



Town and city water security definition and diagnostic

Public report prepared for the Department of Agriculture,
Water and Environment

Prepared by Aither

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Project overview and scope

Across Australia, secure urban water supply to towns and cities is critical for human health and wellbeing, economic growth, and green and liveable environments. Recent reports have noted the need for improved urban water security and called for greater national leadership and collaboration on the issue.

Aither was engaged to develop a definition and a diagnostic for reporting on town and city water security, and to test these through consultation and trialling. This report presents the results and conclusions of this work.

The project involved three rounds of consultation, two rounds of trials and four iterations of the definition and diagnostic. A review of national and international experience informed this work, along with the results of trialling and engagement to test the proof of concept.

Report structure

- **Proof of concept:** Presents the findings and conclusions from the project. It also includes advice on possible next steps for implementation.
- **Developing a definition and diagnostic:** Summarises the definition and diagnostic, and rationale for each element.
- **Insights and lessons:** Provides lessons and insights from developing, trialling and testing the definition and diagnostic through this project. This section offers information to support the findings and conclusions in Section 1.
- **Appendix A- Diagnostic indicators and rationale:** Provides the diagnostic in full, including specific indicators and further detailed explanation.

Acknowledgements

This project has relied extensively on the contribution of water sector stakeholders, including water utilities, government agencies, industry bodies and academics. We acknowledge their significant contribution to the project.

1. Proof of concept

To test proof of concept, the project sought to establish whether it is *feasible* to develop a definition and diagnostic, and whether there is *value* in using the definition and diagnostic in practice.

The project has confirmed that developing and using a definition and diagnostic for reporting on town and city water security is both feasible and adds value. Having established this, thought was then given to implementation, with advice on next steps also provided in this report.

1.1. Definition of town and city water security in Australia

Developing a diagnostic and reporting on town and city water security first requires a clear and agreed definition of what town and city water security means. Town and city water security can be defined in terms of quantity, quality and affordable access. Figure 1 shows the definition in full.

Figure 1 Definition of town and city water security

<i>Town and city water security is meeting needs, over time and under changing supply and demand profiles, across the following dimensions...</i>		
Quantity	Quality (i.e. fit for purpose)	Affordability and access
This includes: <ul style="list-style-type: none">• Drinking water supply for households and businesses• Water to support wider customer and community value (e.g. public spaces, recreational uses and other liveability outcomes)	This includes: <ul style="list-style-type: none">• Safe drinking water• Meeting appropriate standards for recycling and reuse for different uses	This includes affordability of and accessibility to adequate quantity and quality of urban water
<i>....and, achieving this is done through investment and operations that are economically efficient, financially and environmentally sustainable, and resilient to shocks</i>		

The definition builds on international definitions and characterisations of water security. It adopts a view of town and city water security that includes the wide array of values or benefits provided by water, beyond meeting critical human needs. Defining water security in this way helps capture the value that water provides to customers and communities. A narrower definition would risk diminishing the value of urban water and its contribution to social, economic and environmental outcomes.

The definition was tested with a range of stakeholders including state and territory governments, water utilities, industry bodies and water sector experts. It evolved with the benefit of stakeholder feedback and enjoys wide support in its current form.

The definition of town and city water security is important and should be adopted

The value of an agreed definition of town and city water security was clear from consultations and the literature review. The term *water security* is often used but rarely defined. Policy, planning and strategy documents often refer to water security without providing a description of what this means. For example, and as summarised further in Box 1, the *Water Act 2007* (Cth), the *Basin Plan 2012*, the

National Water Initiative 2004 (NWI), and even the *National Plan for Water Security* refer to, but do not define, water security (Taylor 2019).

While there are some existing water security definitions, the scope of these definitions varies considerably. For example, in different contexts water security can refer to water availability, water access, security of water-related services, and protection from water-related risks (such as flooding). This project focuses primarily on security of water supply services for towns and cities (hence the use of the term *town and city water security*) – an important area which warrants a clear definition.

Failing to define water security leaves no common point of reference for tackling related issues. During one consultation it was noted that *very often we all agree heatedly about a topic and it's only when we start to talk about what we really mean, that we recognise we have different perspectives*. Defining town and city water security can clarify objectives, enable more effective conversations among stakeholders, and is a prerequisite for monitoring and improvement over time.

The definition of town and city water security presented here frames the diagnostic. It has proved to be fit for purpose and has the potential to be adopted across the urban water sector to support a common framing, and guide policy and planning processes. Consideration should now be given to national adoption of this definition. One potential pathway to achieve this could be through a renewed NWI.

Box 1 – What the literature says about water security

The term 'water security' is often used but rarely defined. The research and consultation for this project demonstrated a clear need to better define *town and city water security* in Australia.

National, state and utility level water policy and plans reference water security and identify principles or criteria for how this is achieved (for example sustainably). But the term is generally not defined, and *water security* may be used interchangeably with *water availability* or *water supply*. International definitions of water security are more common and typically take a broader scope, often with more of a development focus.

Common elements in existing references to water security include:

- availability of water to meet urban water needs
- water quality that is fit for purpose
- affordable access to water for health, hygiene and sanitation.

These three objectives informed the definition of town and city water security developed and proposed for Australia.

1.2. Diagnostic for town and city water security

A diagnostic for town and city water security can support consistent, Australia-wide reporting.

This has the potential to help:

- identify common challenges or issues, and opportunities for improvement
- raise awareness of local or regional shortcomings where proactive intervention could improve preparedness for drought or other threats to water security

- support transparency and confidence in town and city water security
- provide a basis for knowledge sharing and capacity building.

A diagnostic aimed at supporting these outcomes was developed and successfully trialled across four different systems and utilities. It has three modules (Box 2), which reflect the broad architecture required for ensuring town and city water security.

Each module contains multiple indicators and questions that focus on quality, quantity and affordable access, at different scales and from different angles. For example, Module 2 focuses on national, state and territory functions and considers the application of the *Australian Drinking Water Guidelines* in supporting water quality, while Module 3 is focused at the system-level and considers actual water quality outcomes. The three modules are outlined in full at Appendix A.

Box 2 – Summary of diagnostic modules

- **Module 1 – Water information:** focuses on trends and changes in water supply, demand, quality and affordability based on water sector data and information. It does not require input from reporting entities. Instead, it uses existing datasets and reporting (including National Performance Reporting) to provide contextual information that complements and provides context to outputs from Modules 2 and 3.
- **Module 2 – National, state and territory functions:** reviews how effective national, state and territory level roles and functions are in supporting town and city water security. It includes questions with both multiple choice and short qualitative responses for completion by both utilities and governments. Module 2 consists of two parts
 - **Part A** – Covers national roles and functions spanning information provision, reporting and guidance, and the extent to which these efforts support town and city water security.
 - **Part B** – Covers state and territory roles and functions in supporting water security, including the interactions between state and territory-level planning and system-level planning.
- **Module 3 – System-level diagnosis of water security:** Combines the status and vulnerability of a system, with the effectiveness and implementation of planning responses, to diagnose town and city water security at the system level. It focuses on the ongoing security of the system, rather than status at a single point in time. The module was designed to be applicable across any system in Australia, which required simplification and assumptions. It is not a replacement for detailed system-level planning and management.

Town and city water security is dynamic, and there is huge variability across different geographies and supply systems. Consultation and trialling underscored that developing a 'one-size fits all' approach to monitoring and reporting on town and city water security across Australia would be difficult.

To overcome this challenge, the aim of the diagnostic is to reflect current practice and identify issues and opportunities for improvement, rather than attempting to set a best-practice model or particular approach for achieving town and city water security. This recognises that while there are common practices for achieving town and city water security across Australia, there are different methods and approaches for achieving the same outcomes.

A town and city water security diagnostic can help identify issues and opportunities for improvement

Application of the diagnostic will generate information to help build a national picture of town and city water security, and identify potential issues and areas for improvement (Figure 2). The diagnostic does not supersede or replace existing arrangements and processes but can help users to understand the effectiveness of steps being taken toward town and city water security, and the vulnerability of particular regions or areas.

The diagnostic is not intended to replace supply-demand planning at the system level, but information from the diagnostic can help to understand whether supply-demand planning is in place and working effectively. Generating these types of insights at scale (for example across regions or borders) provides the basis for better targeting and coordinating efforts in response. This might include infrastructure or non-infrastructure solutions and could involve federal, state or local efforts.

Figure 2 Purpose of diagnostic for reporting on town and city water security



The diagnostic responds to multiple calls for improved effort and coordination on town and city water security, as evidenced by recent reports:

- Infrastructure Australia's *2020 Infrastructure Priority List* identified 'town and city water security' as a national priority initiative, as well as announcing several specific infrastructure priorities to improve water security and calling for the development of a national water security strategy.
- The Productivity Commission's 2017 *Triennial assessment of national water reform* found that maintaining water security in major cities requires more robust and transparent centralised supply augmentation planning processes. It proposed formal compliance requirements for the *National urban water planning principles* to help improve urban water security.
- The *Review of the National Urban Water Utility Performance Reporting Framework* (2019) found that urban water security was an area of highest concern from a policy, performance and customer interest perspective.
- The Urban Water Reform Committee's (UWRC) *Advancing the urban water sector* (2019) identified urban water security as a major priority, and called for greater transparency and national reporting on urban water security as an action in response.

These examples highlight the importance of town and city water security for government agencies, utilities and customers, as well as the appetite and opportunity for more coherent and coordinated efforts across Australia.

