Assessment of water security risks to self-supplied remote communities in South Australia

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Acknowledgement of Country

We acknowledge and respect the Traditional Custodians whose ancestral lands we live and work upon and we pay our respects to their Elders past and present.

We acknowledge and respect their deep spiritual connection and the relationship that Aboriginal and Torres Strait Islanders people have to Country.

We also pay our respects to the cultural authority of Aboriginal and Torres Strait Islander people and their nations in South Australia, as well as those across Australia.

Acknowledgements

We would like to thank Owen Love for his invaluable assistance in visiting remote communities to conduct interviews and collect information on water supply arrangements. We especially extend our heartfelt thanks to the remote community members who generously shared their time, knowledge and experience during the data collection process, improving our understanding of their water supply arrangements. Our appreciation also goes to the Outback Communities Authority (OCA), the South Australian Arid Lands Landscape Board, the Eyre Peninsula Landscape Board, SA Water and the Yartawarli Aboriginal Corporation Resource Agency for their valuable assistance in providing essential location information for remote communities. This report is a result of the collaborative efforts of these individuals and organisations, and we are thankful for their contributions.

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Summary

In South Australia, a number of remote communities independently manage their water supply, operating outside the oversight of third parties or the SA Water distribution network. These communities confront vulnerabilities relating to both the quantity and quality of water. Factors such as limited supply and supply diversity, poor water quality, compromised water delivery infrastructure and reliance on climate-dependent water sources contribute to these vulnerabilities.

The Department for Environment and Water has initiated the *Stocktake and Water Security Assessment for Self-Supplied Remote Communities* project to better understand the water supply arrangements and challenges of remote communities. This risk report supports the project by documenting the outcomes of interviews with remote communities regarding their water supply arrangements and concerns and by assessing water security risks for these communities over the next decade.

The data collection process involved visits to the identified in-scope remote communities and conducting semi-structured interviews with community members who understand their water supply arrangements. Physical and observational data, including water quality and infrastructure condition, were also gathered. These efforts informed the risk analysis for each community, which was conducted through workshops involving science and policy participants from the Department for Environment and Water.

The risk analysis employed consequence criteria reflecting potential impacts on community health and wellbeing arising from water supply interruptions or degraded water quality. Consequence severity was categorised based on direct human impacts, the proportion of the community impacted and the duration of impact.

The analysis indicates that 5 out of the 14 assessed communities face low water supply risks over the next 10 years. Two communities were evaluated as being at medium risk, while the remaining 7 communities were classified as high risk. Primary risk factors included insufficient or loss of water supply, water quality issues, infrastructure concerns and rising demand.

The risk assessment is consistent with the ISO 31000 risk management process. It acknowledges the uncertainties linked to climate variability, infrastructure resilience, incomplete evidence and population dynamics.

The findings presented in this report contribute to a better understanding of the complex water supply challenges faced by remote communities in South Australia. It provides an evidence base that can be used to design management strategies to ensure sustainable and resilient water supply systems for these communities into the future.

1 Introduction and context

1.1 Purpose and scope

In South Australia, a number of remote communities independently manage their water supply, operating outside the oversight of third parties or the SA Water distribution network. These communities confront vulnerabilities relating to both the quantity and quality of water. Factors such as limited supply and supply diversity, poor water quality, compromised water delivery infrastructure and reliance on climate-dependent water sources contribute to these vulnerabilities.

The in-scope remote communities considered in this report are depicted in Figure 1-1, noting that commercial camps/homesteads and individual properties have not been included.

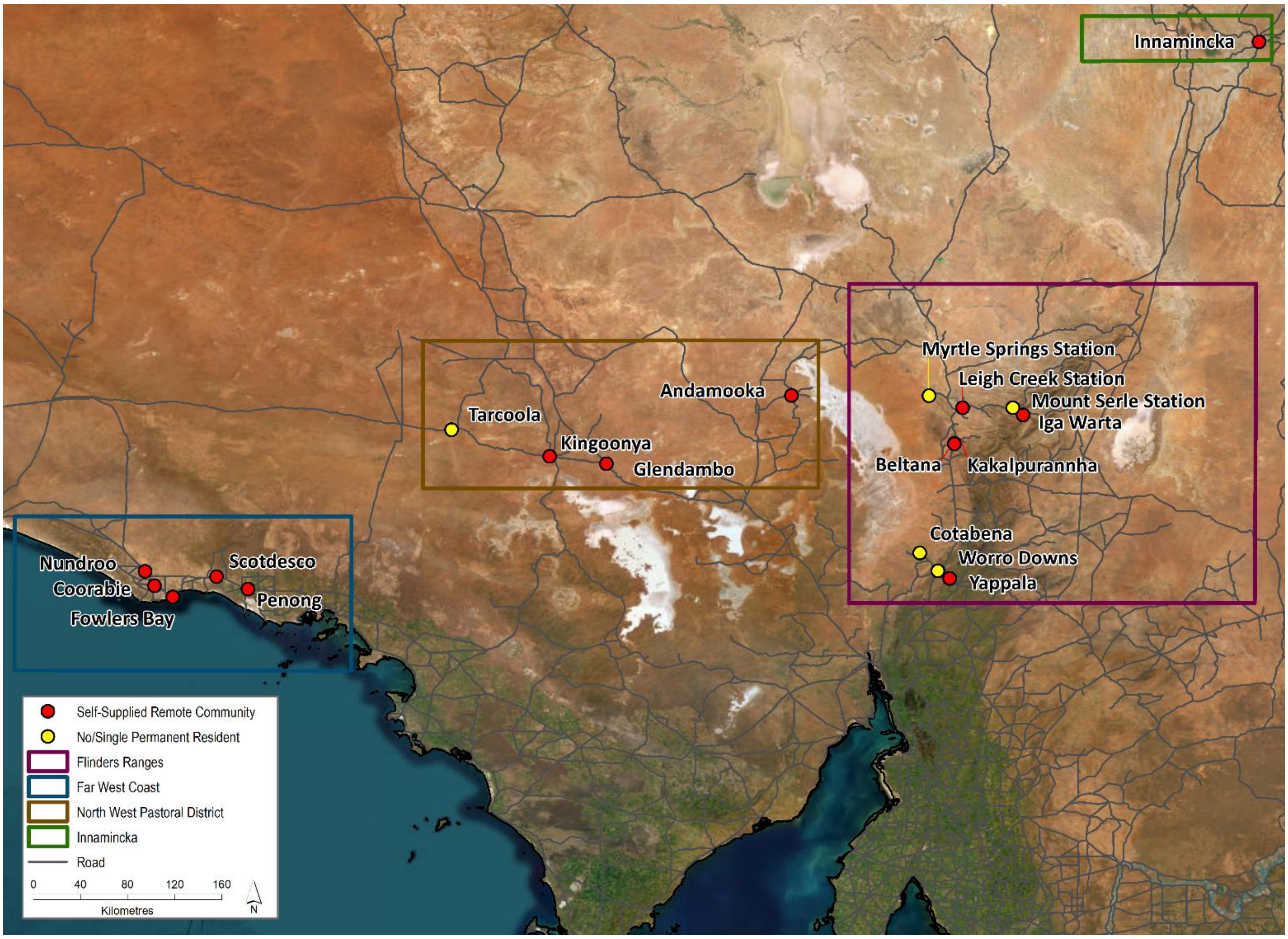

Figure 1-1: Identified self-water-supplied remote communities in South Australia (DEW 2024).

As these remote communities are responsible for their own water supply, there is limited knowledge regarding the implemented water supply arrangements and their reliance on them. Additionally, there is little understanding of the water supply challenges they currently experience or the emerging risks they may face in the future.

To address this lack of understanding on water supply arrangements and challenges, the Department for Environment and Water (DEW) implemented the *Stocktake and Water Security Assessment for Self-Supplied Remote Communities* project to better understand the water supply arrangements and challenges of the self-supplied remote communities identified in Figure 1-1.

The report presented here supports the *Stocktake and Water Security Assessment for Self-Supplied Remote Communities* project by documenting the results of in-scope remote-community interviews on current water supply arrangements and issues (Section 3.2), and using this information to conduct an assessment of water security risks to these communities over the next 10 years (Section 4).

1.2 Approach to risk assessment

South Australia has adopted a risk management framework for water planning and management (DEWNR 2012), which is based on the AS/NZS ISO 31000:2009 international standard. The risk management process is summarised as 3 steps (Figure 1-2), which are:

1. *Establishing context*, which involves determining the purpose, scope, principles, scales and criteria to be taken into account when managing risk
2. *Assessing risks,* involving:
    a. *risk identification,* whereby risks are identified, recognised and described
    b. *risk analysis,* which involves comprehending the risk and determining likelihood and consequence
    c. *risk evaluation,* to determine the tolerability of the risk and the need for treatment
3. *Risk treatment,* involving actions in response to the risk assessment (e.g. reducing risk, avoidance, transfer to another party, retain and accept).

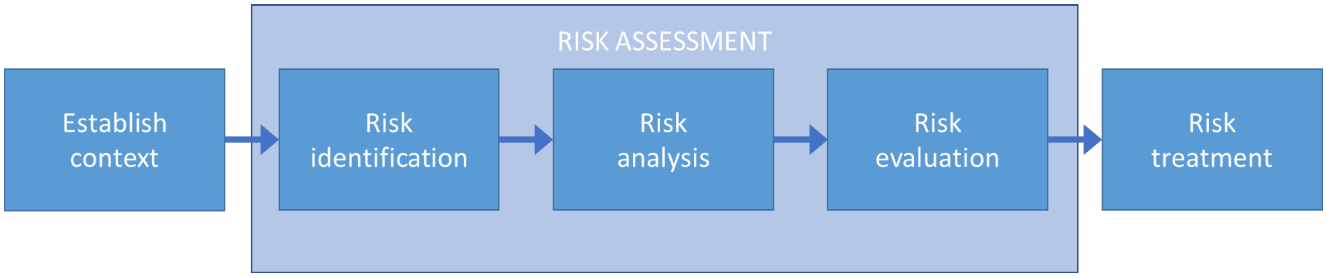

Figure 1-2: AS/NZS ISO 31000:2009 risk management process (after DEWNR, 2012)

This report covers the assessment of water supply risks for remote communities. It aims to identify and assess risks and inform risk treatment priorities to render the overall risk profile acceptable or tolerable. Discussion of potential treatments is outside the scope of this report and will be the focus of a separate assessment.

2 Risk identification

2.1 Pathway of risk

Consistent with AS/NZS ISO 31000:2009 international standard, DEW has previously adopted a simple 3-part model for describing water resource risks (e.g. DEW, 2019b). This is summarised below and in Table 2.1.

There is the potential that [RISK SOURCE] leads to [EVENT] which results in [CONSEQUENCE] where:

- a risk source is an element which alone, or in combination, has the intrinsic potential to give rise to risk
- an event is an occurrence or change of a particular set of circumstances
- a consequence is the outcome of an event affecting the objective of communities having a secure supply of suitable quality water.

For this context, an *EVENT* is defined as a reduction in the availability of water of suitable quality to a self-supplied remote community. The task of risk identification therefore involves determination of the *SOURCE* of risk that could cause events and the types of *CONSEQUENCE* that could eventuate.

RISK SOURCE considered in this assessment are:

- loss or reduction in water supply (rainfall, streamflow, groundwater)
- poor water quality (e.g. salinity, turbidity, calcium)
- failure of water delivery infrastructure (e.g. pipes, pumps, tanks)
- increased demand for available water (e.g. tourism, increasing community population).

Consistent with the purpose of this risk assessment, *CONSEQUENCE* has been assessed as an impact to human health, wellbeing and the proportion of the community that would be affected. Consequences include:

- loss of drinking or cooking water
- loss or restriction of personal washing and cleaning water
- health and wellbeing impact due to drinking, cooking or washing in poor quality water
- damage to cleaning or washing infrastructure.

Table 2.1: Elements of risk pathway

Element of risk pathway	Circumstance	Scope
Source of risk	Loss or reduction in water supply (rainfall, streamflow, groundwater). Poor water quality (e.g. salinity, turbidity, calcium). Failure of water delivery infrastructure (e.g. pipes, pumps, tanks). Increased demand for available water (e.g. tourism, increasing community population).	Limited to consideration of current water supply mechanisms.
Event	Reduction in availability of water of suitable quality to self-supplied remote community.	Precludes consideration of infrequent emergency actions to resupply water (e.g. water carting is not considered if it is not a regular '*business as usual*' mechanism of supplying water to the community).
Consequence	Loss of drinking or cooking water. Direct health impacts due to ingesting or washing in poor quality water. Loss of personal washing and cleaning water. Damage to cleaning or washing infrastructure.	Limited to impacts to current permanent residents. Does not consider the opportunity cost of supporting a larger population or new/increasing water-dependent business. Does not include consideration of water for tourists or stock (apart from flow-on impacts to permanent residents).

3 Risk analysis and evaluation

The purpose of risk analysis is to comprehend the nature of risk by assigning likelihood and consequence to the identified sources of risk.

3.1 Evidence collection

The collection of evidence to inform risk analysis involved visits to identified in-scope remote communities (Figure 1-1) and conducting semi-structured interviews with community members involved in the management of water supply. Note that information collected for the communities of Nundroo and Coorabie were collected at a single community meeting, and results have been reported together due to similarities of issues. The information collected is broadly summarised in Table 3.2. The interview data collection sheet is attached in Appendix A.

