0.0002	<0.0005	1.1	<0.001	0.9	<0.0002	<0.005	0.1	1.1
No. Samples	8	8	8	8	8	8	8	8	9
Alpurrurulam	<0.0002	0.002	0.1	<0.001	0.4	<0.0002	<0.005	0.2	**1.7**
No. Samples	11	11	11	11	11	11	11	11	11
Canteen Creek*	<0.0002	0.0005	0.1	<0.001	0.3	<0.0002	<0.005	0.03	0.55
No. Samples	2	2	2	2	2	2	2	2	2
Imangara*	<0.0002	0.001	0.4	<0.001	0.4	<0.0002	<0.005	<0.01	0.90
No. Samples	2	2	2	2	2	2	2	2	2
Nturiya*	<0.0002	<0.0005	<0.05	<0.001	0.7	<0.0002	<0.005	<0.01	0.97
No. Samples	2	2	2	2	2	2	2	2	2
Tara	<0.0002	0.0005	<0.05	<0.001	0.5	<0.0002	<0.005	0.08	0.9
No. Samples	1	1	1	1	1	1	1	1	1
Willowra	<0.0002	0.002	0.05	<0.001	0.6	<0.0002	<0.005	0.01	0.8
No. Samples	16	16	16	16	16	16	16	16	12
Wilora	0.0013	0.002	0.05	<0.001	0.9	<0.0002	<0.005	0.01	1.0
No. Samples	17	17	17	17	17	17	17	17	11
Wutunugurra*	<0.0002	0.001	0.3	<0.001	0.2	<0.0002	<0.005	<0.01	0.30
No. Samples	2	2	2	2	2	2	2	2	2

Numbers in bold exceed the guideline value.
* 2019 data used as no samples taken due to COVID-19 restrictions.

Lead	Manganese	Mercury	Molybdenum	Nickel	Nitrate	Radiological	Selenium	Silver	Uranium
0.01 mg/L	**0.5 mg/L**	**0.001 mg/L**	**0.05 mg/L**	**0.02 mg/L**	**50 mg/L**	**1 mSv/yr**	**0.01 mg/L**	**0.1 mg/L**	**0.017 mg/L**
0.003	<0.005	<0.0001	<0.005	0.004	23	0.1	<0.001	<0.01	0.00073
8	8	8	8	8	9	2	8	8	8
0.007	<0.005	<0.0001	<0.005	<0.002	4	0.1	0.002	<0.01	0.01
11	11	11	11	11	11	4	11	11	11
<0.001	<0.005	<0.0001	<0.005	<0.002	6	0.3	0.001	<0.01	0.0029
2	2	2	2	2	2	3	2	2	2
<0.001	0.01	<0.0001	<0.005	<0.002	10	0.3	0.001	<0.01	0.016
2	2	2	2	2	2	1	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	10	0.1	0.003	<0.01	0.015
2	2	2	2	2	2	4	2	2	2
<0.001	<0.005	<0.0001	<0.005	0.004	24	0.3	0.002	<0.01	0.004
1	1	1	1	1	1	2	1	1	1
0.002	<0.005	<0.0001	<0.005	<0.002	42	0.1	0.004	<0.01	**0.025**
16	16	16	16	16	12	2	16	16	16
0.02	<0.005	<0.0001	<0.005	<0.002	19	0.2	0.006	<0.01	0.024
17	17	17	17	17	11	12	17	17	17
<0.001	<0.005	<0.0001	<0.005	<0.002	8	0.2	<0.001	<0.01	0.015
2	2	2	2	2	2	3	2	2	2