1.3. The value of a definition and diagnostic

There is a range of benefits that will support improved town and city water security

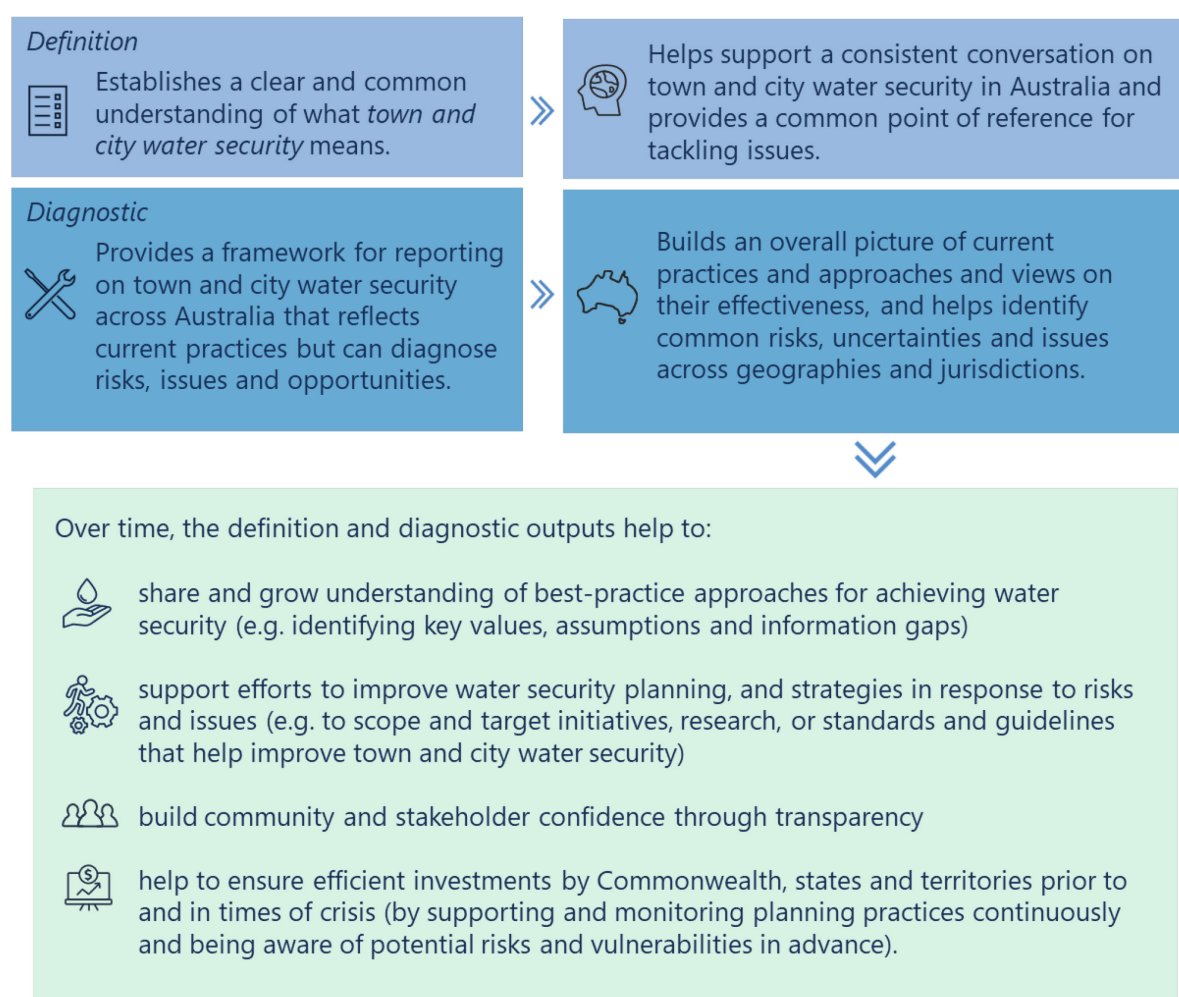
Town and city water security is a prominent issue. Repeated calls for greater attention to address water security challenges, alongside numerous examples of towns and cities threatened by water security issues, underscore the need for a better response.

Stakeholders identified many common questions and challenges through the course of the project – across different systems, regions and climates. Utilities and governments across the country all face the challenge of how to best manage an uncertain future. They are seeking information and ideas to help them make the decisions that will ensure town and water security into the future. The definition and diagnostic offer a range of benefits, including:

1. elevating the discussion of common issues and providing a consistent framing of town and city water security
2. building an overall picture of current practices, approaches and issues through regular reporting
3. providing the data and platform to support a range of strategic initiatives and improvements.

These benefits are further described in Figure 3.

Figure 3 The value of a definition and diagnostic for reporting on town and city water security



Implementation is feasible but will require further refinement, planning and engagement

There is good stakeholder support for the definition. It can be used in its current form for reporting on town and city water security and provides an appropriate foundation for the diagnostic. The definition could also be broadly adopted, and there is an opportunity to consider this through a renewed NWI.

The definition was tested with stakeholders, including state and territory governments, utilities operating in different environments, industry bodies and water sector experts from scientific bodies and universities. It is widely supported by stakeholders and aligns with leading literature and research.

Trialling of the diagnostic was successful, with four trials across four utilities with vastly different geographies and operating environments. Trialling yielded useful insights and demonstrated that the diagnostic is widely applicable and can be undertaken in a relatively short amount of time. This suggests that implementing the diagnostic across Australia is feasible with further refinement.

The first round of trials uncovered some shortcomings with the diagnostic, which led to changes and improvements ahead of the second trial round. The fact that the diagnostic benefitted from early trial and improvement suggests that further strengthening may be possible. A summary of the insights from trialling and testing the method is included in Box 3.

Despite over 30 consultations, and four trials, the diagnostic and definition were still only tested with a relatively small cross-section of the sector. This targeted approach was important for getting detailed input and allowing follow-up consultations and feedback. However, there was significant demand and interest for additional conversations and input from a range of stakeholders. Further stakeholder input is likely to improve the diagnostic beyond this proof of concept phase and will be needed to develop technical guidance, test sensitivities on reporting and to gain wider buy-in and support from the sector.

There is confidence in the logic and structure of the diagnostic modules. However specific indicators and metrics will benefit from further technical refinement and input. Given stakeholder interest it will also be important to socialise and test the definition and diagnostic openly as part of the finalisation process.

Implementation planning and coordination will also be required. While the diagnostic has a specific purpose and role, existing reporting arrangements and processes could be leveraged to minimise duplication and avoid unnecessary complexity in reporting. There are existing reporting processes established between utilities and state and territory governments, as well as under the National Performance Reporting framework. Working with these processes is likely to ease implementation and was viewed favourably by most stakeholders consulted.

Building on these insights, Section 1.4 outlines a pathway for bridging the gap between proof of concept and implementation across Australia.

Box 3 – Trialling insights

Insights from trialling and testing have been summarised in this box. They are included in more detail in Section 3.

The definition and diagnostic can be of value to the water sector, and support improved town and city water security. Stakeholders saw value in the definition and diagnostic, and identified a range of beneficial uses, from the definition supporting a more consistent conversation about town and city water security, to identifying common issues and challenges across regions and systems using the diagnostic.

The diagnostic can complement and sit alongside existing processes. It serves a specific unmet need and can add value to planning and policy that supports town and city water security, without duplicating or replicating existing efforts. For example, the diagnostic does not replace supply-demand planning, but can help identify how or where (geographically) supply-demand planning processes or capabilities might be improved.

The diagnostic tool in Module 3 performed well across different contexts and can help highlight system-level water security and its drivers. Module 3 was trialled across different systems with very different settings. It was found to work across different contexts and yield useful insights – noting further refinement will likely be required.

Qualitative indicators appear effective but will need further refinement. The diagnostic relies on a mix of quantitative and qualitative indicators or questions, which helps to produce more useful and useable insights but also means there is some subjectivity for certain indicators. This approach was tested in consultations and trialling and generally viewed as fit for purpose – noting subjectivity could be reduced through improved phrasing and guidance. It was noted that, while potentially more subjective, many qualitative indicators can also yield much deeper and more nuanced insights.

Implementation could align with other reporting and may suit shorter timesteps. Initial conversations on implementation supported the view that the diagnostic could be reported through similar, existing reporting processes to minimise reporting efforts. Further conversations on the frequency of reporting with a wider cross-section of the sector are needed, but reporting every 1-3 years appears reasonable. Somewhere in this range would strike a balance between the reporting burden and the usefulness (and currency) of the information reported.

1.4. Confirming the definition and diagnostic, and moving towards implementation

Proof of concept has been established

The outcomes of this project suggest that:

1. The definition of town and city water security is appropriate and supported. A consistent definition has value independent of the diagnostic and/or national reporting. Consideration should now be given to national adoption of the definition.

2. The diagnostic can be applied at different scales and to different systems. Consultation and trialling indicate that the diagnostic covers the right elements and, pending the further refinement and agreement to specific indicators, generates useful information about town and city water security.
3. There is sufficient interest and perceived value in applying the definition and diagnostic to support moving toward implementation and reporting across Australia.
4. Based on the trials, the diagnostic tool is straightforward to complete and the effort required is not a major barrier to implementation.

Building on these conclusions, further guidance on next steps and considerations for implementation have been developed.

Next steps and considerations for implementation

Further work is required prior to implementation

There are items that need to be resolved to proceed to national reporting on the diagnostic. Proposed next steps for consideration include:

1. Adoption or endorsement of the definition of town and city water security by each jurisdiction (potentially under a renewed NWI).
2. Further technical work to finalise specific diagnostic indicators and to develop guidance on using the diagnostic. This process requires expert technical input from the sector and will help ensure ownership of, and familiarity with, the diagnostic tool.
3. Detailed implementation planning to determine governance and resourcing arrangements, reporting frequency, and processes for data collection and collation, and report compilation.