Where possible, physical and observational data was also collected from each community. This included:

- water quality (total dissolved solids, TDS)
- depth to water in groundwater wells
- visible damage to water supply infrastructure.

For reference, there is no specific national health limit for TDS as there are no health effects directly attributable to TDS. However, the Australian Drinking Water Guidelines link to the World Health Organization palatability guidelines as shown in Table 3.1.

Table 3.1: TDS palatability guidelines (NHMRC 2011)

TDS (mg/L or ppm)	Palatability
0–600	Good
600–900	Fair
900–1200	Poor
>1200	Unpalatable

Table 3.2: Community information collection

Data focus	Interview information gathered
Community	
Population	• Number of residents • Number of visitors • Long-term and short-term stability • Reasons for population change
Infrastructure	• Number of houses • Number and type of other buildings • Open space
Aspirations	• Community goals • Connection to Country (for First Nations communities)

Data focus	Interview information gathered
Water supply	
Rainwater	• Use and demand • Water storage and distribution infrastructure (tanks, pipes, pumps) • Infrastructure reticulation (supply to individuals or community) • Infrastructure condition • Storage capacity • Reliability of supply and water quality • Backup supply • Water quality
Groundwater	• Use and demand • Groundwater source (perched vs. regional aquifer) • Number of water supply bores • Water storage and distribution infrastructure (tanks, pipes, pumps) • Infrastructure reticulation (supply to individuals or community) • Infrastructure condition • Storage capacity • Reliability of supply and water quality • Backup supply • Water quality
Surface water	• Use and demand • Surface water source(s) • Water storage and distribution infrastructure (dams, tanks, pipes, pumps) • Infrastructure reticulation (supply to individuals or community) • Infrastructure condition • Storage capacity • Reliability of supply and water quality • Backup supply • Water quality
Other water sources (e.g. water carting; bottled water)	

3.1.1 Drinking/cooking vs. hygiene water

Many communities have diversified sources of water supply that often support different critical human water needs. This diversified supply of water results in varying levels of water supply security based on its use. To address this, risk related to drinking and cooking (Critical Need 1) and cleaning and washing (Critical Need 2) (Table 3.3) were assessed separately where they rely on different sources of water.

Table 3.3: Critical human water need categorisation

Critical human water need	Description
Critical need 1 (CN1)	Water that is to be ingested, either via drinking or cooking
Critical need 2 (CN2)	Water used for maintaining human hygiene and wellbeing, largely cleaning and washing

3.2 Results of community interviews

3.2.1 Iga Warta

Community overview	
Population	• 25 permanent residents • Tourism is significant, with facilities able to accommodate up to 75 visitors/night
Climate	• Annual average rainfall: ~250 mm (very variable)
Infrastructure	• 7 occupied houses • Iga Warta complex/café/shop, museum, toilet blocks, camping ground with cabins (inc. ensuite), fixed tents
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water supply/distribution not required to be licensed or registered under either Act
Drinking/cooking water source (CN1)	• Rainwater
Cleaning/washing water source (CN2)	• Groundwater

Context and evidence gathered through community interviews in Iga Warta is presented in Table 3.4.

Table 3.4: Context and water supply risk factors for Iga Warta

Water supply	Water quality	Infrastructure	Increasing demand
CN1: Rainwater • Captured and managed by individual residences. • Rainwater sometimes used as a backup when CN2 groundwater is not available. • Community has run out of rainwater multiple times in the past. **CN2: Groundwater** • Single bore (#6636-225) drilled in 1996 into a fractured rock aquifer. • SA Geodata drill records indicate bore drilled to 146 m, cased to 112 m. • Water level unknown. • Yield 1.6 L/sec when drilled. • Office for Local Government indicates that yield is now at 0.5 L/sec.	**CN1: Rainwater** • Majority of tanks are polycarbonate and enclosed. • Water is not filtered. • No history of water quality issues. **CN2: Groundwater** • The project recorded low TDS (723 mg/L) during community visit. • Community indicates that water is regularly contaminated with high levels of iron bacteria. • Community members occasionally suffer rashes due to showering (uncertain if cause is related to presence of high levels of iron bacteria). • Iron bacteria treated via chlorination.	**CN1: Rainwater** • Each house has one rainwater tank. • Rainwater tanks hold 20,000 L. • Infrastructure appears well maintained and in good condition. • Infrastructure is privately owned and managed by each household. **CN2: Groundwater** • Extracted from well via manually operated solar powered pump. • Pumped into 2 x 250,000 L header tanks. • Piped from header tanks to individual residences. • Visible calcification on header tanks. • Pumps and pipes have reduced lifespan due to high calcium loads.	• Stable permanent resident population. • Can accommodate up to 75 tourists/day. • Water for tourists is sourced and stored separately from community water. • Tourism water is sourced from rain runoff from tourist infrastructure (captured by tourist amenities block) held in 2x 20,000 L tanks.

Water supply	Water quality	Infrastructure	Increasing demand
• Groundwater supply has never been insufficient to meet community needs.	• Iron bacteria contamination and treatment time makes groundwater unusable for up to 3 weeks per incident. • High calcium levels reduce the lifespan of whitegoods by at least half.		

3.2.2 Leigh Creek Station

Community overview	
Population	• 20 permanent residents • No tourism
Climate	• Annual average rainfall: ~250 mm (very variable)
Infrastructure	• 3 houses, 1 large homestead • Multiple shearing and work sheds
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water supply/distribution not required to be licensed or registered under either Act
Drinking/cooking water source (CN1)	• Rainwater
Cleaning/washing water source (CN2)	• Groundwater

Context and evidence gathered through community interviews in Leigh Creek Station is presented in Table 3.5.

Table 3.5: Context and water supply risk factors for Leigh Creek Station

Water supply	Water quality	Infrastructure	Increasing demand
CN1: Rainwater • Captured and managed by individual residences. • Community do not feel secure with current level of rainwater supply and storage. • Community have run out of local rainwater several times in recent history. One incident resulted in the loss of CN1 water for 2 years. **CN2: Groundwater** • Supplied via 2 active bores.	**CN1: Rainwater** • Majority of tanks are polycarbonate and enclosed. • Water is not filtered. • No history of water quality issues. **CN2: Groundwater** • Visible calcification on water storage and distribution infrastructure. • Community must periodically replace or clean calcification from pipework.	**CN1: Rainwater** • Each house has one rainwater tank. • Rainwater tanks hold 10–20,000 L. • Infrastructure is privately owned and managed by each household. • Tank maintenance and condition are unknown. **CN2: Groundwater** • Extracted from Well 1 via solar-powered pump. • Extraction method from Well 2 is unknown.	• Stable permanent resident population. • No tourism. • Demand for water unlikely to change significantly.

Water supply	Water quality	Infrastructure	Increasing demand
• Well 1 (#6536-422): SA Geodata indicates bore drilled in 1983 to a depth of 64 m. Project recorded a depth to water of 5.2 m. Original yield 14 L/sec. Now low yielding and supply will cease if pumped at full capacity for >2 hrs. • Lowering pump may improve supply. • Well 2 (possibly #6536-3): Partially collapsed hand-excavated well. Project recorded a total depth of 5.4 m and a depth to water of 3.5 m. Historically supplied 'good' yields.	• Pumps have reduced lifespan due to high calcium levels. • Community has redundancy in wells, pumps and header tanks – reducing likelihood of loss of water to the community.	• Pumped into single 20,000 L poly holding tank. • Then pumped into 4 x 20,000 L header tanks. • Piped from header tank to individual residences. • Visible calcification on holding tank and pipe network. • History of calcium blocking pipe network. • Pumps and pipes have reduced lifespan due to high calcium loads.	

3.2.3 Kakalpurannha

Community overview	
Population	• 20 permanent residents • No tourism
Climate	• Annual average rainfall: ~250 mm (very variable)
Infrastructure	• 4 houses • Multiple sheds, playground, chicken coop
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water supply/distribution not required to be licensed or registered under either Act
Drinking/cooking water source (CN1)	• Rainwater
Cleaning/washing water source (CN2)	• Groundwater

Context and evidence gathered through community interviews in Kakalpurannha is presented in Table 3.6.

Table 3.6: Context and water supply risk factors for Kakalpurannha

Water supply	Water quality	Infrastructure	Increasing demand
CN1: Rainwater • Captured and managed by individual residences. • No history of water loss. **CN2: Groundwater**	**CN1: Rainwater** • Majority of tanks are polycarbonate and enclosed. • Water is not filtered. • No history of water quality issues.	**CN1: Rainwater** • Each house has one rainwater tank. • Rainwater tanks hold 20,000 L.	• Stable permanent resident population. • No tourism. • Demand for water unlikely to change significantly.

Water supply	Water quality	Infrastructure	Increasing demand
• Supplied via 2 active bores. • Well 1 (#6536-4427): SA Geodata indicates bore drilled in 2020 to a depth of 12.5 m. Project recorded a depth to water of 6.29 m. Original yield 0.65 L/sec. Now low yielding. • Well 2 (not recorded in SA Geodata): Depth to water 5.97 m. Other characteristics unknown. • No reported history of supply issues.	**CN2: Groundwater** • Project recorded a TDS of 1,527 mg/L. • High calcium levels damage pumps and pipes and reduce the lifespan of whitegoods by at least half.	• Infrastructure is privately owned and managed by each household. • Tanks appear to be well maintained and in good condition. **CN2: Groundwater** • Extracted from wells via solar pumps. • Piped into 2 galvanised 90,000 L header tanks. • Piped from header tanks into individual houses. • Visible calcification and rust on header tanks. • Pumps and pipes have reduced lifespan due to high calcium loads.	

3.2.4 Beltana

Community overview	
Population	• 25–30 permanent residents • Additional ~35 non-permanent residents during school holidays and long weekends • Some tourism via the campground
Climate	• Annual average rainfall: ~230 mm (very variable)
Infrastructure	• 23 houses • Community hall, park, campground, church, pub (not currently open)
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water supply/distribution not required to be licensed or registered under either Act
Drinking/cooking water source (CN1)	• Rainwater
Cleaning/washing water source (CN2)	• Rainwater (all residents) • Groundwater (2/3 of residents) o Rainwater used as backup

Context and evidence gathered through a phone interview is presented in Table 3.7.

Table 3.7: Context and water supply risk factors for Beltana

<table>
<tr><th>Water supply</th><th>Water quality</th><th>Infrastructure</th><th>Increasing demand</th></tr>
<tr>
<td>CN1: Rainwater
Captured and managed by individual residences.
Rainwater tanks fill in most years.
Water levels get low but rarely completely run out.
Rainwater levels got very low during Millennium Drought (2001-2009).
Individuals ran out of water in 2019.
OCA has installed a portable desalination plant for tourists to purchase water, but residents do not use this.
CN2: Rainwater and groundwater
As for CN1 for rainwater supply.
2/3 of residents have access to groundwater through individual shallow bores (bore IDs unknown), and other residents use rainwater.
Groundwater supply is variable across residences.
Rainwater is used as a backup when needed.
Access to CN2 water got very low in Millennium Drought (2001–2009).
Individuals ran out of water in 2019 (mix of rainwater and shallow groundwater).</td>
<td>CN1: Rainwater
Tanks are enclosed.
Water is not filtered.
No history of water quality issues.
CN2: Rainwater and groundwater
Rainwater has good quality.
Salinity of groundwater unknown but residents report that it 'tastes salty.'
Groundwater has high calcium loads.
Lifespan of whitegoods, hot water services and toilets are reduced by at least half due to high calcium levels in groundwater.</td>
<td>CN1: Rainwater
Infrastructure is privately owned and managed by each household.
Tanks are galvanised due to heritage listing.
Most tanks appear to be in poor condition due to age and rust (~60% need replacing).
Replacing tanks takes ~3 months.
CN2: Rainwater and groundwater
As for CN1 for rainwater infrastructure.
Groundwater storage tanks also in poor condition, with ~40% needing replacing.
Groundwater pumps, pipes and tanks have reduced lifespan due to calcification.
Not uncommon for pumps and tanks to fail.
Takes ~1 week for new pump to be delivered and installed.</td>
<td>Demand on an annual basis is relatively stable.
Stable permanent resident population.
Population regularly doubles during school holidays and long weekends.
Visitors and those staying at the campground supply their own water or buy water from an OCA desalination plant.</td>
</tr>
</table>

3.2.5 Yappala

Community overview	
Population	• 30 permanent residents • Population regularly increases to 60 for family gatherings • No tourism
Climate	• Annual average rainfall: ~250 mm (very variable)
Infrastructure	• 9 houses • Conference building, multiple sheds
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water supply/distribution not required to be licensed under the *Water industry Act 2012*, but may need to be registered under the *Safe Drinking Water Act 2011* due to reticulation of drinking water
Drinking/cooking water source (CN1)	• Rainwater
Cleaning/washing water source (CN2)	• Groundwater

Context and evidence gathered through community interviews in Yappala is presented in Table 3.8.