Table 24 Aesthetic Parameters in Barkly region communities 2019-20

	Aluminium	Chloride	Free Chlorine (Odour threshold)	Copper	Colour (True)	Hardness (as CaCO3)	Iron	Manganese	pH	Silica
ADWG Units	**0.2 mg/L**	**250 mg/L**	**0.6 mg/L**	**1 mg/L**	**15 CU**	**200 mg/L**	**0.3 mg/L**	**0.1 mg/L**	**6.5-8.5 pH unit**	**80 mg/L**
Community	Aesthetic parameters – mean values									
Ali Curung	<0.02	46	**1.2**	0.02	<2	7	0.02	<0.005	7.9	59
No. Samples	8	9	24.0	8	9	9	8	8	9	9
Alpurrurulam	<0.02	177	**1.0**	0.03	<2	**476**	<0.02	<0.005	7.6	64
No. Samples	11	11	33.0	11	11	11	11	11	11	11
Canteen Creek**	<0.02	110	**1.2**	0.02	2	**242**	0.2	<0.005	7.5	64
No. Samples	2	2	33.0	2	2	2	2	2	2	2
Imangara**	<0.02	37	**1.1**	<0.01	3	**264**	0.07	0.008	7.9	77
No. Samples	2	2	36.0	2	2	2	2	2	2	2
Nturiya**	<0.02	**335**	**0.7**	<0.01	2	316	<0.02	<0.005	7.9	75
No. Samples	2	2	35.0	2	2	2	2	2	2	2
Tara	<0.02	**350**	**1.1**	0.08	2	**332**	0.04	<0.005	6.9	21
No. Samples	1	1	36.0	1	1	1	1	1	1	1
Willowra	<0.02	171	**1.2**	<0.01	<2	**252**	<0.02	<0.005	8.1	80
No. Samples	16	12	36.0	16	12	12	16	16	12	12
Wilora*	<0.02	**518**	N/A*	<0.01	<2	**645**	<0.02	<0.005	8.0	**85**
No. Samples	17	11	0.0	17	11	11	17	17	11	11
Wutunugurra*	<0.02	62	**1.2**	<0.01	2	160	<0.02	<0.005	7.8	77
No. Samples	2	2	27.0	2	2	2	2	2	2	2

Numbers in bold exceed the guideline value.
* Disinfection in Wilora is via UV and not chlorination, thus chlorine does not need to be measured.
** 2019 data used as no samples taken due to COVID-19 restrictions.

Sodium	Sulfate	TDS	Turbidity	Zinc	Alkalinity (as CaCO3)	Bromine	Calcium	Electrical conductivity	Iodine (taste threshold)	Potassium	tin
180 mg/L	**250 mg/L**	**600 mg/L**	**5 NTU**	**3 mg/L**	**mg/L**	**mg/L**	**mg/L**	**µS/cm**	**0.15 mg/L**	**mg/L**	**mg/L**
					Other parameters – mean values						
79	3	276	0.5	0.02	116	0.3	1.3	447	0.08	13	<0.01
9	9	9	9	8	9	8	9	9	8	9	8
144	58	**906**	0.4	0.01	467	0.7	62	1636	0.11	7	<0.01
11	11	11	11	11	11	11	11	11	11	11	11
111	26	**607**	3	<0.01	315	0.3	34	1000	0.09	12	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
43	<0.3	489	0.9	0.03	350	0.1	37	835	0.06	30	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
241	169	**1155**	0.3	0.06	210	3	78	1900	**0.18**	23	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
224	141	**1020**	0.60	0.04	200	0.7	38	1800	0.14	24	<0.01
1	1	1	1	1	1	1	1	1	1	1	1
138	58	**748**	0.50	0.01	241	0.6	51	1308	**0.17**	31	<0.01
12	12	12	12	16	12	16	12	12	16	12	16
323	173	**1655**	0.6	0.09	384	3	101	2900	**0.23**	57	<0.01
11	11	11	11	15	11	17	11	11	17	11	17
54	8	384	0.4	0.02	175	0.1	33	600	0.06	8	<0.01
2	2	2	2	2	2	2	2	2	2	2	2