A high-level pathway showing these steps is presented in Figure 4. There is additional information from the trialling and engagement process in Section 3 which can also inform scoping of the next steps.

Figure 4 Pathway to implementation



2. Developing a definition and diagnostic

This section explains the definition and the diagnostic, and the logic for each. The definition and diagnostic were developed and refined based on an extensive literature review, and multiple rounds of engagement and targeted trialling. The approach to developing the definition and diagnostic is summarised in Box 4. Reflections on how this approach informed the rationale and development of the definition and diagnostic are included in this section, while overall insights and lessons from testing and trialling are included in Section 3.

Box 4 – Summary of approach to developing definition and diagnostic

The definition and diagnostic were developed by drawing on available literature and consultation with a range of sector stakeholders. In the first instance a draft definition was developed along with a high-level scope for the diagnostic – including the need for separate modules to address different aspects of town and city water security. This initial work was tested through consultation with a number of stakeholders that included utilities, water sector experts and academics, industry bodies and government stakeholders.

The feedback informed the next iteration of a draft definition and diagnostic. These were tested through further consultation with sector stakeholders, as well as two trials with water utilities. This helped to confirm certain aspects of the definition and diagnostic, as well as areas for improvement.

The draft definition and diagnostic were updated based on feedback and tested again through further consultation with stakeholders and two more utility trials. This stage included engaging with some of the same stakeholders to test improvements and refinements based on the first round of testing.

While the approach to developing the definition and diagnostic included three iterations, four trials and many consultations, this still accounts for just a small cross-section of the sector. The process sought to test the definition and diagnostic across different systems and states and territories in Australia, but there is still a need for wider testing and socialisation of the definition and diagnostic.

Trials of the definition and diagnostic were conducted in-confidence with different utilities across Australia. The utilities participated faithfully and provided confidential information on the basis that the trial focus was to test and develop the diagnostic tool, not assess or report on their systems. The trial participants and results have therefore not been published in this report.

2.1. Developing the definition of town and city water security

The definition (see Section 1.1, Figure 1) is based on an extensive literature review of national and international definitions of, and methods for assessing, water security. An early iteration was tested with a mix of water sector academics and stakeholders (including utilities and government). Generally, only minor amendments were proposed with changes in language and clarification of terms such as 'liveability'.

The most substantive questions about the definition were whether it should be broad or narrow, and whether water security could be defined in more quantitative or definitive terms.

In some cases, water security can be synonymous with supply or water availability. However, defining town and city water security solely as having adequate quantity of water, or in terms of water availability, would neglect things like water quality and whether water is affordable and accessible. The consensus view supported a definition with a broader scope that considers quantity, quality and affordable access, and the range of uses and users that urban water can support (beyond water for critical human needs).

Adopting a more holistic definition for town and city water security was generally supported by consultees and seen to reflect the outcomes expected from ensuring town and city water security. The definition is also generally consistent with established international definitions of water security from the Global Water Partnership, the World Bank and UN-Water (Global Water Partnership 2000; Grey and Sadoff; UN-Water 2013) – all of whom adopt holistic and interdisciplinary definitions that aim to capture all perspectives and dimensions (see Table 1). Definitions of water security in Australia were also researched (see Section 1.1). However, whilst commonly used, the term water security is not often defined when applied domestically, or it is linked to established international definitions.

While existing water security definitions provide a good starting point, most also included elements beyond the scope of this project and its focus on town and city water security in Australia. For example, international definitions of water security also refer to protection from water-related risks (such as flooding or water borne diseases). This project focuses primarily on security of water supply services for towns and cities (hence the use of the term *town and city water security*) in the Australian context. The definition of town and city water security does not aim to capture other water services (including wastewater or stormwater) or more general water-related risks such as flooding.

Table 1 Standard water security definitions

Institution	Definition
Global Water Partnership	Water security, at any level - from the household to the global - means that every person has access to enough safe water, at an affordable cost, to lead a clean, healthy, and productive life, while ensuring that the natural environment is protected and enhanced.
World Bank	Water security is the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems, and production, coupled with an acceptable level of water-related risks to people, environments, and economies.
UN-Water	Water security is the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.

In developing the definition, use of the term *urban water security* was also researched. While there are some existing definitions of water security, there are fewer definitions at the scale of 'urban' water security, and no widely endorsed ones (Clement 2013; Allan et al 2018; Cook and Baker 2012; Nazif et al 2013; Howlett et al 2017; Damkiaer and Taylor 2017; Aboelnga 2019). Competing terms for urban

water security include integrated, sustainable and adaptive urban water management, urban water resilience, and climate-proof cities (Hoekstra et al 2018). These terms informed the definition but ultimately did not provide the right scope for defining town and city water security in this context.

The second key decision point was whether to define town and city water security in quantifiable terms, rather than more general objectives. This could include, for example, setting thresholds for whether a system or region is secure based on metrics like availability and reliability of supply, current and future demand, or the ability to restrict demand in times of shortage. While there are examples of methods that, in effect, define water security against a set of objective criteria or metrics, the major challenge is replicating this in a way that can apply to the very different systems and regions across Australia. What may be an appropriate threshold or measure of security in one context may not be as relevant in another context. Many jurisdictions also seek to involve customers in setting the level of service they want for their water supply system, given the trade-offs this entails (especially for prices).

For the scope of this project, defining water security as a threshold or a standard applicable across multiple systems, climates and geographies was not feasible. Instead, town and city water security has been defined qualitatively. This also allows other parties to have greater flexibility in how they might define more discrete water security targets or standards, where quantified targets or thresholds may be more appropriate (for example across a system, catchment or region).

2.2. Developing the diagnostic

This section introduces and explains the three modules of the diagnostic, as well as how they were developed and refined by building on research and engagement with stakeholders. The three modules of the diagnostic have specific functions and aim to cover the broad architecture of institutional arrangements, planning, service delivery and regulation that contribute to achieving town and city water security, at the system and utility level, through to the state and territory and national level.

Module 1 – Water security information

Module 1 is focused on water security data and information. It builds on existing datasets and reporting (such as National Performance Reporting (NPR)) and aims to provide contextual information that supports Modules 2 and 3 (and potentially enables comparison of outcomes across cities and towns with similar contextual factors). See Appendix A for the full set of metrics in Module 1 and the rationale for each.

Module 1 does not explicitly assess or evaluate water security, but tracks trends in water availability and supply, demand, and quality. The module does not require input from utilities or governments and can be completed based on existing reporting and datasets.

The trialling of this module revealed that there is a good level of availability and transparency of water security information for major urban centres through existing national datasets. The Bureau of Meteorology's (BoM) Water in Australia reports, annual NPR, and the National Water Account provide information against all indicators.

However, these national datasets do not represent the entire nation, and information at the town-level and for smaller urban systems is often not collected. Therefore, there are gaps in the data. For example, information presented in the annual NPR is only informed by the 80 utilities and councils and five bulk water authorities that report. While these authorities provide urban water services to over 20 million people across Australia, there are many systems that are not represented. The NPR

does not cover utilities with less than 10,000 connections, meaning the outcomes from many smaller utilities are not captured.

Testing and consultation confirmed there is a role for some contextual water information, but more valuable information will be captured through Modules 2 and 3 (see discussion in Section 3). Relying on existing datasets for contextual water information is generally appropriate (and avoids imposing additional reporting requirements), but could be improved by expanding the reach of information collection under existing processes.

Module 2 – National, state and territory functions supporting town and city water security

Module 2 focuses on how effective current roles and functions at the national and state and territory level are in supporting town and city water security. It includes questions with both multiple choice and short qualitative responses that are intended to be completed by both utilities and governments. It is not intended to be an in-depth evaluation of institutional arrangements or policy and planning processes. Rather, it is a survey of how utilities and governments view the efficacy of different functions and roles currently performed in support of town and city water security. See Appendix A for the full set of metrics in Module 2 and the rationale for each.

While issues of town and city water security typically manifest at the system level, roles and functions at both the national and state level play a vital role in ensuring town and city water security. The questions in Module 2 can help identify how national, state and territory level roles and functions can better support town and city water security. Module 2 is divided into two tranches targeted respectively at the state and territory level, and national level.

The first tranche of questions focuses on national functions regarding information, reporting and guidance. The federal government plays an important role in supporting water security through the NWI, providing leadership and guidance on common issues and needs (such as national principles or guidelines like the *Australian Drinking Water Guidelines*), collecting and reporting information (for example through the NPR), and providing information, science and analysis to support future planning.

The second tranche of questions focuses on state and territory functions and roles in supporting water security, including how this supports system level planning. State and territory governments have primary responsibility for water management. They undertake a range of water planning and management processes that ultimately set the basis for sharing of water resources, monitoring long-term water resource availability, and making decisions about major supply augmentations. This then informs how water businesses operate and undertake more detailed system-level supply-demand planning.

Module 2 was generally supported. However, some stakeholders questioned whether some of the questions were relevant or answerable for utilities. The utilities included in the trial did not have issues with responding to the questions, but there were mixed views from trial participants on the value of the information generated. Some saw Module 2 as particularly important and felt it provided valuable insights, while others saw it as less relevant to their day-to-day operations. These views likely reflected the respective participants' roles and frame of reference.