Table 3.8: Context and water supply risk factors for Yappala

Water supply	Water quality	Infrastructure	Increasing demand
CN1: Rainwater • Captured and managed by individual residences. • Community has run out of water multiple times in recent history (most recently in 2022). **CN2: Groundwater** • Supplied via single bore (#6534-204). • SA Geodata indicates bore originally drilled to 70 m, and a depth to water of 63 m. • Current water level is unknown. Community advise that yield is 'low.' • Supply sometimes struggles to keep up with demand. • History of community-imposed water restrictions.	**CN1: Rainwater** • Majority of tanks are polycarbonate and enclosed. • Water is not filtered. • No history of water quality issues. **CN2: Groundwater** • The project recorded TDS of 1,922 mg/L during community visit. • High calcium levels damage pumps and taps and reduce the lifespan of whitegoods by at least half.	**CN1: Rainwater** • Most houses have a single rainwater tank. • Conference centre and sheds have rainwater tanks. • Total of approximately 16 polycarbonate rainwater tanks across the community. • Rainwater tanks hold 5–10,000 L. • Tanks are reticulated across the community, with water able to be pumped/transferred between storages. • Tanks are privately owned and managed by each household. • Tanks appear to be well maintained and in good condition. • Pipework between tanks is owned and managed by the community. • Buried pipework is not mapped and is occasionally damaged through excavation.	• Relatively stable permanent resident population. • Occasionally doubles during family gatherings. • Increased demand has contributed to loss of both rainwater and groundwater. • No current tourism. • BHP currently working with the Yappala community to build an art gallery, which will increase tourism. • Water supply for this increased demand is uncertain, but likely to involve runoff from new art gallery facilities.

Water supply	Water quality	Infrastructure	Increasing demand
		CN2: Groundwater • Single bore pumps into 3 header tanks. • Water from header tanks is piped via gravity 2.5 km into individual houses. • Pumps and taps have reduced lifespan due to high calcium loads. • Condition of header tank is unknown. • Some pipework is above ground, reducing lifespan [NOTE: Groundwater pipework is separate from rainwater pipework]. • Buried pipework is not mapped and is occasionally damaged through excavation.	

3.2.6 Penong

Community overview	
Population	• ~170 permanent residents • Population slightly increasing • Significant and increasing transient tourism, mostly to visit the beach
Climate	• Annual average rainfall: ~300 mm
Infrastructure	• 50–60 houses • Hotel, caravan park, general store, service station, school, community hall, surf board factory, footy club rooms • Open space: Footy oval
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water supply/distribution not required to be licensed or registered under either Act
Drinking/cooking water source (CN1)	• Rainwater
Cleaning/washing water source (CN2)	• Mostly rainwater • Very small number of houses have groundwater bores

Context and evidence gathered through community interviews in Penong is presented in Table 3.9.

Table 3.9: Context and water supply risk factors for Penong

Water supply	Water quality	Infrastructure	Increasing demand
• Rainwater: CN1 & CN2 (a small number of houses use groundwater to support CN2). • On average, rainwater storage tanks are full at the end of winter. • On average, storage tanks are half-full at the end of summer. • Community advises it is very rare to run out of rainwater. Any water shortages are restricted to individual residences.	• Tanks are polycarbonate and enclosed. • Water is not filtered (except for the primary school). • No history of water quality issues.	• Majority of dwellings have 2 large rainwater tanks. • Average total storage per household: 50,000 L. • Rainwater infrastructure is well maintained and in good condition. • Rainwater infrastructure is privately owned and managed by each household. • Football oval has 416,000 L rainwater storage capacity for oval irrigation and water for firefighting.	• Permanent residents: slightly increasing due to subdivision. • Tourism visitation is significant and increasing. • Tourists generally supply own water.

3.2.7 Fowlers Bay

Community overview	
Population	• ~22 permanent residents • Permanent population fluctuates throughout the year, reaching a peak of ~40 • Significant transient tourism of 9,000/year (July to Sept) • Transient tourism trend increasing
Climate	• Annual average rainfall: ~300 mm
Infrastructure	• 34 houses • Town hall, caravan park, public toilet block
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water supply/distribution not required to be licensed or registered under either Act
Drinking/cooking water source (CN1)	• Rainwater
Cleaning/washing water source (CN2)	• Mostly rainwater • Caravan park and small number of residents use shallow groundwater

Context and evidence gathered through community interviews in Fowlers Bay is presented in Table 3.10.

Table 3.10: Context and water supply risk factors for Fowlers Bay

Water supply	Water quality	Infrastructure	Increasing demand
• Mostly rainwater (CN1 and CN2). • Caravan Park and small number of residents use shallow groundwater for washing and cleaning (CN2). • No recorded history of groundwater supply issues. • On average, rainwater storage tanks are full at the end of winter. • On average, water storages are 2/3 full at end of summer. • Residents have never run out of rainwater. • Caravan park ran out of rainwater in early years of operation. Have not run out in recent years due to experience in managing water.	• Tanks are polycarbonate and enclosed. • Water is not filtered. • No history of rainwater quality issues. • Occasional issues with turbidity, tannins and animal deaths in shallow groundwater. • Residents use rainwater as backup when groundwater water quality is unsuitable.	• Majority of dwellings have 2 large rainwater tanks. • Average total storage per household: 38,000 L. • Infrastructure is well maintained and in good condition. • Caravan Park groundwater pump has failed in the past and took 3 weeks to replace. • Caravan park now replaces groundwater pumps every 2 years as part of its maintenance schedule. • Infrastructure is privately owned and managed by each residence (inc. caravan park). • Community hall collects ~80,000 L of rainwater in polycarbonate tanks for firefighting and to top up individuals' rainwater tanks when required.	• Stable permanent resident population. • Tourism visitation is significant (~9,000/year). • Tourists generally provide their own water. • Caravan park provides both CN1 and CN2 water for their customers. • Water supply to caravan park visitors is sufficient to meet changing seasonal demand.

3.2.8 Nundroo and Coorabie

Community overview	
Population	• 30–40 permanent residents • Minimal tourism
Climate	• Annual average rainfall: ~300 mm
Infrastructure	• ~30 houses • Roadhouse, mechanic, farmhouse accommodation, town hall
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water supply/distribution not required to be licensed or registered under either Act
Drinking/cooking water source (CN1)	• Rainwater
Cleaning/washing water source (CN2)	• Rainwater • Groundwater (only for a small number of households)

Context and evidence gathered through community interviews in Nundroo and Coorabie is presented in Table 3.11.

Table 3.11: Context and water supply risk factors for Nundroo and Coorabie

Water supply	Water quality	Infrastructure	Increasing demand
• Rainwater (CN1 and CN2). • Small number of households supplement CN2 water with groundwater from personal shallow bores. • On average, rainwater storage tanks are full at the end of winter. • Tanks still have 'pretty good storage' at the end of summer. • Residents rarely run out of rainwater. • Residents cart water in when necessary. • Resupply from carting takes <1 day.	• Tanks are polycarbonate and enclosed. • Water is not filtered. • No history of water quality issues.	• Majority of dwellings have multiple rainwater tanks. • Average total storage per household is 75,000-115,000 L. • Infrastructure is well maintained and in good condition. • Infrastructure is privately owned and managed by each household.	• Stable permanent resident population. • Water demand due to tourism is minimal.

3.2.9 Scotdesco

Community overview	
Population	• 16 houses • ~50 permanent residents • Residents increase on weekends and school holidays • Up to 50 tourists/day
Climate	• Annual average rainfall: ~300 mm
Infrastructure	• Tourist accommodation, conference facility, multiple sheds, sheeted catchment
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water supply/distribution not required to be licensed under the *Water industry Act 2012*, but may need to be registered under the *Safe Drinking Water Act 2011* due to reticulation of drinking water
Drinking/cooking water source (CN1)	• Rainwater
Cleaning/washing water source (CN2)	• Rainwater

Context and evidence gathered through community interviews in Scotdesco is presented in Table 3.12.

Table 3.12: Context and water supply risk factors for Scotdesco

Water supply	Water quality	Infrastructure	Increasing demand
• Rainwater (CN1 and CN2). • Community ran out of water in 2019. • Community experienced a number of self-imposed water restrictions prior to 2019.	• Majority of tanks are polycarbonate and enclosed. • Water is not filtered. • The community regularly report the presence of *E. coli* in rainwater tanks across the community. • Sickness due to *E. coli* has been reported across the community. • Bladder dam is enclosed. • Water in bladder dam is chlorinated.	• All dwellings have 3 rainwater tanks (~20,000 L each). • Two tanks collect and store roof runoff. • One tank connects to a community bladder dam (1.5 ML) that captures water via a sheeted catchment. • Water from the bladder dam is pumped to individual residences. • Infrastructure is maintained by the Scotdesco Corporation. • Rainwater tank infrastructure appears to be in good condition. • Bladder dam is showing signs of wear, with some surface tearing apparent.	• Stable permanent resident population. • Up to 50 tourists/day. • Water for tourists is sourced and stored separately from community water. • Tourism water is sourced from rain runoff from tourist infrastructure (hall and accommodation).

3.2.10 Kingoonya

Community overview	

Population	• 12 permanent residents
	• Tourism significant and increasing
	  ○ April to October: 100–120/week
	  ○ October to March: 20/week

Climate	• Annual average rainfall: ~150 mm (very variable)
Infrastructure	• 7–9 occupied houses • Town hall (condemned), pub, caravan park, medical centre
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water supply/distribution not required to be licensed or registered under either Act
Drinking/cooking water source (CN1)	• Rainwater
Cleaning/washing water source (CN2)	• Groundwater

Context and evidence gathered through community interviews in Kingoonya is presented in Table 3.13.

Table 3.13: Context and water supply risk factors for Kingoonya

Water supply	Water quality	Infrastructure	Increasing demand
CN1: Rainwater • Captured and managed by individual residences. • Rainwater storage can get very low during periods of low rainfall. • Community does not feel that current rainwater supply and storage is secure. • Could capture significantly more rainfall with more tanks (not all roof space captures rainfall). **CN2: Groundwater** • Supply from existing town-owned bore is insufficient to supply town. • Groundwater supply is via a bore owned and operated by Northwell Station (bore ID unknown). • Northwell Station bore is situated adjacent to the town water supply bore. • Supply from Northwell Station bore is currently sufficient to meet the town's CN2 water needs. • There is no formal agreement for the supply of water from Northwell Station. • Water in source aquifer is very responsive to local rainfall.	**CN1: Rainwater** • Majority of tanks are polycarbonate and enclosed. • Water is not filtered. • No history of water quality issues. **CN2: Groundwater** • Salinity is variable and is fresher after significant rainfall events. • Community records indicate that salinity has been steadily increasing from 550 mg/L in 2017 to 1,550 mg/L in 2022. • High calcium levels reduce the lifespan of whitegoods by at least half.	**CN1: Rainwater** • Most houses have 1-2 rainwater tanks. • Some tanks are older and in need of repair. • Average storage: 10,000–20,000 L per house. • There is additional rainwater capture capacity at the medical centre and the town hall. **CN2: Groundwater** • Well and pumping infrastructure is owned by Northwell Station (Note: there is no formal agreement on the use of this infrastructure). • Groundwater pumped 3.5 km into town header tank (110,000 L). • Pipe from bore to header tank is new. • Fiberglass header tank is old (age unknown) but appears in good condition. • Groundwater is pumped from header tank to individual residences.	• Stable permanent resident population. • Tourism significant and increasing. • Pub and caravan park supply drinking water for clients. • Tourists advised to provide own water for larger events. • OCA sells drinking water to tourists via a small desalination plant. • Desalination plant sources water from the town groundwater supply.

3.2.11 Glendambo

Community overview	
Population	• 3 permanent residents • 15–20 non-permanent residents (operating businesses; number is higher in peak tourism season) • Many transient tourists stay as a stopover while travelling north/south
Climate	• Annual average rainfall: ~173 mm (very variable)
Infrastructure	• Permanent residents in 2 occupied houses • Pub (including pool), 2x service stations, caravan park
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Glendambo and District Progress Association Inc. has exemption from the *Water Industry Act 2012* in relation to the retailing of water services • Not required to be registered under the *Safe Drinking Water Act 2011*

Drinking/cooking water source (CN1)	• Resident
	  o Rainwater
	• Businesses
	  o Desalinated groundwater

Cleaning/washing water source (CN2)	• Resident
	  o Groundwater: bathroom, shower, hot water, toilet
	  o Rainwater: dish washing, house cleaning, air conditioning
	• Businesses
	  o Use desalinated groundwater for everything

Context and evidence gathered through community interviews in Glendambo is presented in Table 3.14.

Table 3.14: Context and water supply risk factors for Glendambo

Water supply	Water quality	Infrastructure	Increasing demand
CN1: Rainwater • Captured and managed by individual residences. • Tanks fill every year. • Lowest level recorded in past 15 years is 1/3 full. **CN2: Groundwater** • Groundwater supply managed and retailed by the Glendambo Progress Association • Progress association have an exemption to retail water under the *Water Industry Act 2012*. • Supply from 2 bores: Eastbore (#6036-161) and Northbore (#6036-239).	**CN1: Rainwater** • Majority of tanks are polycarbonate and enclosed. • Water is not filtered. • No history of water quality issues. **CN2: Groundwater** • Salinity is variable and is fresher after significant rainfall events. • The project recorded a TDS of 2,903 mg/L in Eastbore at the time of visitation. • Residents recorded a TDS of 2,100 mg/L in Northbore in October 2023.	**CN1: Rainwater** • 1-2 rainwater tank per residence. • Total storage ~22,000 L per household. • Infrastructure appears well maintained and in good condition. • Infrastructure is privately owned and managed by each household. **CN2: Groundwater** • Infrastructure is managed by Glendambo Progress Association. • Supply from 2 bores (Eastbore and Northbore).	• Stable permanent resident population. • Tourism/transient population is significant due to Glendambo being a stopover point for tourists travelling through the outback. • Caravan park supplies clients with desalinated groundwater. • No records of groundwater supply being unable to meet tourism visitor demand.