Table 25 Health Parameters in Southern region communities 2019-20

	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Copper	Fluoride
ADWG Units	**0.003 mg/L**	**0.01 mg/L**	**2 mg/L**	**0.06 mg/L**	**4 mg/L**	**0.002 mg/L**	**0.05 mg/L**	**2 mg/L**	**1.5 mg/L**
Community	Health parameters – 95th percentile or maximum values								
Amoonguna*	<0.0002	<0.0005	0.1	<0.001	0.1	<0.0002	<0.005	0.06	0.49
No. Samples	3	3	3	3	3	3	3	3	3
Ampilatwatja	<0.0002	0.0005	<0.05	<0.001	0.34	<0.0002	<0.005	0.04	1.2
No. Samples	2	2	2	2	2	2	2	2	2
Areyonga*	<0.0002	<0.0005	0.1	<0.001	0.2	<0.0002	<0.005	<0.01	0.40
No. Samples	2	2	2	2	2	2	2	2	2
Atitjere*	<0.0002	<0.0005	0.05	<0.001	0.1	<0.0002	<0.005	<0.01	0.63
No. Samples	2	2	2	2	2	2	2	2	2
Engawala*	<0.0002	<0.0005	0.2	<0.001	0.2	<0.0002	<0.005	<0.01	0.66
No. Samples	2	2	2	2	2	2	2	2	2
Finke	<0.0002	0.0005	0.2	<0.001	0.08	<0.0002	<0.005	0.01	0.2
No. Samples	2	2	2	2	2	2	2	2	2
Haasts Bluff*	<0.0002	<0.0005	<0.05	<0.001	0.4	<0.0002	<0.005	0.01	0.50
No. Samples	2	2	2	2	2	2	2	2	2
Hermannsburg*	<0.0002	<0.0005	<0.05	<0.001	0.2	<0.0002	<0.005	<0.01	0.33
No. Samples	2	2	2	2	2	2	2	2	2
Imanpa	0.001	<0.0005	<0.05	<0.001	1.2	<0.0002	0.005	0.01	0.9
No. Samples	10	10	10	10	10	10	10	10	10
Kaltukatjara	<0.0002	<0.0005	<0.05	<0.001	0.1	<0.0002	<0.005	0.01	0.4
No. Samples	2	2	2	2	2	2	2	2	2
Kintore	<0.0002	<0.0005	<0.05	<0.001	0.4	<0.0002	<0.005	<0.01	0.5
No. Samples	8	8	8	8	8	8	8	8	6
Laramba	<0.0002	0.001	0.3	<0.001	0.7	<0.0002	<0.005	0.05	1.3
No. Samples	16	16	16	16	16	16	16	16	13
Mt Liebig*	<0.0002	<0.0005	0.05	<0.001	0.3	<0.0002	<0.005	0.01	1.2
No. Samples	2	2	2	2	2	2	2	2	2
Nyirripi	<0.0002	0.002	1.1	<0.001	0.5	<0.0002	<0.005	0.02	**2.4**
No. Samples	8	8	8	8	8	8	8	8	8
Papunya*	<0.0002	0.0005	0.1	<0.001	0.3	<0.0002	<0.005	0.01	0.99
No. Samples	2	2	2	2	2	2	2	2	2
Pmara Jutunta*	<0.0002	0.001	0.05	<0.001	0.4	<0.0002	<0.005	<0.01	0.78
No. Samples	2	2	2	2	2	2	2	2	2
Santa Teresa	<0.0002	<0.0005	0.4	<0.001	0.06	<0.0002	<0.005	<0.01	0.2
No. Samples	2	2	2	2	2	2	2	2	2
Titjikala	<0.0002	0.001	0.3	<0.001	0.1	<0.0002	<0.005	0.02	0.6
No. Samples	2	2	2	2	2	2	2	2	2
Wallace Rockhole*	<0.0002	0.001	<0.05	<0.001	0.4	<0.0002	0.04	0.01	0.80
No. Samples	2	2	2	2	2	2	2	2	2
Yuelamu	<0.0002	<0.0005	<0.05	<0.001	1	<0.0002	<0.005	0.01	0.8
No. Samples	10	10	10	10	10	10	10	10	10
Yuendumu	<0.0002	<0.0005	<0.05	<0.001	0.4	<0.0002	<0.005	0.03	0.5
No. Samples	12	12	12	12	12	12	12	12	6

Numbers in bold letter exceed the guideline value.
* 2019 data used as no samples taken due to COVID-19 restrictions.