Stakeholder consultations helped to ensure the questions' scope was adequate, and to test whether the questions were understandable (and answerable). While feedback provided refinements, the structure of the module remained substantively unchanged from the initial draft version. There were also discussions about the usefulness of the module for different audiences and stakeholders and the value of the insights it can generate, which is further discussed in Section 3.

Module 3 – System-level diagnostic

Module 3 focuses on water security at the system level. It is more complex than Modules 1 and 2, and combines multiple answers to produce a diagnosis of water security at the system level.

A key challenge for the development of a system-level module was the need to ensure its applicability to any context. In response, the approach taken was to first consider the critical elements that help to diagnose water security in any system:

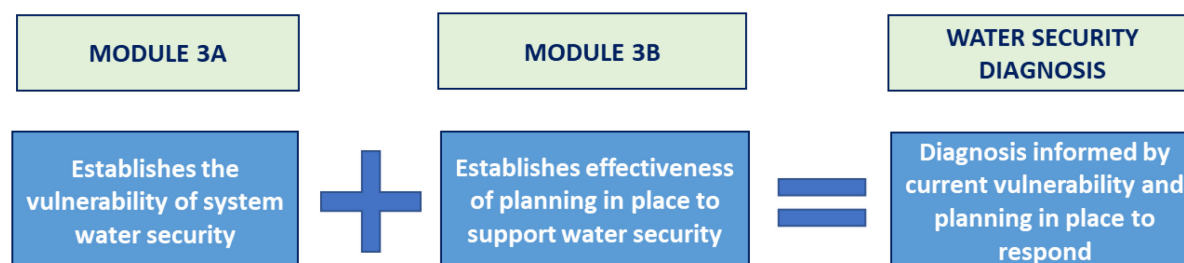
1. the vulnerability of the system, arising from its attributes and existing status
2. the appropriateness and effectiveness of the planning in place to respond.

The first element recognises that few, if any, systems do not have at least some level of water security vulnerability (including both quantity and quality), especially over time. The ability to achieve and maintain water security is then dependent on the capacity to understand and respond to that vulnerability.

Detailed technical and analytical approaches exist to inform these elements. However, the way this is performed will differ between jurisdictions, and even from system to system within jurisdictions. It is only appropriate, for example, that much greater analytical complexity and effort is deployed in the water security planning for a capital city of four million than for a town with a population of a few thousand.

The design of the module needed to avoid unnecessary detail and focus on aspects common to any system, of any scale, in any jurisdiction. The combination of the elements of *vulnerability* and *planning effectiveness* provided this framework (Figure 5).

Figure 5 Conceptual summary of Module 3 (system-level water security diagnosis)



The intent is to provide an indicative diagnosis of water security, to help inform broad trends and opportunities. It is not a substitute for the more detailed analysis that is and should be undertaken by utilities for every system.

The assessment is qualitative and does not attempt to quantify, rank or prescribe a level of performance. The outcome of the water security diagnosis is a qualitative description, based on the outcomes of the respective vulnerability and planning effectiveness assessments (Figure 6). Although the final water security diagnosis infers some level of performance through the position in the outcome matrix, the value is in understanding whether water security is at risk, and what is driving this.

The specific indicators for Module 3 (parts A and B) are listed in full and explained in Appendix A along with further explanation of the design of the module.

Figure 6 Water security diagnosis outcome

WATER SECURITY DIAGNOSIS OUTCOME		EFFECTIVENESS & PERFORMANCE		
		A robust plan to maintain water security exists	A plan to maintain water security exists, but may be incomplete or have shortcomings	No evidence of a plan to maintain water security over the long term
VULNERABILITY ASSESSMENT	System status or attributes suggest water security is not vulnerable	System attributes and robust planning support good water security	System attributes support good water security despite some planning shortcomings	A lack of planning could undermine water security over the longer term
	System status or attributes suggest water security may be vulnerable	Potential vulnerability is mitigated by robust planning to support water security	Planning shortcomings could be inadequate to address potential system vulnerability	Water security is undermined by a lack of planning to mitigate potential system vulnerability
	System status or attributes suggest water security is vulnerable	Water security is supported by robust planning, but may be limited by underlying system attributes	Water security could be undermined because shortcomings in planning don't address system vulnerability	Water security is vulnerable and there is no plan to improve it

3. Insights and lessons

This section discusses the overall insights and lessons from this project. It draws from the process of developing the definition and diagnostic, and consultations and trialling with stakeholders, to reflect on:

- the value of having a definition and diagnostic
- whether the diagnostic can be applied consistently to a system of any scale in any location, and
- how diagnostic might be implemented, and the outcomes reported.

The content in this section provides additional information in support of the insights and lessons summarised in Section 1, including further detail that may assist in informing next steps.

3.1. Insights on the definition and diagnostic

The definition and diagnostic can be of value to the water sector, and support improved town and city water security

Although testing and trialling of the definition and diagnostic often focused on technical accuracy and robustness, a key feature was also testing whether there was value in the overall concept of establishing a definition and diagnostic for reporting on town and city water security across Australia. Most stakeholders were supportive of the concept, and saw potential value in reporting at scale. Through testing and trialling, the purpose and value of the concept was defined and demonstrated (with changes flowing through to the definition and diagnostic).

The definition and diagnostic can support a more consistent and clear discussion about water security, generate a better national picture of the status of town and city water security, and identify common risks, uncertainties and issues. It also provides the basis for supporting a range of wider improvements and outcomes over time. For example, the diagnostic generates information that can:

- share and grow understanding of best-practice approaches for achieving water security (such as identifying key values, assumptions and information gaps)
- support efforts to improve water security planning, and strategies in response to risks and issues (for instance to scope and target initiatives, research, or standards and guidelines that help improve town and city water security)
- build community and stakeholder confidence through transparency
- help to ensure efficient investments by the Commonwealth, states and territories prior to and in times of crisis (by supporting and monitoring planning practices continuously and being aware of potential risks and vulnerabilities in advance).

The definition is well supported and can be used in its current form

The definition was tested with water utilities, state and territory governments, industry bodies and water sector experts. It evolved with the benefit of stakeholder feedback and enjoys wide support in its current form.

Throughout consultations only minor refinements were proposed and made to the definition, and the definition is largely aligned with leading literature and research on water security. Given this, there is confidence that the definition is appropriate and can be used in its current form. The exception to this may be minor refinements to words or phrasing. For example, of the changes made since the definition was first drafted, most related to preferences regarding specific terms (such as changing 'potable water' to 'drinking water'). Such changes that do not materially alter the meaning of the definition may be useful if it improves understanding and readability.

While the definition is important in the context of the diagnostic and reporting on town and city water security, it has wider applicability and value. Some stakeholders made the point that there was value in a clear and commonly used definition of town and city water security independent of the diagnostic or reporting arrangements. There is a clear opportunity to establish a definition of town and city water security in Australia that can help frame policy and planning, and provide a common starting point for tackling issues. Adopting the definition at the national level should be given further consideration.

Modules 1 and 2 are appropriate but may require some refinement

Testing of Modules 1 and 2 produced similar findings about their overall appropriateness and usefulness. Each was seen as having relevance in the diagnostic, and only minimal refinements were made based on consultation. Some stakeholders thought the two modules were not particularly useful but necessary, while others found them critically important.

The main limitation of Module 1 highlighted by stakeholders is that it relies on existing reporting arrangements that do not provide complete coverage of the urban water sector. This is not a fatal flaw of the module, but reporting on town and city water security could be enhanced if existing reporting requirements were extended to smaller utilities.

Module 2 was viewed as very important to some stakeholders, and less so to others. Some utilities were not as concerned with national, state and territory functions and roles, and were more concerned with Module 3. However, most government stakeholders, industry representative bodies and indeed several utilities saw particular value in reporting on Module 2. The trialling and testing of Module 2 showed that it can produce useful insights; for example, on the perceived usefulness and appropriateness of government guidance and information to support planning (and how this could be improved). Capturing this information across utilities and regions would be particularly informative for improving policy and planning, and could help inform government decision-making.

On balance, most stakeholders saw value in Module 2, and some believed it was critical to the diagnostic as it pertained to roles and functions that are essential for ensuring town and city water security. While it is difficult to assess the effectiveness or robustness of the module (as it is exploratory in nature and will be of use when multiple responses are recorded and analysed), there is enough evidence and support to confirm that it is an important feature of the diagnostic.

Minor refinements may benefit Modules 1 and 2 as part of next steps, but they appear largely fit for purpose and should not require substantial changes.

Module 3 can help highlight system-level water security and its drivers

Trial participants generally saw merit and value in the system-level diagnosis from Module 3, and felt (with the benefit of testing and refinement) it produced a relatively robust and reasonable appraisal of their system.

Partly because of the climate conditions that much of Australia has faced in recent years, the issue of water security had primacy for most respondents. They could readily relate to the scope of the diagnostic, and saw value in its potential to elevate and highlight the status and drivers of water security outcomes for their systems.

It was often noted that the trial was a 'safe' and isolated environment in which to interrogate system-level water security. While participants were comfortable that the findings relating to their respective systems were reasonable, they also recognised the likelihood that their businesses may be less comfortable sharing the findings widely, or publicly.

For the value of Module 3 to be realised, perceptions about the purpose of reporting on water security will need to be carefully managed. Respondents indicated that any sense that utilities are being judged, or 'shamed', will be a clear disincentive to participation. The trials demonstrated the value that the method can provide in highlighting and raising awareness about potential improvement opportunities – both within the businesses themselves, and when trends and outcomes are observable from aggregated responses. Ensuring this value outweighs any perceived risk will be an important element of the method's further development (and possible implementation).