Water supply	Water quality	Infrastructure	Increasing demand
• Northbore collapsed in January 2022 floods but has recently been rehabilitated. • Community advises that the rehabilitated Northbore has a yield of 1.6 L/s. • Eastbore was drilled in 1986 to a depth of 15 m, a depth to water of 11 m, and a yield of 0.83 L/s. • Community advises that supply from Eastbore declines during extended dry periods but appears to recover quickly after rainfall events. • Supply has never been insufficient to meet needs.	• Groundwater is sourced from an unconfined aquifer 400 m from the township. • Previous testing of aquifers in the region have found groundwater in Glendambo to be chemically and microbiologically non-potable (Willis *et al*, 2015). o NOTE: Groundwater is not used as potable water. • Water quality is suitable and within guidelines for domestic non-potable uses (washing, cleaning). • Businesses treat groundwater via desalination.	• Backup groundwater pump stored in town. • Groundwater pumped into 2 new 75,000 L header tanks. • Groundwater pumped 1.7 km into town from header tanks.	

3.2.12 Andamooka

Community overview	
Population	• ~260 permanent residents (peak in recent times has been ~2,500) • Town does encourage and support tourism
Climate	• Annual average rainfall: ~190 mm (very variable)
Infrastructure	• 200–250 occupied households (out of 900 available blocks of land) • Kiosk/café, school, liquor shop, motel, caravan park, medical clinic, mechanic, recreation hall, observatory, church, town management committee office
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Exempt from *Safe Drinking Water Act 2011* as OCA on-sell from BHP Olympic Dam Corporation Pty Ltd who are a registered provider o Water carters are registered Water Carters of Safe Drinking Water • Exempt from *Water Industry Act 2012* as potable water is carted and not reticulated to individual residences
Drinking/cooking water source (CN1)	• Rainwater • Groundwater (desalinated from Olympic Dam)
Cleaning/washing water source (CN2)	• Rainwater • Groundwater (desalinated from Olympic Dam)

Context and evidence gathered through community interviews in Andamooka is presented in Table 3.15.

Table 3.15: Context and water supply risk factors for Andamooka

Water supply	Water quality	Infrastructure	Increasing demand
CN1: Rainwater • Captured and managed by individual residences. • Capture and storage varies across residences. **CN2: Groundwater** • Sourced from the Great Artesian Basin. • Desalinated and piped 25 km from Olympic Dam. • Supply managed by the OCA through an agreement between Olympic Dam, OCA and the Andamooka Progress and Opal Miners Association. • Supply has never been insufficient to meet needs.	**CN1: Rainwater** • Majority of tanks are polycarbonate and enclosed. • Water is not filtered. • No history of water quality issues. **CN2: Groundwater** • Groundwater is desalinated. • Water quality is regularly tested. • No history of water quality issues.	**CN1: Rainwater** • Variable number and storage volume of tanks across residences. • Infrastructure appears well maintained and in good condition. • Infrastructure is privately owned and managed by each household. **CN2: Groundwater** • Olympic Dam owns and manages source wells that take water from the Great Artesian Basin. • Water piped 25 km from Olympic Dam into 2 header tanks (200,000 L each). • Groundwater from header tanks piped ~2 km to stand pipe in Andamooka. • Residents purchase water from standpipe. • OCA actively manages infrastructure between Olympic Dam and Andamooka standpipe. • Infrastructure management (repair/replacement) funded through the purchase of water.	• Permanent resident population stable or slightly decreasing. • Tourism does increase demand for water. • Supply of desalinated water from Olympic Dam is well able to meet demand.

3.2.13 Innamincka

Community overview	
Population	• 14 permanent residents (increases to ~36 in peak tourist season) • Tourism is significant (~1,500 tourists/week in peak season)
Climate	• Annual average rainfall: ~178 mm (very variable)
Infrastructure	• 6 occupied houses • Pub; trading post; Royal Flying Doctor clinic; homestay accommodation; DEW accommodation, offices and sheds; OCA public showers and toilets
Water governance • *Water Industry Act 2012* • *Safe Drinking Water Act 2011*	• Water distribution not required to be licensed under *Water Industry Act 2012* • Innamincka Hotel is a registered drinking water provider under *Safe Drinking Water Act 2011* • Supply from surface (Cooper Creek) and groundwater managed by Innamincka Progress Association.

Drinking/cooking water source (CN1)	• Surface water (Cooper Creek) and groundwater
	  o Both stored in same header tanks
	• Rainwater
	  o Used as a backup for when surface and groundwater are insufficient

Cleaning/washing water source (CN2)	• Surface water (Cooper Creek) and groundwater
	  o Both stored in same header tanks
	• Rainwater
	  o Used as a backup for when surface and groundwater are insufficient

Context and evidence gathered through community interviews in Innamincka is presented in Table 3.16.

Table 3.16: Context and water supply risk factors for Innamincka

Water supply	Water quality	Infrastructure	Increasing demand
CN1 and CN2: Surface water • Pumped from Cooper Creek into town header tanks. • Reliability depends on flow. • Supply ran out in 2016 and 2018. **CN1 and CN2: Groundwater** • Sourced from bore #7042-83 in unconfined aquifer adjacent to Cooper Creek. • SA Geodata shows bore was drilled in 2008 to a depth of 60 m, had depth to water of 22 m, and a yield of 2.5 L/s.	**CN1 and CN2: Surface water** • The project recorded low TDS (70 mg/L) from the source Cooper Creek during community visit. • High turbidity. • Filtered at each residence prior to use. • History of blue-green algae outbreaks during periods of low flow which prevents its use. **CN1 and CN2: Groundwater** • The project recorded low TDS (250 mg/L) during community visit. • Filtered at each residence prior to use.	**CN1 and CN2: Surface and groundwater storage** • Both pumped and stored in 3 town header tanks. • Total header tank storage volume is ~700,000 L. • Water from header tanks is piped to individual residences where it is filtered prior to use. **CN1 and CN2: Surface water** • Pumped from Cooper Creek. • Solar pump placed 3 m into the river and piped 8 km to the township.	• Permanent resident population fluctuates between 14 and 36. Increase is during peak tourism season. • Tourism is significant (~1,500 tourists/week in peak season). • Current (working) supply is able to meet this demand.

Water supply	Water quality	Infrastructure	Increasing demand
• Groundwater supply historically ran dry when pump was at 40 m. • Pump lowered to 52 m in 2021 and supply has been steady ever since. • Community advised that groundwater yield is now 2.1 L/sec. **CN1 and CN2: Rainwater** • Captured and managed by individual residences. • Rainwater largely used as a backup after surface and groundwater becomes insufficient. • Community has run out of rainwater in the past, but it is rare.	• No history of water quality issues. **CN1 and CN2: Rainwater** • Majority of tanks are polycarbonate and enclosed. • Water is not filtered. • Pub chlorinates its rainwater. • No history of water quality issues.	• Pump has failed 3 times in past 3 years due to high turbidity. • Pumps takes up to 6 weeks to repair/replace. • Pump repaired under warranty. **CN1 and CN2: Groundwater** • Solar pumped and piped from town groundwater bore to town header tanks. • No history of infrastructure issues. **CN1: Rainwater** • Variable number and storage volume of tanks across residences. • Infrastructure appears well maintained and in good condition. • Infrastructure is privately owned and managed by each household. • Hotel has 160,000 L storage capacity across multiple tanks. • Trading post has 50-75,000 L across multiple tanks.	

3.3 Analysis of risk

Evidence collected during site visits (Section 3.2) was used to inform the analysis of risk for each of the identified in-scope remote communities (Section 4). The analysis was undertaken through a series of workshops with science and policy participants from within DEW.

Participants made judgements about the level of risk by assigning likelihood of consequences based on the evidence collected during visits to each remote community.

The analysis precluded any consideration of infrequent emergency actions to resupply water (e.g. water carting is not considered if it is not a regular 'business as usual' mechanism of supplying water to the community).

The results of the risk analysis were sent to each visited remote community to check the data collected and the results of the risk assessment to ensure accurate representation of their water supply situation.

3.4 Consequence criteria

The consequence criteria established for this assessment were designed to reflect the potential impacts on community health and wellbeing arising from interruptions to water supply as a result of the sources of risk established for this assessment (Section 2.1). The criteria consider 2 key parameters related to domestic use of water including 1) potable water for drinking and cooking, and 2) water available for other hygiene domestic uses such as washing, cleaning and toilet flushing (see Section 3.1.1).

As well as these 2 parameters related to direct human impacts, the criteria consider the potential for damage to domestic appliances caused by poor water quality, such as calcium damage to showers, toilets or washing machines. These criteria were informed through verbal information collected during community interviews on the lifespan of white goods.

Consistent with the risk frameworks established by DEWNR (2012), this assessment defines 5 levels of consequence severity from insignificant through to very high (Table 3.17). Criteria for consequence severity are based on impacts that occur as a result of interruptions to water supply or degraded water quality.

The 5 levels of consequence criteria are framed such that they describe all the potential outcomes for communities, from insignificant through to very high, that could occur over the assessment period of 10 years (2023 to 2032). The assessment is made on the basis that one of these 5 outcomes will be observed over this timeframe. However, in many cases it may be impossible to say with certainty which outcome will occur *a priori*. Therefore, as per established risk frameworks, the analysis involves establishing the likelihood of consequences based on available evidence and knowledge. Given this framing, the role of the assessment panel was to consider the evidence, exercise judgement, and provide justification on the plausible combination of likelihood and consequence that leads to the highest level of risk for each of the remote communities.

Specific consequence criteria were developed by the DEW project team, with membership having expertise in both Science and Policy. As there are currently no water security standards for South Australia, the development of consequence criteria (outlined in Table 3.17), were guided by the South Australian Council of Social Service (SACOSS) Policy Brief, *Improving water security in regional and remote South Australia* (SACOSS 2021). The brief states that policy should be developed for South Australia that outlines a base level of safe and reliable water services that considers 'drinking water security of supply, quality, governance and service delivery arrangements and costs.' The scope of this project is focused on 'self-supplied' remote communities, hence *governance and service delivery arrangements and costs* criteria were not considered further for inclusion in the consequence criteria, as water supply is self-governed by each community.

Drinking and cooking water consequence (CN1)

Consistent with the SACOSS Policy Brief, consequence severity criteria for security of supply of suitable quality drinking water were developed based on either 1) lack of water supply, or 2) poor water quality. Consequence severity was assessed according to 1) the proportion of the community impacted, and 2) the duration of that impact should supply run out, or water quality become unsuitable.

Consequence severity where only an individual household is impacted was rated lower than where the broader community is impacted. Similarly, consequence severity was rated higher where supply interruptions are longer, and lower consequence severity was assigned to shorter interruptions. Further rationale for consequence criteria are shown in Table 3.17.

Washing and cleaning water consequence (CN2)

Despite not being mentioned in the SACOSS Policy Brief, consideration of water used for washing and cleaning was included as part of the risk assessment. These consequence criteria were included as a result of preliminary conversations with communities that indicated the need to assess the social and hygiene consequences of inadequate washing or cleaning water as a critical water need. Note that many communities rely on separate sources of water based on use – rainwater is almost universally used for potable water (CN1), and groundwater is most often used for washing and cleaning (CN2). The reliability of supply for CN1 vs. CN2 water needs may therefore be different based on sources of water.

As for drinking and cooking water, consequence severity criteria were developed based on either 1) lack of water supply, or 2) poor water quality, and modified according to 1) the proportion of the community impacted, and 2) the duration of that impact. A third consequence modifier was introduced, which assesses the severity of water restriction of access to washing and cleaning water.

Two levels of water restriction were defined for this assessment:

Level 1: Water efficiency measures put in place. Shorter showers. Limited flushing of toilet. No significant impact to quality of life.

Level 2: Daily showers prohibited. Washing house, cleaning car, watering garden prohibited. Hygiene impacted. Quality of life severely affected.

Table 3.17: Consequence criteria

Level	ID	Criteria	Rationale
Very high	VH.1	Any single incident of CN1 water loss at the community level that lasts for >3 days.	This duration of potable water loss is likely to be due to infrastructure failure. Community interviews indicated that most supply infrastructure failures can be repaired within 3 days. Loss of potable (CN1) water beyond this timeframe is unacceptable.
	VH.2	Any single incident of Level 2 restrictions of CN2 water for a period >3 months.	Three months of highly restricted (Level 2) washing and cleaning water was deemed to have an unacceptable impact on quality of life. Subjective duration based on conversations with the Scotdesco community, who observed adverse social impacts due to inability of children to shower.
	VH.3	Any single incident of contaminated water leading to acute sickness at the community level.	Consistent with the *Safe Drinking Water Act 2011*, acute sickness across the community due to either ingesting (drinking/cooking) or washing in poor quality water is deemed unacceptable.
High	H.1	Any single incident of CN1 water loss at the community level that lasts for 1–3 days.	As for VH.1. While repairable, complete loss of potable water for 1–3 days was assumed to be an indicator of a non-robust water supply given existing water supply arrangements.
	H.2	Any single incident of Level 1 restrictions of CN2 water at the community level for a period >6 months.	Subjective duration threshold made by DEW project team, noting that Level 1 restrictions do not significantly impact quality of life.
	H.3	Any single incident of Level 2 restrictions of CN2 water at the community level for 1 week to 3 months.	One week to 3 months duration of highly restricted (Level 2) washing and cleaning water was deemed to have a high impact on quality of life. Subjective decision by DEW project team.
	H.4	Any single incident of contaminated water leading to mild sickness at the community level.	As for VH.3. Consequence severity is relatively lower due to sickness being mild.