PowerWater

Lead	Manganese	Mercury	Molybdenum	Nickel	Nitrate	Radiological	Selenium	Silver	Uranium
0.01 mg/L	0.5 mg/L	0.001 mg/L	0.05 mg/L	0.02 mg/L	50 mg/L	1 mSv/yr	0.01 mg/L	0.1 mg/L	0.017 mg/L
0.003 / 3	0.09 / 3	<0.0001 / 3	<0.005 / 3	<0.002 / 3	8 / 3	0.2 / 3	0.001 / 3	<0.01 / 3	0.0085 / 3
0.001 / 2	0.005 / 2	<0.0001 / 2	<0.005 / 2	0.008 / 2	26 / 2	0.2 / 6	0.002 / 2	<0.01 / 2	0.0094 / 2
<0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	0.006 / 2	8 / 2	0.5 / 2	0.001 / 2	<0.01 / 2	0.013 / 2
<0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	<0.002 / 2	30 / 2	0.06 / 2	0.003 / 2	<0.01 / 2	0.0069 / 2
<0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	<0.002 / 2	30 / 2	0.08 / 4	0.002 / 2	<0.01 / 2	0.0040 / 2
<0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	<0.002 / 2	8 / 2	0.09 / 2	<0.001 / 2	<0.01 / 2	0.0028 / 2
<0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	0.004 / 2	6 / 2	0.1 / 3	0.002 / 2	<0.01 / 2	0.011 / 2
<0.001 / 2	0.02 / 2	<0.0001 / 2	<0.005 / 2	<0.002 / 2	5 / 2	0.2 / 3	<0.001 / 2	<0.01 / 2	0.0044 / 2
<0.001 / 10	0.04 / 10	0.0001 / 10	<0.005 / 10	0.004 / 10	29 / 10	0.5 / 4	0.004 / 10	<0.01 / 10	0.012 / 10
<0.001 / 2	0.01 / 2	<0.0001 / 2	<0.005 / 2	<0.002 / 2	<0.1 / 2	0.08 / 3	<0.001 / 2	<0.01 / 2	<0.00001 / 2
<0.001 / 8	<0.005 / 8	<0.0001 / 8	<0.005 / 8	<0.002 / 8	25 / 6	0.04 / 3	<0.001 / 8	<0.01 / 8	0.00019 / 8
0.004 / 16	<0.005 / 16	<0.0001 / 16	<0.005 / 16	<0.002 / 16	42 / 13	0.9 / 2	0.004 / 16	<0.01 / 16	**0.052** / 16
<0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	<0.002 / 2	20 / 2	0.09 / 2	0.002 / 2	<0.01 / 2	0.0064 / 2
<0.001 / 8	<0.005 / 8	<0.0001 / 8	<0.005 / 8	<0.002 / 8	28 / 8	0.2 / 2	0.002 / 8	<0.01 / 8	0.010 / 8
<0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	<0.002 / 2	20 / 3	0.1 / 3	0.005 / 2	<0.01 / 2	0.0095 / 2
<0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	<0.002 / 2	50 / 2	0.1 / 4	0.002 / 2	<0.01 / 2	0.0066 / 2
<0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	<0.002 / 2	8 / 2	0.2 / 3	0.003 / 2	<0.01 / 2	0.0030 / 2
0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	<0.002 / 2	16 / 2	0.08 / 2	<0.001 / 2	<0.01 / 2	0.0036 / 2
<0.001 / 2	<0.005 / 2	<0.0001 / 2	<0.005 / 2	0.002 / 2	20 / 2	0.2 / 2	0.004 / 2	<0.01 / 2	0.0059 / 2
0.001 / 10	0.005 / 10	<0.0001 / 10	<0.005 / 10	<0.002 / 10	13 / 10	0.3 / 2	<0.001 / 10	<0.01 / 10	0.0073 / 10
0.001 / 12	<0.005 / 12	<0.0001 / 12	<0.005 / 12	<0.002 / 12	5 / 6	0.4 / 5	0.002 / 12	<0.01 / 12	0.016 / 12