This can be supported by:

- continuing to emphasise the purpose of reporting on water security, the benefits, and that the outcomes are not a judgement of utilities' performance
- nuancing the wording of the diagnosis outcomes, focusing as far as possible on dispassionate and factual descriptions
- considering the way outcomes are presented, such as avoiding colours (such as 'traffic light' icons) that might have unintended connotations.

The system-level diagnosis performed well across different contexts

The system-level diagnosis in Module 3 – combining the elements of system vulnerability with the effectiveness of planning in response – was widely endorsed as a useful way of approaching a diagnosis of water security. There was a good appreciation of the contribution of planning and preparedness to water security, and therefore the inclusion of related indicators.

The case studies represented a reasonable diversity of systems (different scales, jurisdictions, climates and infrastructure). In each case, the participants felt that the method provided a fair diagnosis of water security in their system, suggesting it has the potential to be applied successfully in any context. This supports proof of concept; however, it is likely that further technical work will support refinements and improvement.

The NPR framework provides a comparable example of the approach and effort that is required to resolve indicators, both to agree on their relevance and to ensure clarity and consistency in their definition. It is envisaged that an industry-led process (such as a technical working group) to finalise the method would:

- bring the right technical skills to ensure indicator appropriateness and clarity
- build ownership and acceptance of the diagnostic.

The concept of a technical working group has been reflected in the proposed next steps in Section 1.

Qualitative indicators appear effective but will need further refinement

The proposed indicators for the system-level diagnostic (Module 3) are not heavily reliant on data. On one hand, this is at odds with the very analytical approach that is required when assessing and planning water security. However, Module 3 had to grapple with the challenge of identifying indicators that are appropriate in all systems in any context across the country. Identifying objective, data-driven indicators that are universally relevant and insightful was viewed as challenging and potentially inappropriate.

This view was largely endorsed through the trials, where it was agreed that many objective measures of performance for one system may not be relevant for another. Further, if pursuing data-driven, objective indicators of system performance, the number and complexity of the indicators required to cater for all circumstances is likely to be significant.

The system-level diagnostic instead relies upon a set of indicators framed as questions. Despite the potential subjectivity of these questions being a common point of discussion, respondents did indicate a good level of comfort with this approach. No alternative quantitative measures were able to be identified through the trials, while feedback suggested the indicators were generally clear. They also benefitted from improvement over the course of the trialling and consultation.

It is expected that this process of indicator refinement will need to continue. They are objective to the extent that they elicit a discrete, qualitative response (yes or no), but the indicator description (and guidance) must be clear and unambiguous to ensure responses are consistent and reliable. This is no different to the process of defining any objective performance measure, where different interpretations are possible across the range of respondents.

System attributes alone are not sufficient to diagnose water security

The staged trial process provided valuable insight that helped inform the evolution of the method for system-level diagnosis.

An early iteration of Module 3 attempted to diagnose system vulnerability by considering specific attributes (such as the number of sources, rate of change in demand, or availability of climate-independent supply). The intent was to identify common attributes that were potential indicators of relative water security, but feedback emphasised that this was not being achieved by the types of indicators that are available.

This led to a shift to focusing on the outcomes being delivered by a system, rather than relying on attributes as a proxy for potential vulnerability. As an outcome most widely associated with risks to water security, the implementation of water restrictions became central to the method for the system-level diagnostic as a result.

Even if water restrictions are applied differently across states and territories, the concept is generally well understood. Demand management is a legitimate measure amongst many to help manage periods of water shortage, but water restrictions – by their nature – present evidence of the potential inability of a system to meet all water needs.

3.2. Insights on application and implementation

Responses were readily facilitated with the use of the tool

The diagnostic tool needs to find the right balance between the complexity and volume of information required, and the robustness and value of the insights that this can deliver. The balance to strike is between:

- too little, or the wrong information, which risks outputs that are unhelpful at best and false at worst
- too much, or overly complex information requirements that are a disincentive to participation, create administrative burden and potentially risk incorrect data returns.

The trials gave confidence that the diagnostic finds this balance, given that participants were able to complete all indicators in a reasonable time, and the water security diagnosis for each system was considered a fair representation.

Respondents typically noted they were able to respond to all indicators in the diagnostic tool within an hour. While it was often observed that this was a 'rapid' assessment, this at least suggests that the number and clarity of the indicators present limited administrative burden when responding. The tool itself proved robust, and with further refinement could be readily used for future data returns.

Although there was a high degree of comfort in using the tool and responding to the indicators, it was noted that this needed to be undertaken by someone suitably qualified (whether one person or many). This is a function of the qualitative nature of the indicators, which imply a good understanding of system status and planning.

However, this was not seen as a barrier, and it was considered appropriate that the right people within a business should be considering and verifying responses.

The diagnostic can complement and sit alongside existing processes

Trial participants tended to try to reconcile the diagnostic with the existing water security planning and reporting processes in their jurisdiction, which vary across the country. Feedback suggested that the diagnostic was not duplicative of existing reporting, where this already occurs, or presented a risk of reporting an outcome that could conflict with other processes.

There also needs to be recognition that this work does not replace or supersede the detailed planning that utilities and state and territory governments undertake. The outputs of this detailed planning are more likely to help inform responses to the diagnostic indicators.

Respondents invariably found the diagnostic straightforward and quick to respond to (while noting that a more considered approach would be necessary for formal submission). However, it was also noted that ensuring a simple and efficient reporting process and avoiding imposing significant additional requirements on utilities would be critical to successful implementation.

Implementation could align with other reporting and may suit shorter timesteps

Parallels with the NPR were drawn by some respondents, who saw a potential opportunity to align reporting on water security with, or as part of, that annual process. However, there were not strong views on the best approach to implementation. There is a clear preference to avoid duplicating or exacerbating reporting requirements. Concerns about this were generally mitigated by the view that the response was relatively straightforward and would not be overly burdensome.

There was also an absence of firm views on the most appropriate frequency of reporting. The discussion balanced the relative burden of reporting more frequently with the value of the insights that reporting would deliver (as well as the likelihood of any change between reporting periods). In general, there was a tendency towards annual or biannual reporting given:

- the administrative burden does not seem excessive
- circumstances can change materially within this timestep.

There was a recognition that annual reporting against the system-level indicators (Module 3) is probably appropriate and useful, but less change could be expected on that timestep for indicators relating to functions and roles (Module 2). This is a question that will be best answered through detailed implementation planning and testing with stakeholders.

Resourcing requirements are reasonable but there are some unknowns

Based on the trialling to date, indicative resourcing for different parties required for implementation is summarised in this subsection. The two main roles for reporting are the role of the party or agency responsible for reporting ('the report administrator'), and those required to report against the diagnostic ('reporting entities').

The definition and diagnostic will ultimately require a clear 'owner' and process for collecting data, collating, analysing and reporting. Further work and discussions between relevant agencies are required to determine the best arrangement. Information on potential resourcing requirements from this project can help inform these discussions.

Report administrator

A 'report administrator' will be required to manage data collection, collation, analysis and reporting. The diagnostic has been designed in a way that this could be undertaken by different parties. The report administrator could be an independent third party or the agency responsible for the definition and diagnostic.

Module 1 can be completed by the report administrator and could be done with minimal effort – provided the right data is available. Modules 2 and 3 would require considerably more time.

The main unknown regarding resourcing is the time required to collect and collate information. This could be relatively efficient if reporting occurs through an existing process, but would be a major undertaking if done as a separate data collection exercise.

It is estimated that a national report combining the results from the diagnostic could be compiled in approximately 3 months, with an equivalent of 2-3 full-time equivalents (FTEs) over that period. This could potentially be streamlined in subsequent years if a standardised reporting template is used.

Reporting entities

Utilities, as well as state and territory governments, would be required to report on the diagnostic. Utilities provide responses to Modules 2 and 3, while state and territory governments would provide responses to Module 2 only.

State and territory governments could provide their responses with minimal resourcing. For a suitably informed representative, Module 2 could be completed in approximately half an hour to an hour. However, the time to agree and sign off on information reported may take longer depending on internal processes.

Utilities (including local government water businesses) would be required to report on Module 2 once, and for each system they operate for Module 3. This varies the resourcing required by each water corporation based on the number of systems.

As an indication, trial participants completed Module 2 and Module 3 (for one system) in approximately an hour or less. Providing multiple responses to Module 3 for different systems could become more efficient once familiar with the tool (around 20 to 30 minutes), however some utilities span many systems (particularly some state-wide water corporations).

It should be noted that trial conditions removed some of the sensitivities for utilities in providing information on town and city water security. Reporting information may require more checks before being returned when the output will be a public report. This could increase the required resourcing but would depend on the utility.