Level	ID	Criteria	Rationale
High (cont)	H.5	Any single incident of contaminated water leading to acute sickness in a single household.	As for VH.3. Consequence severity is relatively lower due to sickness being restricted to a single household.
Medium	Me.1	Any single incident of CN1 water loss at the community level that lasts for <1 day.	As for H.1. Consequence severity is relatively lower due to shorter duration of supply interruption, which is assumed to indicate more robust water supply infrastructure.
	Me.2	Loss of CN1 water only impacts individual households and lasts for >1 day per year.	Potable water (CN1) in remote communities is generally managed by individual households. This criteria allows for extended water supply interruptions to individual households to be accounted for. Extended duration of water supply interruption could be due to supply, water quality or infrastructure reasons.
	Me.3	More than one Level 1 restriction of CN2 water, each lasting <1 month.	As per H.2. Relative lower consequence severity due to multiple short duration Level 1 restrictions.
	Me.4	Any single incident of Level 1 restrictions of CN2 water at the community level for a period of 1–6 months.	As per H.2. Relative lower consequence severity due to shorter duration Level 1 restrictions.
	Me.5	Less than 3 incidents of Level 2 restrictions of CN2 water at the community level, each lasting <1 week.	As per H.3. Relative lower consequence severity due to shorter duration Level 2 restrictions.
	Me.6	Any single restriction of CN2 water to an individual household that lasts for >6 months.	As per H.3. Relative lower consequence severity due to smaller proportion of the community impacted by Level 2 restrictions.
	Me.7	Any single incident of contaminated water leading to sickness is mild and restricted to a single household.	As per H.5. Relative lower consequence severity due to sickness being mild.
	Me.8	Water quality issues reduces lifespan of whitegoods by at least half.	Subjective measure included by DEW project team based on feedback from community during preliminary conversations. Based largely on limescale of white goods due to high calcium loads in source water. Used as an indicator of economic impact of infrastructure failure and impact to quality of life.
Minor	Mi.1	No incidents of CN1 water loss at the community level.	Desired level of consequence at the community level. Note that does not account for loss of CN1 water to individual households (see I.1).
	Mi.2	Loss of CN1 water only impacts individual residences and lasts for <1 day per year.	As for Me.2, but accounts for relative lower consequence severity due to duration of impact. Shorter duration impact likely to be due to minor infrastructure failures.

Level	ID	Criteria	Rationale
Minor (cont)	Mi.3	Any single incident of Level 1 restriction of CN2 water at the community level for a period of 1 week to 1 month.	As per Me.3. Relative lower consequence severity due to shorter duration.
	Mi.4	Any single restriction of CN2 water to an individual that lasts <6 months.	As per Me.6. Relative lower consequence severity due to shorter duration.
Insignificant	I.1	No incidents of CN1 water loss at the individual residence or community level.	Desired level of consequence.
	I.2	Any single incident of Level 1 restriction of CN2 water at the community level that lasts for <1 week.	Desired level of consequence.
	I.3	No history of contaminated water causing sickness in the community.	Desired level of consequence.

The consequence criteria shown in Table 3.17 are consistent with:

- **Water Security Statement prepared under the *Water Industry Act 2012*, Priority action 4**: *Provision of critical human water needs – ensuring that the critical human water needs of all South Australians are able to be met, including in remote communities*.
- **Closing the Gap national strategy, Target 9b**: *By 2031, all Aboriginal and Torres Strait Islander households:*
    - *i. within discrete Aboriginal or Torres Strait Islander communities receive essential services that meet or exceed the relevant jurisdictional standard;*
    - *ii. in or near to a town receive essential services that meet or exceed the same standard as applies generally within the town.*
- **Falling through the gaps report (SACOSS) recommendation**: *Undertake a state-wide stocktake of current water supply arrangements to townships and communities (including remote Indigenous communities). This stocktake should consider drinking water security of supply, quality, governance and service delivery arrangements and costs, and look at delivery from the source to the household.*

3.5 Likelihood criteria

For the present assessment, likelihood is defined as the probability that a given consequence will be the worst observed at some point in the next 10 years to 2033.

Criteria for categories of likelihood (Table 3.18) provide descriptions of probability to incorporate into the evaluation of risk (Section 4). As an example, a likelihood rating of ‘possible’ indicates that the project team judged a 31% to 50% probability that a given consequence will be the worst observed in the next 10 years to 2033. Probabilities were judged and assigned based on evidence collected from the in-scope remote communities.

The scope of information captured during community interviews (Table 3.2) provided a broad understanding of water supply arrangements, and current and historic issues relating to water supply and quality. The collection of detailed quantitative information such as water supply, storage and consumption volumes are outside the scope of this investigation. As such, the risk assessment presented in this report is based largely on a qualitative assessment of likelihood, with significant weighting given to historic examples of interruptions as informed through community interviews. Specifically, community information was collected on interview responses to questions regarding historic interruptions due to 1) inadequate supply, 2) poor water quality, 3) infrastructure failure, or 4) increasing demand. This information is presented in Section 3.2.

Table 3.18: Likelihood criteria

Category	Description	Likelihood
Very rare	Not expected to occur in most circumstances	0–1% chance
Rare	Only occurs in exceptional circumstances	2–5% chance
Unlikely	Unusual but not exceptional	6–30% chance
Possible	Less than even chance but not unusual	31–50% chance
Likely	Greater than even chance but not certain	51–90% chance
Almost certain	Expected in most circumstances	91–100% chance

3.6 Risk evaluation and tolerability

The level of risk is correlated with likelihood and consequence. Criteria for risk tolerability is expressed as a risk matrix (Figure 3-1). Risk is evaluated into 3 levels – low, medium and high.

These risk levels represent the target/ideal condition with respect to likelihood and consequence. Thus:

- very rare likelihood = low risk, because this is the desired likelihood for all consequences
- insignificant consequence = low risk, because this is the desired outcome.

The risk matrix represents these conditions by setting the column representing ‘insignificant’ and the row representing ‘very rare’ to low risk.

		Consequence				
		Insignificant	Minor	Medium	High	Very high
Likelihood	Almost certain 91–100%	**Low**	**Medium**	**Medium**	**High**	**High**
	Likely 51–90%	**Low**	**Medium**	**Medium**	**High**	**High**
	Possible 31–50%	**Low**	**Low**	**Medium**	**Medium**	**High**
	Unlikely 6–30%	**Low**	**Low**	**Medium**	**Medium**	**High**
	Rare 2–5%	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Very rare 0–1%	**Low**	**Low**	**Low**	**Low**	**Low**

Figure 3-1: Risk evaluation criteria – 3 levels of risk according to the combination of likelihood and consequence

The level of risk indicates the need for treatment to modify risk:

- Low risk means that risk is acceptable, and no further action is required apart from monitoring the risk.
- Medium risk is conditionally tolerable, depending on the practicality and benefits of risk treatment.
- High risk means that risk is intolerable, requiring treatment to modify the risk level.

Typically the decision to treat medium risk depends on consideration of the costs versus benefits of treatment. One common principle is that medium risk is tolerated providing it is as low as reasonably practicable, which means that the benefits of treatment are greatly outweighed by the costs.

4 Results: Risk analysis and evaluation

The following tables show the results of the risk assessment for each in-scope self-supplied remote community according to the risk pathways identified in Section 2. Each table provides notes on the key likelihood and consequence factors considered important by the assessment panel. The final colour-coded column shows the result of the risk evaluation given the combination of likelihood and consequence (see Figure 3-1).

4.1 Iga Warta

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Possible** • Rainfall is low (~250 mm/yr) and variable. • Most residences have only one rainwater tank. • Rainwater tanks hold ~20,000 L. • Community has run out of rainwater in the past.	**Very high** • Periods of reduced rainfall likely to result in a loss of CN1 water at the community level until the next rainfall event. • Any loss could be for >3 days.	H
	CN2 (GW)	**Rare** • Sourced from single bore. • Yield has dropped from 1.6 L/sec to 0.5 L/sec over 27 years. • Current yield of 0.5 L/sec is sufficient to meet community needs. • Water level is unknown.	**Very high** • Further reductions in yield could lead to loss of CN2 water at the communty level. • Level 2 restrictions could be for >3 months.	M
Water quality	CN1 (RW)	**Very rare** • Most rainwater tanks are polycarbonate and enclosed. • Water is not filtered. • No reported history of water quality issues.	**High** • Sickness due to water quality issues should it occur could be acute but would be restricted to individual residences.	L
	CN2 (GW)	**Almost certain** • Community groundwater reguarly impacted by high levels of iron bacteria. • Community members occasionally suffer rashes due to showering (uncertain if cause is related to presence of high levels of iron bacteria). • Iron bacteria treated via chlorination. • High calcification levels are currently reducing the usable lifespan of whitegoods by greater than half.	**High** • Complete loss of groundwater due to high iron bacteria can be up to 3 weeks while water is treated (chlorinated). • Sickness (rashes) due to water quality issues have occurred and could be distributed across the community (uncertain if cause is related presence of high levels of iron bacteria).	H

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Infrastructure	CN1 (RW)	**Very rare** • Most residences have a single rainwater tank resulting in little redundancy due to infrastructure failure. • Rainwater tanks appear to be well maintained and in good condition.	**Minor** • Rainwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Sourcing supplies and expertise to repair/replace water tank infrastructure likely to take between 1 day and 1 week. • Individuals able to access other community water while infrastructure is being replaced or undergoing repairs. • Any loss of CN1 water expected to be <1 day.	**L**
	CN2 (GW)	**Unlikely** • Reduced yield in groundwater supply well may be due to partial collapse at bottom of the bore. • Visible calcification and rust on header tanks increasing chance of failure. • Pumps have significantly reduced lifespan due to calcification. • Likelihood rating due to multiple avenues of plausible infrastructure failure.	**High** • Groundwater is reticulated across the community. • Loss of groundwater due to infrastructure failure will affect the whole community. • Infrastructure repair/replacement could take between 1 week and 3 months.	**M**
Increasing demand	CN1 (RW)	**Very rare** • Permanent population appears to be largely static. • Water supply for tourism is separate from community water.	**Medium** • Any depletion of rainwater due to unanticipated take from community water could result in a loss of CN1 water for individual until the next rainfall event. • Loss likely to be for >3 days (next rainfall event).	**L**
	CN2 (GW)	**Very rare** • Current yield of 0.5 L/sec is sufficient to meet both community and visitor needs.	**Medium** • Recovery of depleted header tanks will be rapid after demand decreases. • Level 2 restrictions of CN2 water expected to last less than 1 week.	**L**

* **CN1**: Water for drinking and cooking; **CN2**: Water for cleaning and washing; **RW**: Rainwater; **GW**: Groundwater; **SW**: Surface water

4.2 Leigh Creek Station

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Almost certain** • Rainfall is low (~250 mm/yr) and variable. • Most residences have only one rainwater tank. • Rainwater tanks hold ~10,000-20,000 L. • Community has run out of local rainwater several times in recent history. One incident resulted in the loss of CN1 water for 2 years. • Community feels current rainwater supply is insufficient to meet CN1 needs.	**Very high** • Periods of reduced rainfall likely to result in a loss of CN1 water at the community level until the next rainfall event. • Any loss could be for >3 days.	H
	CN2 (GW)	**Almost certain** • Sourced from 2 bores. • Yields from both bores have signficantly declined since being drilled. • Summer supply is insufficient to fill header tanks.	**Medium** • Lower groundwater yields could lead to restrictions of CN2 water at the communty level. • Restrictions likely to last less than 1 week while supply in header tanks is replenished.	M
Water quality	CN1 (RW)	**Very rare** • Most rainwater tanks are polycarbonate and enclosed. • Water is not filtered. • No reported history of water quality issues.	**High** • Sickness due to water quality issues should it occur could be acute but would be restricted to individual residences.	L
	CN2 (GW)	**Almost certain** • High calcification levels are currently reducing the usable lifespan of whitegoods by greater than half.	**Medium** • Lifespan of whitegoods reduced by at least half due to high calcium levels.	M
Infrastructure	CN1 (RW)	**Rare** • Most residences have only one rainwater tank. • Rainwater tanks hold ~10,000-20,000 L. • Tank condition and maintenance is unknown, elevating likelihood from very rare (one tank on main homestead is currently not operational).	**Minor** • Rainwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Sourcing supplies and expertise to repair/replace water tank infrastructure likely to take between 1 day and 1 week. • Individuals able to access other community water while infrastructure is being replaced or undergoing repairs. • Any loss of CN1 water expected to be <1 day.	L