Table 26 Aesthetic Parameters in Southern region communities 2019-20

	Aluminium	Chloride	Free Chlorine (Odour threshold)	Copper	Colour (True)	Hardness (as CaCO3)	Iron	Manganese	pH	Silica
ADWG	0.2	250	0.6	1	15	200	0.3	0.1	6.5-8.5	80
Units	mg/L	mg/L	mg/L	mg/L	CU	mg/L	mg/L	mg/L	pH unit	mg/L
Community	Aesthetic parameters – mean values									
Amoonguna*	0.06	73	**0.9**	0.05	2	191	0.2	0.04	7.40	17
No. Samples	3	3	24	3	3	3	3	3	3	3
Ampilatwatja	<0.02	165	**1.2**	0.03	<2	**482**	0.09	<0.005	8	34
No. Samples	2	2	30	2	2	2	2	2	2	2
Areyonga*	<0.02	120	**1.0**	<0.01	2	**472**	<0.02	<0.005	7.7	19
No. Samples	2	2	30	2	2	2	2	2	2	2
Atitjere*	<0.02	98	**1.1**	<0.01	<2	**252**	<0.02	<0.005	8.1	35
No. Samples	2	2	36	2	2	2	2	2	2	2
Engawala*	<0.02	125	**1.2**	<0.01	<2	**371**	<0.02	<0.005	7.8	66
No. Samples	2	2	33	2	2	2	2	2	2	2
Finke	<0.02	160	**1.2**	<0.01	3	**213**	0.07	<0.005	7.57	17
No. Samples	2	2	31	2	2	2	2	2	2	2
Haasts Bluff*	<0.02	**375**	**1.1**	<0.01	3	**595**	0.03	<0.005	7.8	40
No. Samples	2	2	36	2	2	2	2	2	2	2
Hermannsburg*	<0.02	115	**1.3**	<0.01	3	260	0.09	0.009	8.0	15
No. Samples	2	2	18	2	2	2	2	2	2	2
Imanpa	<0.02	**417**	**1.0**	<0.01	<2	**497**	0.04	0.008	8	24
No. Samples	10	10	33	10	10	10	10	10	10	10
Kaltukatjara	<0.02	88	**1.0**	<0.01	<2	**271**	0.07	0.008	7.9	12
No. Samples	2	2	34	2	2	2	2	2	2	2
Kintore	<0.02	40	**1.1**	<0.01	<2	78	<0.02	<0.005	7.5	**90**
No. Samples	8	6	22	8	6	4	8	8	5	4
Laramba	<0.02	110	**1.1**	<0.01	<2	**254**	<0.02	<0.005	7.6	**87**
No. Samples	16	13	33	16	13	13	16	16	13	13
Mt Liebig*	<0.02	125	**1.1**	<0.01	4	282	0.03	<0.005	7.7	46
No. Samples	2	2	36	2	2	2	2	2	2	2
Nyirripi	<0.02	98	**1.0**	<0.01	<2	**245**	<0.02	<0.005	8	**85**
No. Samples	8	8	24	8	8	8	8	8	8	8
Papunya*	<0.02	220	**1.1**	<0.01	3	259	<0.02	<0.005	8.1	59
No. Samples	2	2	36	2	2	2	2	2	2	2
Pmara Jutunta*	<0.02	69	**1.3**	<0.01	<2	207	<0.02	<0.005	7.9	92
No. Samples	2	2	36	2	2	2	2	2	2	2
Santa Teresa	<0.02	10	**1.2**	<0.01	<2	**233**	<0.02	<0.005	8	19
No. Samples	2	2	36	2	2	2	2	2	2	2
Titjikala	<0.02	31	**1.3**	0.01	3	**215**	<0.02	<0.005	8	34
No. Samples	2	2	15	2	2	2	2	2	2	2
Wallace Rockhole*	0.1	140	**1.1**	<0.01	3	281	0.06	<0.005	7.7	12
No. Samples	2	2	33	2	2	2	2	2	2	2
Yuelamu	<0.02	28	**1.1**	<0.01	<2	56	0.02	<0.005	8	78
No. Samples	10	10	33	10	10	10	10	10	10	10
Yuendumu	0.02	**273**	**1.1**	0.01	<2	**513**	0.05	<0.005	8	16
No. Samples	12	6	33	12	6	6	12	12	6	6