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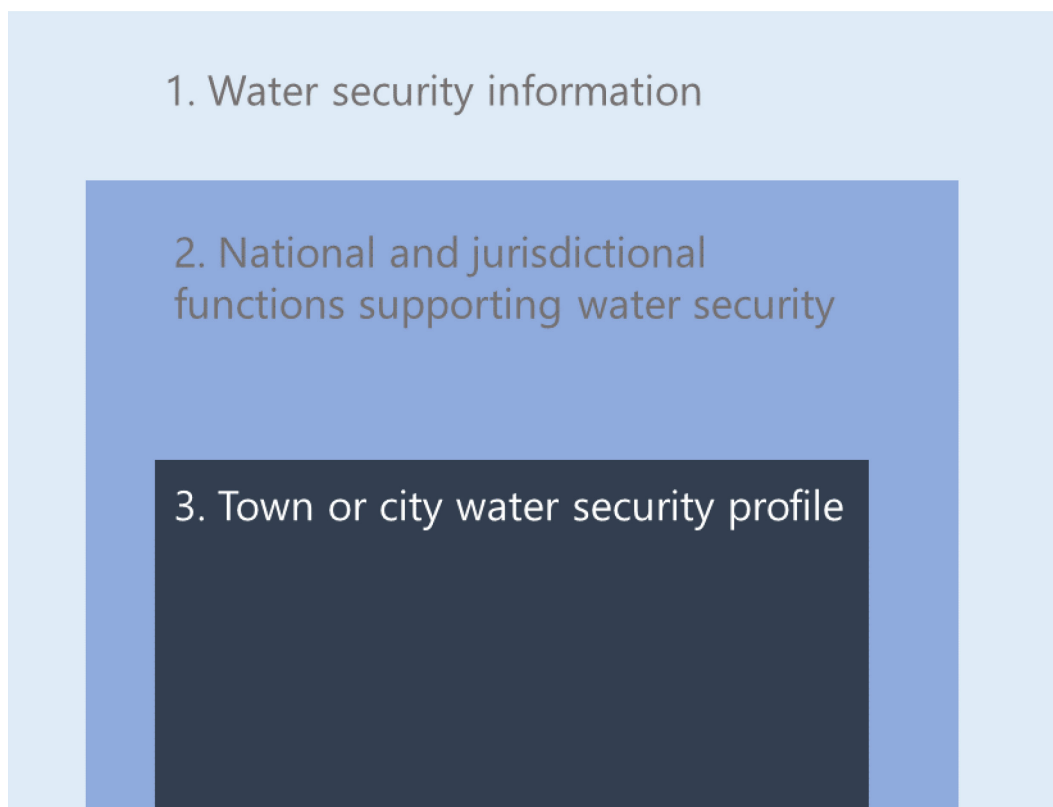
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Appendix A- Diagnostic indicators and rationale

This appendix further details the rationale for Modules 1, 2 and 3 of the diagnostic. The diagnostic was developed using different 'modules' that reflect the settings and practices that support town and city water security. The diagnostic aims to respond to the different dimensions of the definition of town and city water security in section 1.1.

The three modules are shown in Figure 7. They flow from more general (1) information on water security, to (2) national and state and territory functions and process, down to (3) the system level. Each module has a slightly different purpose and focus and contains a mix of both quantitative indicators/metrics and evaluative questions. Each of the three modules is outlined in the next three subsections.

Figure 7 Methodology modules



Module 1 – Water security information

Module 1 is focused on water security data and information. It builds on existing datasets and reporting (such as the NPR) and aims to provide contextual information that supports Modules 2 and 3 (and potentially enables comparison of outcomes across cities and towns with similar contextual factors).

Module 1 does not explicitly assess or evaluate water security, but tracks trends in water availability and supply, demand, and quality over time. The module does not require input from utilities or governments and can be completed based on existing reporting and datasets.

The indicators contained in this module are shown in Table 2.

Table 2 Module 1 Indicators

No.	Indicators	Description
1.1	Balance of storage levels for all major urban water supply (and change over time) (%)	Provides snapshot of storage levels across the country, and change over time.
1.2	Total urban water use (and change over time) by residential and non-residential customers (ML / yr)	Shows the overall demand for urban water and how this is changing over time.
1.3	Average volume of water supplied per residential property (ML / property)	Shows demand at the household level, noting there are differences across different geographies.
1.4	Urban water use by water source (ML / yr)	Shows the relative reliance on different water sources and how this might change over time (for instance greater reliance on climate independent sources for example).
1.5	Number of utilities with non-permanent water restrictions in place (and change over time)	Provides a high-level metric of systems experiencing water stress, noting there is not a standard for levels of water restrictions.
1.6	Historical and projected temperatures	Recorded and projected temperatures can influence both supply and demand, and tracking changing temperature can help understand what impacts on supply and demand might occur.
1.7	Historical and projected rainfall	Many systems are still largely reliant on rainfall for supply. Looking at historical and projected rainfall trends provides high-level insights into water availability.
1.8	SDG 6.4.2 water stress indicator - Freshwater withdrawal as a proportion of available freshwater resources	Australia currently reports on Sustainable Development Goals (SDG), including SDG 6.4.2 which focuses on water stress.
1.9	Percentage of population where microbiological compliance was achieved	Water quality is a key dimension of water security. Microbiological compliance (based on the NPR indicator H3) was viewed as the best overall measure of quality (noting other modules contain more specific questions on water quality at the system level).

No.	Indicators	Description
1.10	Annual water bill: annual residential bill for 200kl per annum and typical residential water bill per annum	Shows changes and trends in water bills across the country as a generally proxy for affordability.

Module 2 – National, state and territory functions

National, state and territory roles and functions support town and city water security. State and territory governments retain the ultimate responsibility for water resource management and planning, while the Commonwealth Government often plays a supporting role through information, guidance and collaboration on joint-challenges (such as the NPR or the National Water Quality Management Strategy).

This module includes survey style questions that aim to unpack the effectiveness of current arrangements in supporting town and city water security. In the diagnostic tool, most Module 2 questions require both a Likert scale response, and provide an option for a short, written response. Where questions have multiple dimensions (such as 'is the information *available* and *used*?') the response sheet requires answers to both dimensions (is the information available [select answer], and is the information used [select answer]). Questions are provided in Table 3 and Table 4.

Table 3 Module 2 Part A questions

No.	Questions	Description
2.1a	Is the Bureau of Meteorology (or designated agency) continuing to collect, hold, manage, interpret and disseminate Australia's water information in line with Part 7 of the Water Act 2007?	This question would be assessed by the report administrator and is a basic measure of whether water information requirements are being met.
2.2a	Is national water information accessible and does it support transparency and planning?	This question would be assessed by the report administrator and is a basic measure of whether water information is readily available.
2.3a	Is national guidance on best practice urban water planning and security (including national urban water planning principles) understood and applied?	This question seeks input on the extent to which national guidance on urban water planning and security is understood, and used in practice.
2.4a	Is guidance for water quality management under the National Water Quality Strategy and associated guidelines appropriate and useful? Is coordination of the Strategy efficient and effective?	This question requests input on the appropriateness and usefulness of the National Water Quality Strategy as a measure of the effectiveness of the national efforts on supporting water quality.

No.	Questions	Description
2.5a	Is the information about climate change (including projections) required to inform planning and understanding of future risks available and used?	Many states and territories, and utilities are grappling with climate change. Federal agencies play a major role in providing climate change information and forecasting and this question aims to understand with the sector believes this is adequate and used.
2.6a	Is the guidance and support required to incorporate future risks to water resources from climate change into planning and management practices available and used?	This question builds on Question 2.5a, following feedback that often the capacity and knowledge to translate climate change science into planning and management is an issue (and barrier to water security).

Table 4 Module 2 Part B questions

No.	Questions	Description
2.1b	Is there a jurisdiction-level water resource strategy that provides clear policy and strategic direction about water resource management?	State or territory level water resource strategies or plans are important for establishing a clear direction for water resource management, and provide confidence that the water sector can meet future needs. This question would be assessed by the report administrator based on a review of available documents rather than a response from participants.
2.2b	Is a jurisdiction level water resource strategy updated or reviewed no greater than every 10 years?	This is a follow-up question to the prior question focused on the currency of the water resource strategy. This question would also be assessed by the report administrator based on a review of available documents rather than a response from participants.
2.3b	Is there a clear framework for how water resources are shared across the jurisdiction?	Either as part of a water resource strategy or similar, having a clear framework for how water resources are shared is important for maintaining water security. This includes clear entitlements and robust arrangements for sharing of water across different uses (such as rural vs. urban). This question would be assessed by the report administrator based on a review of available documents rather than a response from participants.

No.	Questions	Description
2.4b	Is there a clear process for assessing long-term water resource availability? Is water resource availability quantified and well understood (where long-term is at least 20 years)?	Having an understanding of long-term water resource availability is critical for effective planning. This question is supported by multiple sub-questions that unpack long-term water resource planning settings including the timing of the last assessment and whether the information is used and embodied in planning.
2.5b	Is there a robust framework within the jurisdiction for undertaking system-level supply-demand planning?	State and territory governments typically set the terms for utilities to undertake system-level supply-demand planning. This question unpacks the extent to which this is done, and the views of the sector on the adequacy of the approach.
2.6b	Are roles and responsibilities for system planning and operation clearly defined (including trans-boundary or vertically dis-integrated arrangements)?	Town and city water security can be undermined where there is a lack of clarity across roles and responsibilities. The question aims to understand the extent to which stakeholders view roles and responsibilities as being clear.
2.7b	Is information required to support future water security planning (including impacts of climate change and population forecasts) available, appropriate and used?	Good information underpins good planning, which is key to ensuring town and city water security. This question looks at the availability and appropriateness of information needs to support effective planning – and whether this information is used in practice.