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Infrastructure (cont)	CN2 (GW)	**Unlikely** • Visible calcification on water storage and distribution infrastructure. • Community has to periodically replace or clean calcification from pipework. • Pumps have reduced lifespan due to high calcium levels. • Community has redundancy in wells, pumps and header tanks – reducing likelihood of loss of water to the community.	**Minor** • Groundwater is reticulated across the community. • Loss of groundwater due to infrastructure failure will affect the whole community. • Infrastructure repair/replacement likely to take <1 month.	**L**
Increasing demand	CN1 (RW)	**Very rare** • Population largely static with no tourism.	**Medium** • Any depletion of rainwater due to unanticipated increased take (increased demand) could result in a loss of CN1 water for individual until the next rainfall event. • Loss likely to be for >3 days.	**L**
	CN2 (GW)		**Medium** • Should increased demand deplete groundwater stores, recovery of header tanks will be rapid after demand decreases. • Level 2 restrictions of CN2 water expected to last <1 week.	**L**

*** CN1**: Water for drinking and cooking; **CN2**: Water for cleaning and washing; **RW**: Rainwater; **GW**: Groundwater; **SW**: Surface water

4.3 Kakalpurannha

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Rare** • Rainfall is low (~250 mm/yr) and variable. • Most residences have 1-2 rainwater tanks. • Tank volume average ~20,000 L. • No history of CN1 water loss.	**Very high** • Periods of reduced rainfall likely to result in a loss of CN1 water at the community level until the next rainfall event. • Any loss could be for >3 days.	**M**
	CN2 (GW)	**Rare** • Sourced from 2 bores. • Yields are low and declining but currently supply sufficient water. • Not reported history of groundwater supply issues.	**Medium** • A reduction in groundwater yields could lead to restrictions of CN2 water at the communty level. • Restrictions likely to last less than 1 week while supply in header tanks is replenished.	**L**
Water quality	CN1 (RW)	**Very rare** • Most rainwater tanks are polycarbonate and enclosed. • Water is not filtered. • No reported history of water quality issues.	**High** • Sickness due to water quality issues should it occur could be acute but would be restricted to individual residences.	**L**
	CN2 (GW)	**Almost certain** • High calcification levels are currently reducing the usable lifespan of whitegoods, hot water systems, air-conditioners, taps and showerheads by greater than half.	**Medium** • Lifespan of whitegoods reduced by at least half due to high calcium levels.	**M**
Infrastructure	CN1 (RW)	**Very rare** • Many residences have more than one rainwater tank providing redundancy in supply due to infrastructure failure. • Rainwater tanks appear to be well maintained and in good condition.	**Minor** • Rainwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Sourcing supplies and expertise to repair/replace water tank infrastructure likely to take between 1 day and 1 week. • Individuals able to access other community water while infrastructure is being replaced or undergoing repairs. • Any loss of CN1 water expected to be <1 day.	**L**
	CN2 (GW)	**Likely** • Visible calcification and rust on header tanks. • Pumps and pipes have significantly reduced lifespan due to calcification. • Likelihood rating due to poor condition of infrastructure and multiple avenues of failure.	**High** • Groundwater is reticulated across the community. • Loss of groundwater due to infrastructure failure will affect the whole community. • Infrastructure repair/replacement could take between 1 week and 3 months.	**H**

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Increasing demand	CN1 (RW)	**Very rare** • Population largely static with no tourism.	**Medium** • Any depletion of rainwater due to unanticipated increased take (increased demand) could result in a loss of CN1 water for individual until the next rainfall event. • Loss likely to be for >3 days.	**L**
	CN2 (GW)		**Medium** • Should increased demand deplete groundwater stores, recovery of header tanks will be rapid after demand decreases. • Level 2 restrictions of CN2 water expected to last <1 week.	**L**

*** CN1**: Water for drinking and cooking; **CN2**: Water for cleaning and washing; **RW**: Rainwater; **GW**: Groundwater; **SW**: Surface water

4.4 Beltana

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Rare** • Rainfall is low (~230 mm/yr) and variable. • Rainwater tanks fill in most years. • Individual tanks get low during the year. • No history of CN1 water loss at the community level, however individuals households ran out in 2019.	**Very high** • Periods of extended reduced rainfall may result in a loss of CN1 water at the community level until the next rainfall event. • Any loss could be for >3 days.	**M**
	CN2 (RW/GW)	**Rare** • Groundwater used by 2/3 of residences. • Rainwater used as backup. • Rainwater tanks fill in most years. • Individual tanks get low during the year. • No history of CN2 water loss at the community level. • Individuals ran out in 2019.	**Medium** • Loss of both rainwater and groundwater has historically caused Level 2 restrictions of CN2 water for individual households. • Loss is likely to be <6 months.	**L**
Water quality	CN1 (RW)	**Very rare** • Most rainwater tanks are galvanised and enclosed. • Water is not filtered. • No reported history of water quality issues.	**High** • Sickness due to water quality issues should it occur could be acute but would be restricted to individual households.	**L**
	CN2 (RW/GW)	**Almost certain** • High calcification levels are currently reducing the usable lifespan of whitegoods, hot water systems and toilet cisterns by at least half.	**Medium** • Lifespan of whitegoods reduced by at least half due to high calcium levels.	**M**
Infrastructure	CN1 (RW)	**Possible** • Tanks have to be galvanised due to heritage status of the Beltana township. • Many (~60%) of rainwater tanks need to be replaced due to being rusted and in poor condition.	**Medium** • Rainwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Individuals able to access other community water while infrastructure is being replaced or undergoing repairs. • Any loss of CN1 water to individuals may be >1 day.	**M**
	CN2 (RW/GW)	**Possible** • Rainwater as above. • Tanks have to be galvanised due to heritage status of the Beltana township. • Many (~40%) of groundwater tanks need to be replaced due to calcification, rust and being in poor condition. • Groundwater pumps and pipes also impacted by calcification.	**Medium** • Rainwater and groundwater are not reticulated across the community. • Loss of rainwater and groundwater due to infrastructure failure will only affect individuals. • Infrastructure repair/replacement could take between 1 week and 3 months.	**M**

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Increasing demand	CN1 (RW)	**Very rare** • Permanent population largely static. • Holiday (school holiday and long weekend) increases in population are consistent. • Tourism is limited. Visitors bring their own water or buy water from the OCA-supplied portable desalination plant.	**Medium** • Any depletion of rainwater due to unanticipated increased take (increased demand) could result in a loss of CN1 water for individual until the next rainfall event. • Loss likely to be for >1 day.	**L**
	CN2 (RW/GW)		**Medium** • Should increased demand deplete groundwater stores, recovery of tanks will be rapid after demand decreases. • Any depletion of rainwater due to unanticipated increased take (increased demand) could result in a loss of CN2 water for individual until the next rainfall event. • Level 2 restrictions of CN2 water to individuals may last >6 months.	**L**

*** CN1**: Water for drinking and cooking; **CN2**: Water for cleaning and washing; **RW**: Rainwater; **GW**: Groundwater; **SW**: Surface water

4.5 Yappala

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Almost certain** • Rainfall is low (~250 mm/yr) and variable. • Most residences have only one rainwater tank. • Average tank capacity is 5,000-10,000L. • Community has run out of rainwater a number of times in the past.	**Very high** • Rainwater is reticulated. • Periods of reduced rainfall will result in a loss of CN1 water at the community level until the next rainfall event. • Any loss could be for >3 days.	**H**
	CN2 (GW)	**Unlikely** • Sourced from single bore. • Unknown yield and water level but sometimes struggles to keep up with demand. • No reports of historic complete failure. • Likelihood score due to uncertainty on yield.	**Very high** • Reduction in yield could lead to loss of CN2 water at the commumty level. • Level 2 restrictions could be for >3 months.	**H**
Water quality	CN1 (RW)	**Very rare** • Most rainwater tanks are polycarbonate and enclosed. • Water is not filtered. • No reported history of water quality issues.	**High** • Sickness due to water quality issues should it occur could be acute but would be restricted to individual residences.	**L**
	CN2 (GW)	**Almost certain** • High calcium loads are currently causing signficant reductions in the lifespan of whitegoods.	**Medium** • Lifespan of whitegoods reduced by at least half due to high calcium levels.	**M**
Infrastructure	CN1 (RW)	**Rare** • Most residences have a single rainwater tank. • Rainwater tanks are reticulated across the community. • Rainwater tanks appear to be well maintained and in good condition. • History of damage to piping infrastructure due to lack of mapping.	**Minor** • Infrastructure failure between tanks unlikely to affect individuals or the community due to redundancy in network. • Any loss of CN1 water expected to be <1 day.	**L**
	CN2 (GW)	**Rare** • No reported issues with groundwater bore. • Condition of header tank is unknown. • Pumps and isolators regularly damaged due to calcium buildup. • Pipe infrastructure is partially above ground, reducing its lifespan. • Buried pipes are unmapped and are occasionally damaged while digging.	**High** • Pipe infrastructure between header tanks and the community is both above and below ground in different sections. • Failure of this infrastructure would cause a restriction in the use of CN2 water for between 1 week and 6 months.	**M**

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Increasing demand	CN1 (RW)	**Almost certain** • Permanent population of 30 appears mostly static. • Population regularly increases up to 60 due to family gatherings. • Gatherings have been cancelled during times of low water supply. • BHP currently working with the Yappala community to build an art gallery, which will increase tourism. • Water supply for this increase in demand is uncertain but likely to involve runoff from new art gallery facilities.	**Very high** • Additional stress on rainwater supply has contributed to the loss of CN1 water at the community level. • Loss likely to be for >3 days (next rainfall event).	**H**
	CN2 (GW)	**Possible** • Permanent population of 30 appears mostly static. • Population regularly increases up to 60 due to family gatherings. • Groundwater supply sometimes struggles to keep up with demand but has never completely failed. • BHP currently working with the Yappala community to build an art gallery, which will increase tourism. • Water supply for this increase demand is uncertain but likely to involve runoff from new art gallery facilities.	**Medium** • Recovery of depleted header tanks will be rapid after demand decreases. • Level 2 restrictions of CN2 water expected to last <1 week.	**M**

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4.6 Penong

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Very rare** • Experiences regular season rainfall (~300 mm). • Rainwater tanks fill in most years, and hold ~2 years of supply. • Historic examples of residents running out of rainwater are rare.	**Very high** • Extended duration of reduced rainfall could result in a loss of CN1 water at the community level until the next rainfall event. • Loss could be for >3 days.	**L**
	CN2 (RW)		**Very high** • Extended duration of reduced rainfall could result in a loss of CN2 water at the community level until the next rainfall event. • Loss could be for >3 months.	**L**
Water quality	CN1 (RW)	**Very rare** • Most rainwater tanks are polycarbonate and enclosed. • Water is not filtered (except for primary school). • No reported history of water quality issues.	**High** • Sickness due to water quality issues should it occur could be acute but would be restricted to individual residences.	**L**
	CN2 (RW)			**L**
Infrastructure	CN1 (RW)	**Very rare** • Rainwater tanks well maintained and in good condition. • Many households have multiple storage tanks providing storage redundancy. • Supplies and expertise to repair infrastructure are readily available within a short period of time.	**Minor** • Rainwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Supplies to repair water tank infrastructure can be sourced within 1 day. • Any loss of CN1 water expected to be <1 day.	**L**
	CN2 (RW)		**Insignificant** • Rainwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Supplies can be sourced and repairs undertaken to infrastructure within 1 day. • Any loss of CN2 water expected to be <1 day.	**L**
Increasing demand	CN1 (RW)	**Very rare** • Water supply is sourced from rainfall and managed individually, therefore any increase in resident population will not affect water supply. • Tourism is significant and increasing. Tourists generally supply their own water. • Occurrences of tourists taking water from resident supplies are rare.	**Medium** • Any depletion of rainwater due to unanticipated increased take (increased demand) could result in a loss of CN1 water for individuals until the next rainfall event. • Loss likely to be for >3 days.	**L**
	CN2 (RW)		**Minor** • Loss of water due to take by tourists would only affect individual residences, who would have to wait until resupply through the next rainfall event. • Loss likely to be less <6 months.	**L**

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4.7 Fowlers Bay

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Very rare** • Experiences regular season rainfall (~300 mm). • Rainwater tanks fill in most years, and hold ~3 years of supply. • No records in past 15 years of residents running out of rainwater.	**Very high** • Extended duration of reduced rainfall could result in a loss of CN1 water at the community level until the next rainfall event. • Loss could be for >3 days.	**L**
	CN2 (RW/GW)	**Very rare** • Rainwater as above. • Caravan park and small number of users use shallow groundwater. • No recorded history of groundwater supply issues.	**Very high** • Extended duration of reduced rainfall could result in a loss of CN2 water for a large proportion of the community until the next rainfall event. • Loss could be for >3 months.	**L**
Water quality	CN1 (RW)	**Very rare** • Most rainwater tanks are polycarbonate and enclosed. • Water is not filtered. • No reported history of water quality issues.	**High** • Sickness due to water quality issues should it occur could be acute but would be restricted to individual residences.	**L**
	CN2 (RW/GW)	**Very rare** • Rainwater as above. • Caravan park and small number of users use shallow groundwater. • Occasional issues with turbidity, tannins and animal deaths in shallow groundwater. • Residents use rainwater as backup when groundwater water quality is unsuitable.		**L**
Infrastructure	CN1 (RW)	**Very rare** • Rainwater tanks well maintained and in good condition. • Many households have multiple storage tanks providing storage redundancy. • Supplies and expertise to repair infrastructure are readily available within a short period of time.	**Minor** • Rainwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Supplies can be sourced and repairs undertaken to infrastructure within 1 day. • Any loss of CN1 water expected to be <1 day.	**L**