Numbers in bold letter exceed the guideline value.
* 2019 data used as no samples taken due to COVID-19 restrictions.

Sodium 180 mg/L	Sulfate 250 mg/L	TDS 600 mg/L	Turbidity 5 NTU	Zinc 3 mg/L	Alkalinity (as CaCO3) mg/L	Bromine mg/L	Calcium mg/L	Electrical conductivity µS/cm	Iodine (taste threshold) 0.15 mg/L	Potassium mg/L	tin mg/L
					Other parameters – mean values						
79.0	39.4	456	4.0	0.023	240	0.24	42.7	813	0.04	4.8	<0.01
3	3	3	3	3	3	3	3	3	3	3	3
118	180	**949**	0.5	0.02	290	0.9	105	1700	0.1	23	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
65.2	83.1	702	0.4	0.04	370	0.31	87.6	1250	0.06	7.0	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
88.4	94.7	606	0.8	<0.01	220	0.27	40.4	995	0.05	7.2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
67.5	40.5	697	0.6	0.05	330	0.42	67.9	1200	0.07	5.9	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
99	60	508	0.9	0.02	120	0.3	62	935	0.02	6	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
167.0	228.0	1205	0.4	0.02	230	0.79	116	2000	0.12	20.0	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
68.0	46.1	552	1.4	<0.01	230	0.34	51.3	950	0.06	5.7	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
227	244	**1369**	1	0.02	209	2	95	2380	**0.3**	29	<0.01
10	10	10	10	10	10	10	10	10	10	10	10
52	42	458	0.8	0.03	240	0.3	52	910	0.06	9	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
62	<0.3	315	0.4	<0.01	150	0.2	12.8	475	0.04	2	<0.01
4	4	6	6	8	6	8	4	6	8	4	8
98	33	**660**	0.4	0.05	293	0.4	51	1123	**0.2**	30	<0.01
13	13	13	13	16	13	16	13	13	16	13	16
100.0	92.0	**648**	0.5	<0.01	260	0.48	61.8	1100	0.10	11.8	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
87	20	597	0.6	<0.01	275	0.2	49	984	0.09	25	<0.01
8	8	8	8	8	8	8	8	8	8	8	8
230.0	63.5	**963**	0.2	<0.01	430	1.01	53.9	1600	0.13	11.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
62.4	27.9	525	0.2	<0.01	210	0.20	46.4	795	0.07	15.5	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
8	<0.3	269	0.3	<0.01	240	0.052	58.6	530	<0.01	3	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
34	6.3	321	1.1	0.02	220	0.125	61.7	585	0.02	3	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
96.7	55.7	569	4.0	0.045	230	0.20	66.6	1100	0.08	8.3	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
35	5	224	0.5	0.3	85	0.3	20	283	0.1	0.4	<0.01
10	10	10	10	10	10	10	10	10	10	10	10
128	109	**943**	0.8	0.1	302	1.1	108	1767	**0.2**	20	<0.01
6	6	6	6	12	6	12	6	6	12	6	12

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