Module 3 – System-level diagnostic

Conceptual logic

A key challenge for the development of a system-level method was the need to ensure its applicability to any context. In response, the approach taken was to first consider the critical elements that help to diagnose water security in any system:

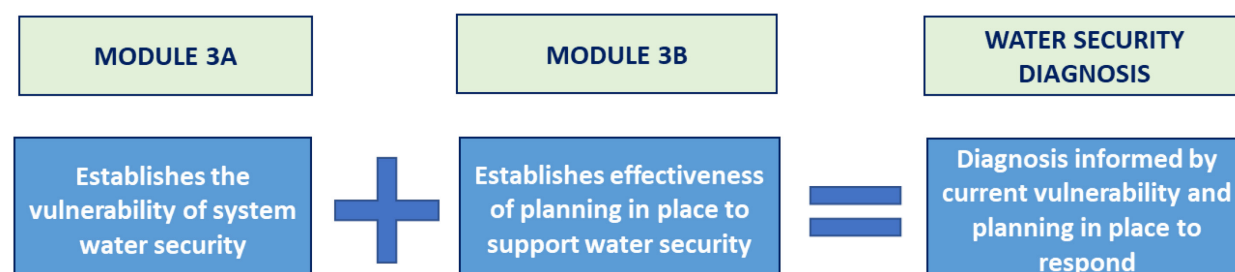
1. The vulnerability of the system, arising from its attributes and existing status
2. The appropriateness and effectiveness of the planning in place to respond.

The first element recognises that few, if any, systems do not have at least some level of water security vulnerability (including both quantity and quality), especially over time. The ability to achieve and maintain water security is then dependent on the capacity to understand and respond to that vulnerability.

Detailed technical and analytical approaches exist to inform these elements. However, the way this is performed will differ between jurisdictions, and even from system to system within jurisdictions. It is only appropriate, for example, that much greater analytical complexity and effort is deployed in the water security planning for a capital city of four million, than for a town with a population of a few thousand.

The method needed to avoid unnecessary detail and focus on aspects common to any system, of any scale, in any jurisdiction. The combination of the elements of vulnerability and planning effectiveness provided this framework (Figure 8). The intent is to provide an indicative diagnosis of water security, to help inform broad trends and opportunities. It is not a substitute for the more detailed analysis that is and should be undertaken by utilities for every system.

Figure 8 Conceptual summary of Module 3 (system-level water security diagnosis)



The assessment is qualitative and does not attempt to quantify, rank or prescribe a level of performance. The outcome of the water security diagnosis is a qualitative description, based on the outcomes of the respective vulnerability and planning effectiveness assessments (Figure 9). Although the final water security diagnosis infers some level of performance through the position in the outcome matrix, the value is in understanding whether water security is at risk, and what is driving this.

Figure 9 Water security diagnosis outcome

WATER SECURITY DIAGNOSIS OUTCOME		EFFECTIVENESS & PERFORMANCE		
		A robust plan to maintain water security exists	A plan to maintain water security exists, but may be incomplete or have shortcomings	No evidence of a plan to maintain water security over the long term
VULNERABILITY ASSESSMENT	System status or attributes suggest water security is not vulnerable	System attributes and robust planning support good water security	System attributes support good water security despite some planning shortcomings	A lack of planning could undermine water security over the longer term
	System status or attributes suggest water security may be vulnerable	Potential vulnerability is mitigated by robust planning to support water security	Planning shortcomings could be inadequate to address potential system vulnerability	Water security is undermined by a lack of planning to mitigate potential system vulnerability
	System status or attributes suggest water security is vulnerable	Water security is supported by robust planning, but may be limited by underlying system attributes	Water security could be undermined because shortcomings in planning don't address system vulnerability	Water security is vulnerable and there is no plan to improve it

Determining system vulnerability (Module 3A)

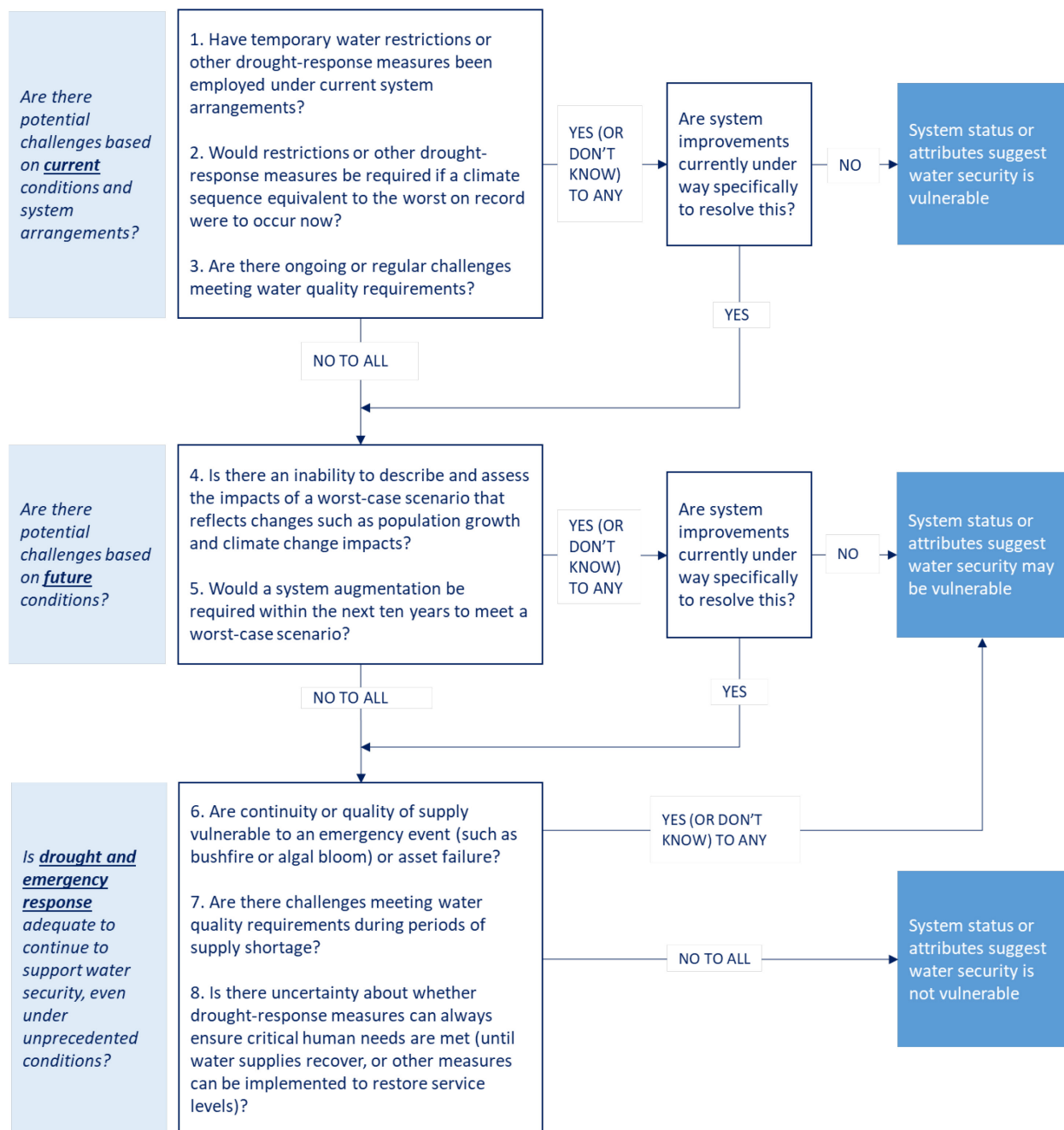
Achieving water security is primarily about managing future uncertainty, whether natural climate variability, changes in climate and population, or the shock of events such as severe drought or bushfire. In this context, the term vulnerability has been used here to describe the extent to which a water supply system is understood to be resilient to these future impacts.

The method does not aim to determine this precisely, but it does rely on reasonable system-level analysis having been undertaken to help inform it. It also takes the precautionary position that the absence of this analysis (a lack of understanding) is an inherent indication of potential vulnerability.

The vulnerability assessment uses a series of questions as indicators, which combine to *suggest* whether a system is, may be, or is not vulnerable. Although all the indicators can be responded to independently, the outcome of the assessment is based on the logic illustrated in Figure 10. This means that, while all indicator responses are captured, some have primacy in determining the outcome.

The method also aims to account for the fact that water security – and the way utilities aim to achieve it – is rarely static.

Figure 10 Module 3a system-level vulnerability assessment



The intent and logic for each indicator is detailed further in Table 5. At a high level, the assessment logic is that systems:

- experiencing challenges with water availability and/or quality under *current* conditions are vulnerable
- not currently experiencing challenges, but will do so in the *future* (indicatively the next ten years), may be vulnerable
- not expecting to face challenges, and always able to meet critical needs, are not vulnerable.

The implementation of this logic is clearly subject to clearly and unambiguously defining the thresholds between these relative states. The indicators and accompanying guidance attempt to do this, but it is expected they will benefit from further development. In doing so, it will be important to balance the precision that is required of the indicators with that expected or required of the outcome. The current approach is premised on the view that some degree of subjectivity or imprecision can still deliver the insight required, without attempting to resolve or remove all subjectivity from every indicator.