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Infrastructure (cont)	CN2 (RW/GW)	**Very rare** • Rainwater as above. • Caravan park and small number of users use shallow groundwater. • Caravan park replaces pumps every 2 years as part of its maintenance schedule. • Resident pumps can be replaced within 3 weeks. • Residents use rainwater as backup.	**Insignificant** • Rainwater and groundwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Supplies can be sourced and repairs undertaken to infrastructure within 1 day. • Any loss of CN2 water expected to be <1 day.	**L**
Increasing demand	CN1 (RW)	**Very rare** • Water supply is sourced from rainfall and managed individually, therefore any increase in resident population will not affect water supply. • Tourism is significant and increasing. Tourists generally supply their own water. • Occurrences of tourists taking water from resident supplies are rare.	**Medium** • Any depletion of rainwater due to unanticipated increased take (increased demand) could result in a loss of CN1 water for individual until the next rainfall event. • Loss likely to be for >3 days.	**L**
	CN2 (RW/GW)	**Very rare** • Rainwater as above. • Caravan park and small number of users use shallow groundwater. • Rain and groundwater supply to caravan park visitors is sufficient to meet changing seasonal demand.	**Minor** • Loss of rainwater due to illegal take by tourists would only affect individual residences, who would have to wait until resupply through the next rainfall event. • Any loss likely to be <6 months.	**L**

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4.8 Nundroo and Coorabie

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Very rare** • Experiences regular season rainfall (~300 mm). • Rainwater tanks fill in most years, and have 'pretty god supply' at the end of summer. • Records of residents running out of rainwater are rare. • Small number of houses have access to shallow GW bores used for toilets and occasionally shandied with rainwater for other CN2 uses.	**Very high** • Extended duration of reduced rainfall could result in a loss of CN1 water at the community level until the next rainfall event. • Loss could be for >3 days.	**L**
	CN2 (RW/GW)		**Very high** • Extended duration of reduced rainfall could result in a loss of CN2 water for the majority of the community until the next rainfall event. • Loss could be for >3 months.	**L**
Water quality	CN1 (RW)	**Very rare** • Most rainwater tanks are polycarbonate and enclosed. • Water is not filtered. • No reported history of water quality issues.	**High** • Sickness due to water quality issues should it occur could be acute but would be restricted to individual residences.	**L**
	CN2 (RW/GW)			**L**
Infrastructure	CN1 (RW)	**Very rare** • Rainwater tanks well maintained and in good condition. • Many households have multiple storage tanks providing storage redundancy. • Supplies and expertise to repair infrastructure are readily available within a short period of time. • Groundwater infrastructure is in good condition.	**Minor** • Rainwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Supplies can be sourced and repairs undertaken to infrastructure within 1 day. • Any loss of CN1 water expected to be <1 day.	**L**
	CN2 (RW/GW)		**Insignificant** • Rainwater not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Supplies sourced and repairs undertaken to infrastructure within 1 day. • Any loss of CN2 water likely <1 day.	**L**
Increasing demand	CN1 (RW)	**Very rare** • Water supply is sourced from rainfall and managed individually, therefore any increase in resident population will not affect water supply. • Tourism is minimal. • No reported incidents of tourists taking community water.	**Medium** • Any depletion of rainwater due to unanticipated increased take (increased demand) could result in a loss of CN1 water for individual until the next rainfall event. • Loss likely to be for >3 days.	**L**
	CN2 (RW/GW)		**Minor** • Any loss of water due to this take by tourists would only affect individual residences, who would have to wait until resupply through the next rainfall event. • Any loss likely to be less <6 months.	**L**

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4.9 Scotdesco

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Possible** • Experiences regular seasonal rainfall (~300 mm). • Community ran out of water in 2019. • Community experienced a number of water restrictions prior to 2019. • No further water security measures have been put in place since 2019. • Repeat CN1 loss of water is possible.	**Very high** • Extended duration of reduced rainfall could result in a loss of CN1 water at the community level until the next rainfall event. • Loss could be for >3 days.	H
	CN2 (RW)	**Possible** • Community ran out of water in 2019. • Community experienced a number of water restrictions prior to 2019. • No further water security measures have been put in place since 2019. • Future severe CN2 restrictions are possible.	**Very high** • Extended duration of reduced rainfall could result in low or loss of CN2 water supply at the community level until the next rainfall event. • Level 2 restrictions could be for >3 months.	H
Water quality	CN1 (RW)	**Likely** • Rainwater tanks are polycarbonate. • Bladder dam is enclosed. • Bladder dam water is chlorinated. • Water from rainwater tanks is not filtered. • Presence of *E. coli* is regularly reported in multiple rainwater tanks across the community. • Sickness due to *E. coli* has also been reported across the community.	**High** • Sickness due to *E. coli* likely to cause mild illness in the majority of instances. • Sickness likely to be distributed across the community.	H
	CN2 (RW)			H
Infrastructure	CN1 (RW)	**Possible** • Rainwater tanks appear to be well maintained and in good condition. • Bladder dam is in poor condition with tears appearing.	**Very high** • Bladder dam water is reticulated across the community and relied upon by community members in most years. • Loss of water due to bladder dam failure will affect the entire community. • Repair or replacement timeline for bladder dam likely to be significant. • Loss of CN1 water due to bladder dam failure could be >3 days.	H
	CN2 (RW)		**High** • Bladder dam water is reticulated across the community, and relied upon by community members in most years. • Loss of water due to bladder dam failure will affect the entire community.	M

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Infrastructure (cont)	CN2 (RW) (cont)		• Repair or replacement timeline for bladder dam could be significant. • Loss of CN2 water due to bladder dam failure could be >1 week but expected to be <3 months.	
Increasing demand	CN1 (RW)	**Very rare** • Permanent population appears to be largely static, although there is a portion of the population who only reside on the property on weekends or in school holidays. • Water supply for tourism is completely separate from community water.	**Medium** • Any depletion of rainwater due to unanticipated increased take (increased demand) could result in a loss of CN1 water for individual until the next rainfall event. • Loss likely to be for >3 days.	**L**
	CN2 (RW)		**Very high** • Any depletion of rainwater due to take from community water could result in a loss of CN2 water for individual until the next rainfall event. • Loss likely to be for >3 months (next rainfall event).	**L**

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4.10 Kingoonya

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Possible** • Rainfall is low (~150 mm) and variable. • Supply in the past has got very low. • Community does not feel current drinking water supply is secure.	**Very high** • Extended duration of reduced rainfall could result in a loss of CN1 water at the community level until the next rainfall event. • Any loss could be for >3 days.	**H**
	CN2 (GW)	**Unlikely** • Source aquifer responsive to contemporary rainfall. • There is uncertainty on the supply–demand water balance from the source aquifer. • Governance risk exists due to township not owning water supply infrastructure and arrangemetns not formalised with Northwell Station.	**Very high** • Level 2 restriction of CN2 water for >3 months at the community level due to either: o reduced rainfall leading to depletion of aquifer, or o Northwell Station ceasing supply of water.	**H**
Water quality	CN1 (RW)	**Very rare** • Most rainwater tanks are polycarbonate and enclosed. • Water is not filtered. • No reported history of water quality issues.	**High** • Sickness due to water quality issues should it occur could be acute but would be restricted to individual residences.	**L**
	CN2 (GW)	**Almost certain** • High calcium loads are currently causing signficant reductions in the lifespan of whitegoods.	**Medium** • High calcium loads in CN2 groundwater is currently reducing the lifespan of whitegoods by at least half.	**M**
Infrastructure	CN1 (RW)	**Rare** • Rainwater tanks are mostly well maintained and in good condition. • Small number of older tanks have rust issues. • Many households have multiple storage tanks providing storage redundancy.	**Minor** • Rainwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Supplies can be sourced and repairs undertaken to infrastructure within 1 day. • Any loss of CN1 water expected to be <1 day.	**L**
	CN2 (GW)	**Very rare** • Groundwater pumping and piping infrastructure is new. • Town header tank is old but appears in good condition.	**High** • Groundwater is reticulated across the community. • Loss of groundwater due to infrastructure failure will affect the whole community. • Infrastructure repair/replacement could take between 1 week and 3 months.	**L**

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Increasing demand	CN1 (RW)	**Rare** • Tourism is significant and increasing. • Pub and caravan park supply community water to tourists. • Tourists are requested to supply own water for larger events. • OCA sell desalinated groundwater to tourists.	**Medium** • Any depletion of rainwater due to unanticipated increased take (increased demand) could result in a loss of CN1 water for individual until the next rainfall event. • Loss likely to be for >3 days.	**L**
	CN2 (GW)	**Very rare** • Tourism is significant and increasing. • Pub and caravan park supply community water to tourists. • High number of tourists over multiple days could deplete header tank.	**Medium** • Recovery of depleted header tanks will be rapid after demand decreases. • Level 2 restrictions of CN2 water expected to last less than 1 week.	**L**

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4.11 Glendambo

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW)	**Very rare** • Rainfall is low (~173 mm/yr) and variable. • Lowest supply has reached in past 15 years is 1/3 full.	**Very high** • Extended duration of reduced rainfall could result in a loss of CN1 water at the community level until the next rainfall event. • Any loss could be for >3 days.	**L**
	CN2 (RW/GW)	**Rare** • Rainwater supply considered secure. Residents have not run out in past 15 years. • Groundwater sourced from 2 bores (Eastbore and Northbore), providing some redundancy. • Community advises that water supply from Eastbore becomes unreliable after long dry periods.	**Very high** • Extended duration of reduced rainfall could result in low or loss of groundwater CN2 (only showering and flushing toilets) water supply for permanent residents until the next rainfall event. • Level 2 restrictions could be for >3 months.	**M**
Water quality	CN1 (RW)	**Very rare** • Most rainwater tanks are polycarbonate and enclosed. • Water is not filtered. • No reported history of water quality issues.	**High** • Sickness due to water quality issues should it occur could be acute but would be restricted to individual residences.	**L**
	CN2 (RW/GW)	**Very rare** • Groundwater has moderate TDS (Eastbore 2,903 mg/L; Northbore 2,100 mg/L). • Groundwater is sourced from an unconfined aquifer 400 m from the township. • Previous testing of aquifers in the region has found groundwater in Glendambo to be chemically non-potable (Willis et al. 2015), but does meet hygiene (showering/teeth cleaning) requirements. • No reported incidents of water quality-related sickness.	**Very high** • Sickness due to groundwater quality issues should it occur could be acute and would be disributed across all permanent residents.	**L**
Infrastructure	CN1 (RW)	**Very rare** • Rainwater tanks appear to be well maintained and in good condition. • 1-2 rainwater tanks per household holds rainwater for CN1.	**Minor** • Rainwater is not reticulated across the community. • Loss of water due to infrastructure failure will only affect individuals. • Supplies can be sourced and repairs undertaken to infrastructure within 1 day. • Any loss of CN1 water expected to be <1 day.	**L**

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Infrastructure (cont)	CN2 (RW/GW)	**Rare** • Northbore collapsed after January 2022 floods but has recently been rehabilitated. • Probability of subsequent collapse, or similar collapse, of Eastbore is unknown. • No reported issues with current groundwater infrastructure. • Backup groundwater pump stored onsite. • Two groundwater header tanks in good condition.	**High** • Groundwater is reticulated across the community. • Loss of groundwater due to infrastructure failure will affect the whole community. • Infrastructure (tank and pipes) repair/replacement could take between 1 week and 3 months.	**M**
Increasing demand	CN1 (RW)	**Very rare** • Water supply is sourced from rainfall and managed individually, therefore any increase in resident population will not affect water supply. • Tourism/transient population is signficant but uses a separate CN1 water supply from that used by permanent residents (desalinated groundwater). • No reported incidents of tourists taking community water.	**Medium** • Any depletion of rainwater due to unanticipated increased take (increased demand) could result in a loss of CN1 water for individual until the next rainfall event. • Loss likely to be for >3 days.	**L**
	CN2 (SW/GW)	**Very rare** • Tourism is significant and increasing. • Tourism water supply is via desalinated groundwater. • Groundwater supply is significantly greater than tourism demand.	**Medium** • Should tourism deplete groundwater stores, recovery of header tanks will be rapid after demand decreases. • Level 2 restrictions of CN2 water expected to last less than 1 week.	**L**

* **CN1**: Water for drinking and cooking; **CN2**: Water for cleaning and washing; **RW**: Rainwater; **GW**: Groundwater; **SW**: Surface water

4.12 Andamooka

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (RW/GW)	**Very rare** • Rainfall used preferentially, with desalinated groundwater as backup. • Rainfall is low (~190 mm/yr) and variable. • Desalinated groundwater supply from Olympic Dam is secure.	**Very high** • Extended duration of reduced rainfall coupled with loss of supply from Olympic Dam would result in a loss of CN1 water at the community level until the next rainfall event. • Any loss likely to be for >3 days.	**L**
	CN2 (RW/GW)		**Very high** • Extended duration of reduced rainfall coupled with loss of supply from Olympic Dam would result in a loss of CN2 water at the community level until the next rainfall event. • Any loss likely to be for >3 days.	**L**
Water quality	CN1 (RW/GW)	**Very rare** • Most rainwater tanks are polycarbonate and enclosed. • Rainwater is not filtered. • Groundwater is desalinated. • No reported history of water quality issues.	**Very high** • Sickness due to water quality issues should it occur could be acut and could be distributed across the community.	**L**
	CN2 (RW/GW)			**L**
Infrastructure	CN1 (RW/GW)	**Very rare** • Rainwater tanks appear to be well maintained and in good condition. • Tanks hold both rainwater and Olympic Dam desalinated groundwater. • Desalinated groundwater infrastructure is actively managed and maintained by the OCA, funded through the purchase of water.	**Very high** • Loss of groundwater due to infrastructure failure will affect the entire community. • Maintenance of infrastructure is actively managed by the OCA, including funding of an onsite infrastructure manager. • Expertise and supplies to repair water tank infrastructure likely to be sourced within 1 day. • Any loss of CN1 water could last for >3 days.	**L**
	CN2 (RW/GW)		**Medium** • Loss of groundwater due to infrastructure failure will affect the entire community. • Maintenance of infrastructure actively managed by the OCA, including funding of an onsite infrastructure manager. • Expertise and supplies to repair water tank infrastructure likely to be sourced within 1 day. • Level 2 restrictions of CN2 water likely to last for <1 week.	**L**
Increasing demand	CN1 (RW/GW)	**Very rare** • Rainwater supply is sourced from rainfall and managed individually, therefore any increase in resident population will not affect water supply.	**Very high** • Should the population of Andamooka increase to a point where desalinated groundwater supply from Olympic Dam becomes insufficient, loss of CN1 water is likely to last >3 days.	**L**

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Increasing demand (cont)	CN2 (RW/GW)	• Groundwater supply greatly exceeds demand.	**Very high** • Should the population of Andamooka increase to a point where desalinated groundwater supply from Olympic Dam becomes insufficient, loss of CN1 water is likely to last >3 months.	**L**

*** CN1**: Water for drinking and cooking; **CN2**: Water for cleaning and washing; **RW**: Rainwater; **GW**: Groundwater; **SW**: Surface water

4.13 Innamincka

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Supply	CN1 (SW/RW/GW)	**Unlikely** • Rainfall is low (~178 mm/yr) and variable. • Surface water supply from Cooper Creek has run out in recent history due to low rainfall in the headwaters. • Groundwater supply has run out in recent history but pump has been lowered and supply now appears secure. • Reason behind groundwater supply running out is unknown. • Unlikely interruption to supply due to mulitple water supply sources.	**Very high** • Extended duration of reduced rainfall and reduced groundwater recharge could result in a loss of CN1 and CN2 water at the community level until the next rainfall or groundwater recharge event. • Any loss of CN1 and CN2 water could be for >3 months.	H
	CN2 (SW/RW/GW)			H
Water quality	CN1 (SW/RW/GW)	**Unlikely** • Most rainwater tanks are polycarbonate and enclosed. • Surface and groundwater have low salinity. • Water is filtered at each residence. • Occasional blue-green algae issue with Cooper Creek water. • There is the potential of the community not detecting blue-green algae and it being pumped to the community as no regular monitoring regime is in place.	**Very high** • Sickness due to water quality (blue-green algae) issues should it occur could be acute and could be distributed across the community.	H
	CN2 (SW/RW/GW)			H
Infrastructure	CN1 (SW/RW/GW)	**Very rare** • Rainwater and header tanks appear to be well maintained and in good condition. • There are 3x headertanks with a total volume of 700,000 L. Header tanks hold water pumped both from Cooper Creek and groundwater. • Two header tanks are new and one is 12 yo. • Water from headertanks is reticulated across the community. • Groundwater pumping and pipe infrastructure appears in good condition. • Cooper Creek pump is new. Currently in for repair under warranty. • Pump repair/replacement can take up to 6 weeks. • High level of redundancy in water supply infrasctructure.	**Minor** • Expertise for most repairs exist in the community. • Supplies for most repairs able to be sourced within 1 day. • Pump replacement can take up to 6 weeks. • High redundancy with multiple water sources. • Any loss of CN1 or CN2 water expected to be <1 day due to high redundancy.	L
	CN2 (SW/RW/GW)			L

RISK SOURCE	CRITICAL NEED*	LIKELIHOOD	CONSEQUENCE	RISK
Increasing demand	CN1 (SW/RW/GW)	**Very rare** • Permanent population largely static. • Increased demand driven by tourism and Station employees. • Current supply from the combination of surface water, groundwater and rainwater is able to meet increases in demand.	**Minor** • Recovery of any depletion of header tanks will be rapid after demand decreases. • Loss of CN1 and CN2 water will be <1 day.	L
	CN2 (SW/RW/GW)			L

* **CN1**: Water for drinking and cooking; **CN2**: Water for cleaning and washing; **RW**: Rainwater; **GW**: Groundwater; **SW**: Surface water

5 Conclusion

5.1 Water supply risk

Evidence collected and the subsequent analysis of risk indicates only 5 of the 14 assessed in-scope communities were assessed as having a low risk to water supply over the next 10 years. Beltana and Glendambo were assessed as being at medium risk, and the other 7 communities were all assessed as being at high risk. Insufficient or loss of water supply was the most common pathway leading to high risk, followed by water quality, infrastructure and increasing demand. Supply risk is spread across all identified water sources (rainfall, groundwater and surface water) – noting that this varies according to the water supplies relied upon by each individual community.

Figure 5-1 summarises the spread of risk across the remote communities investigated as part of this project. This summary reports the highest risk for each risk pathway, regardless of critical water need (drinking and cooking vs. washing and cleaning). See Section 4 for a complete breakdown of source of risk.

Figure 5-1: Summary of water supply risks for each community

5.2 Risk treatment

The risk assessment has identified a number of communities with medium and high risks to water supply. The definition of risk used for this assessment indicates that medium risks are conditionally tolerable, and that high risks are intolerable and require treatment.

Specific recommendations for risk treatments are outside the scope of this assessment and will be the focus of a separate process conducted by DEW.

5.3 Uncertainty

The ISO 31000 definition of risk is 'the effect of uncertainty on objectives'. The ISO 31000 risk management process followed in this risk assessment then presents the evidence to enable defensible decisions given uncertainty.

The risk assessment presented outlines 5 levels of consequence. One of these consequences is certain to occur within our 10-year timeframe of interest, but there is inherent uncertainty on which it will be. Some risk assessments (e.g. DEW 2020) represent this uncertainty by providing a probability distribution of consequences. This risk assessment has instead considered and presented the plausible combination of likelihood and consequence that leads to the highest level of risk.

This combination of likelihood and consequence has been selected based on the judgement of the project team, informed by evidence collected through remote community site inspections and interviews. This evidence is documented in Section 4 of this report; however, uncertainty remains as the assessments are based on judgements of an unknowable future.

Key uncertainties affecting this risk assessment include:

- **Future climate** – A key factor considered through this risk analysis is the frequency of water supply failures over the past decade or decades as a result of the climate that was experienced over this period. Future water supply risks depend on future climatic cycles that are inherently unpredictable, noting that climate change projections indicate a drier and hotter future climate through much of the state.
- **Infrastructure resilience** – Risk analysis of infrastructure failure considers historic infrastructure failures, community opinion, and project team knowledge. There is inherent uncertainty regarding the failure rate of infrastructure that depends on current condition and the maintenance and replacement regime that is in place.
- **Incomplete evidence gathered via community interviews** – Effort was made to ensure that the most relevant community members were interviewed to understand water supply issues. However, it is possible that the evidence base is incomplete due to knowledge held by community members other than those interviewed.
- **Population variability** – A key piece of evidence used to judge risk is the population dynamic of each community, including historic and expected future increases in demand for community water. There is inherent uncertainty regarding the actual future population (resident and transient) of each community over the next 10 years.

6 Appendices

A. Community data collection sheet

Community name	
Visit date	
Community contact	
Phone number	
Email	

Connection to Country

Community Goals

Property/Infrastructure	

Population
• Does this change over the year?
• What is the reason for changes in population?
    o Tourism
    o Residents
    o Cultural gatherings
• Is this change regular?
• Is it expected that the number of residents will increase over the next 10 years?	

Houses (No.)	
Other buildings or infrastructure	
Open spaces	

RAINFALL: Water Source	
Number of rainwater tanks	
Capacity of rainwater tanks	
What is rainwater used for? • Drinking/cooking • Washing/cleaning • Other (e.g. stock / crops / tourism)	
Other demands on rainwater? • Transient tourists • Abundant species (e.g. roos/goats)	
How full do rainwater tanks normally get by end of winter?	
How empty do rainwater tanks normally get by end of summer?	
RAINFALL: Water Source	
Have you run out of rainwater before? • How often? • How long for? • What was the cause? (infrastructure vs. supply) **Have there been restrictions?** • How often? • How long for? • What was the cause? (infrastructure vs. supply)	
Where does the community source water when it runs out of rainwater?	

RAINFALL: Water Quality	
Has there historically been any issues with rainwater quality? • What was the cause?	
Did rainwater quality prevent its use? • What uses did it prevent? o Drinking/cooking o Washing/cleaning o Other (e.g. stock/crops/tourism) o Economic • How often? • How long for?	
RAINFALL: Infrastructure	
How is rainwater distributed?	
Age of infrastructure? • Pumps • Pipes • Tanks	
Evidence of current rainwater infrastructure damage?	
Has the community experienced loss of rainwater due to infrastructure in the past? • What was the cause? • How often? • How long for? • How was the issue fixed?	
Was the entire community impacted by any historical rainwater infrastructure failure?	

GROUNDWATER: Water Source	
Groundwater resource (small perched / large regional)	
Number of groundwater bores? • Depth to groundwater? • Depth of bore?	
What is groundwater used for? • Drinking/cooking • Washing/cleaning • Other (e.g. stock / crops / tourism) • Economic	
Other demands on groundwater? • Transient tourists? • Abundant species? (e.g. roos/goats) • Other external users/extraction?	
Have you run out of groundwater before? • How often? • How long for? • What was the cause? (infrastructure vs. supply) **Have there been restrictions?** • How often? • How long for? • What was the cause? (infrastructure vs. supply)	
Where does the community source water when it runs out of groundwater?	
GROUNDWATER: Water Quality	
What is the quality of groundwater? • Salinity • Calcium • Other	
Has water quality prevented the use of groundwater in the community? • Drinking/cooking • Cleaning/washing • Other (e.g. stock/crops) • Economic • What was the cause? • How often? • How long for? • Has issue been addressed?	

GROUNDWATER: Water Supply Infrastructure	
How is groundwater pumped?	
How is groundwater stored?	
How is groundwater distributed?	
Age of infrastructure? • Pumps • Pipes • Tanks	
Evidence of current groundwater infrastructure damage?	
Has the community experienced loss of groundwater due to infrastructure in the past? • What was the cause? • How often? • How long for? • How was the issue fixed?	
Was the entire community impacted by any historical groundwater infrastructure failure?	
SURFACE WATER (inc. DAMS): Water Source	
Number of surface water sources	
Size of dams if present	
What is surface water used for? • Drinking/cooking • Washing/cleaning • Other (e.g. stock / crops / tourism) • Economic	
Other demands on surface water? • Transient tourists • Abundant species (e.g. roos/goats) • Other users/extraction	
For direct extraction from a watercourse • How often does the watercourse flow? • For how long?	

If present, how full do onstream dams normally get at the end of winter? **OR: if direct extraction, how full does storage get at end of flowing season?**	
If present, how empty do onstream dams normally get by the end of summer? **OR: if direct extraction, how empty does storage get at end of flowing season?**	
Have you run out of surface water before? • How often? • How long for? • What was the cause? (infrastructure vs. supply) **Have there been restrictions?** • How often? • How long for? • What was the cause? (infrastructure vs. supply)	
Where does the community source water when it runs out of surface water?	
SURFACE WATER (DAMS): Water Quality	
What is the quality of surface water? • Salinity • Turbidity • Other	
Has water quality prevented the use of surface water in the community? • Drinking/cooking • Cleaning/washing • Other (e.g. stock/crops) • Economic • What was the cause? • How often? • How long for? • Has issue been addressed?	

SURFACE WATER (DAMS): Water Supply Infrastructure	
Is surface water pumped? What infrastructure is used?	
How is surface water stored?	
How is surface water distributed?	
Age of infrastructure? • Pumps • Pipes • Tanks	
Evidence of current surface water infrastructure damage?	
Has the community experienced loss of surface water due to infrastructure in the past? • What was the cause? • How often? • How long for? • How was the issue fixed?	
Was the entire community impacted by any historical surface water infrastructure failure?	
OTHER WATER SOURCES	
Water carting	
Mains	
Desalination Plants	
Other	

<table>
<tr><th colspan="2">OTHER RISKS</th></tr>
<tr><td>Drinking/cooking</td><td></td></tr>
<tr><td>Washing/cleaning</td><td></td></tr>
<tr><td>Economic</td><td></td></tr>
<tr><td>Social</td><td></td></tr>
<tr><td>Other</td><td></td></tr>
<tr><th colspan="2">Other Information</th></tr>
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