Table 5 Module 3A indicators and guidance

Indicator	Guidance & logic
Have temporary water restrictions or other drought-response measures been employed under current system arrangements?	<p>Seeks to understand whether water restrictions and/or other drought response measures have been temporarily required in the past to help manage demand when supply is reduced. This excludes permanent restrictions (for example water saving) and would not apply if a major system augmentation had been implemented since restrictions were last applied.</p> <p>Noting restrictions are a legitimate and important means of managing some systems, the logic is that their implementation is, by definition, an indication that a system is vulnerable to supply shortages.</p>
Would restrictions or other drought-response measures be required in the next few years if a climate sequence equivalent to the worst on record were to occur?	<p>Seeks to understand whether - regardless of past restriction regimes and any subsequent demand and supply-side responses - the system would likely face restrictions to manage climatic conditions equivalent to the worst sequence on record (as relevant for the system - whether short-term or prolonged).</p> <p>This indicator complements the first question because it recognises that systems have experienced climate extremes to different extents, with some having been exposed to worst conditions on record, while others have not.</p>

Indicator	Guidance & logic
Are there ongoing or regular challenges meeting water quality requirements?	<p>Seeks to understand whether meeting water quality requirements - consistent with relevant guidelines - is a persistent challenge for the system. Recognising that factors can contribute to incidental non-compliance in even the most robust system (and that an arbitrary compliance threshold may not be a good indicator of system vulnerability), informed judgement about the system robustness is expected.</p> <p>This indicator addresses the inclusion of water quality in the definition of water security.</p>
Is there an inability to describe and assess the impacts of a future worst-case scenario that reflects changes such as population growth and climate change impacts?	<p>Seeks to understand whether there is the ability to confidently model a range of possible future scenarios (typically based on relevant guidance) to assess the way the system will perform. Noting there will always be uncertainty attributed to the inputs and assumptions (such as population forecasts, or climate change impacts), this is about the ability to use data that is available to provide some indication of the future outcomes for the system.</p> <p>This (and the next) indicator is based on the expectation that utilities should have the capacity and capability to model and understand the implications of possible future scenarios to at least some extent (consistent with relevant jurisdiction guidelines). Limitations to (or the absence of) this capability and understanding is taken to represent a potential vulnerability, on the basis that the future robustness of the system is not well known.</p>
Would a system augmentation be required within the next ten years to meet a worst-case scenario?	<p>Seeks to understand how soon a system augmentation would be required to ensure service levels can be maintained, should a worst-case scenario eventuate. The 'worst-case' scenario is premised on the informed modelling of potential future scenarios (likely to be consistent with relevant guidance). If this modelling has not occurred, or possible future scenarios are not understood (if the answer to the preceding question is either 'no' or 'don't know'), then the answer to this question is most likely to be 'don't know'.</p>
Are continuity or quality of supply vulnerable to an emergency event (such as bushfire or algal bloom) or critical asset failure?	<p>Seeks to understand the extent to which water supply is at risk of protracted interruption (potentially requiring restrictions or other measures) from an emergency event or failure. This requires informed judgement, likely to be based on system operators' existing risk assessment processes. For example, many systems may face this risk to some extent, but it is either evaluated as very low, or readily mitigated and managed. By contrast, such disruptions may be identified as presenting a material residual risk for some systems, even after mitigation measures. Respondents should use their judgement based on the outcomes of their risk assessment processes. The lack of any such risk assessment process may trigger 'don't know' as a response.</p>

Indicator	Guidance & logic
Are there challenges in meeting water quality requirements during periods of supply shortage?	Further to the earlier question about water quality, this question seeks to understand whether water quality issues are known to arise specifically during periods of supply shortage (for example due to poorer source water quality). Informed judgement is required to determine if this is a recognised challenge for the system, based on understanding of raw water sources and treatment infrastructure.
Is there uncertainty about whether drought-response measures can always ensure critical human needs are met (until water supplies recover, or other measures can be implemented to restore service levels)?	Based on respondents' modelling and analysis of their system, seeks to understand whether the system remains capable of meeting critical human needs under the most severe conditions. Without prescribing what such conditions might entail, it requires informed judgement based on system attributes and performance. The question goes to the confidence respondents have in their ability to maintain supply under foreseeable emergency or drought events.

Determining planning effectiveness and performance (Module 3B)

Water security is not static and intrinsically linked to future uncertainty and change. Planning therefore has a critical role in achieving and maintaining water security over time. The most robust system may ultimately be at risk if no consideration is given to future challenges, while a system that faces a multitude of risks can be successfully managed with good planning.

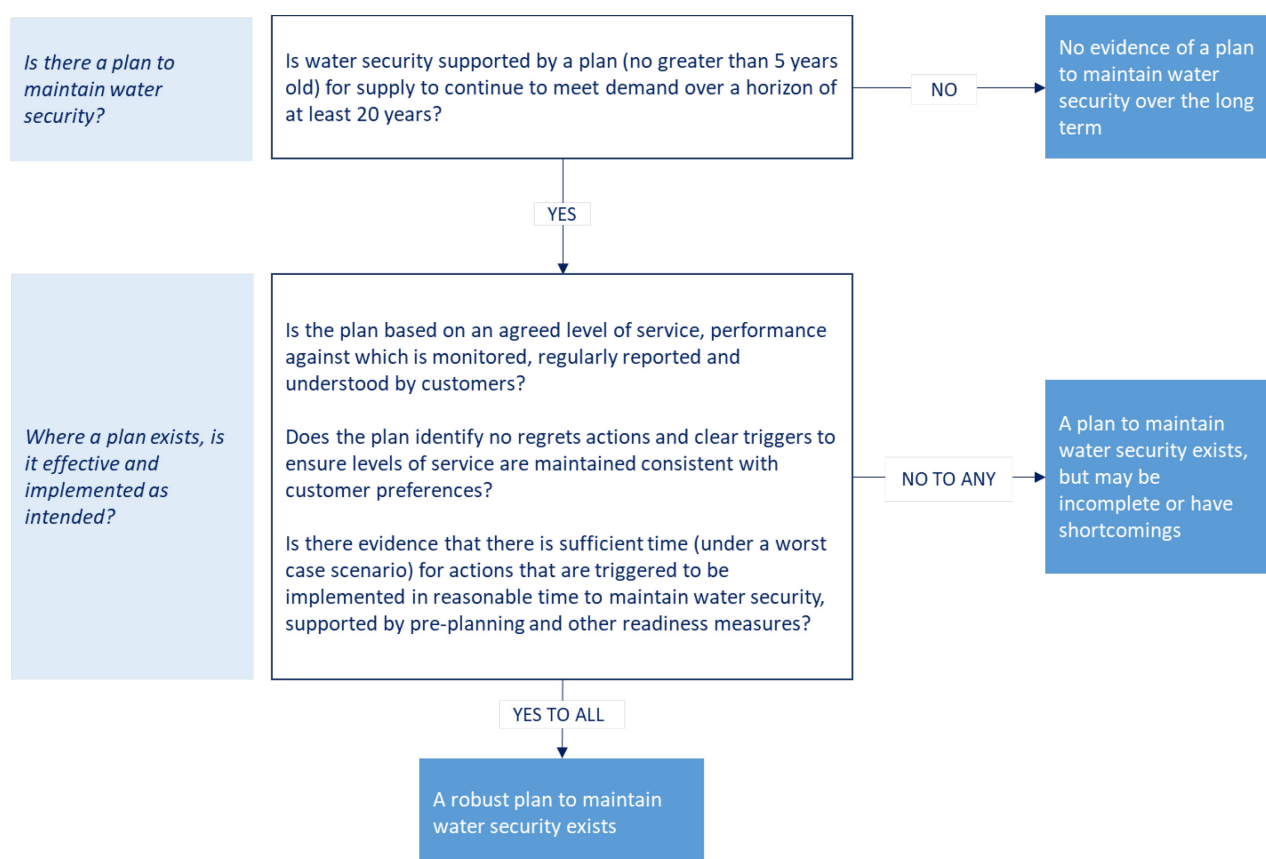
Importantly, the presence alone of a plan or strategy to achieve water security is not sufficient. A plan is of no value unless the processes and governance frameworks are in place to implement it successfully.

The indicators focus on the presence of what are considered key attributes of a robust plan, as a proxy for its implementation and performance. This was viewed as more robust than an indication of whether a plan is viewed by respondents as being implemented as intended.

The high-level logic of the assessment of planning effectiveness (Figure 11) is that:

- the absence of a plan indicates no evidence of a plan to maintain water security over the long term
- where a plan does exist, the absence of some key attributes suggests it may have shortcomings
- a plan that includes those key attributes is robust and can be implemented effectively as conditions require.

Figure 11 Module 3 assessment of the effectiveness and performance of planning



The intent and logic for each indicator is detailed further in Table 6.

Table 6 Module 3B indicators and guidance

Indicator	Guidance & logic
Is water security supported by a plan (no greater than 5 years old) for supply to continue to meet demand over a horizon of at least 20 years?	<p>Aims to identify whether there is a relevant plan in place that is guiding actions and responses to maintain both short-term and long-term water security.</p> <p>While arbitrary, the selection of five years as the point at which a plan is effectively outdated is based on:</p> <ul style="list-style-type: none"> alignment with the planning cycles of some jurisdictions, where plans are revisited every five years recognition that the rate of change (as exemplified by jurisdictions that do adopt a five-year planning cycle) is so great in many situations that planning efficacy relies on renewing plans more rather than less frequently.

Indicator	Guidance & logic
Is the plan based on an agreed level of service, performance against which is monitored, regularly reported and understood by customers?	<p>Should consider the extent to which customers have been involved in establishing - and would understand - an agreed level of service that will be maintained over time (such as frequency and extent of water restrictions).</p> <p>The importance of service levels (and customers understanding them) is that this underpins expectations about the reliability of a system, and the efficient investments that should be made in support. For example, enduring some level of water restriction during less frequent, dry conditions may be the only means of efficiently and affordably meeting needs. If stakeholders do not understand (or have not helped inform) this, implementation of restrictions could be perceived as a failure.</p>
Does the plan identify no regrets actions and/or clear triggers to ensure levels of service are maintained consistent with customer preferences?	<p>Establishes whether the plan identifies clear actions, including their timing or triggers for implementation, that are based on ensuring that agreed service levels continue to be maintained.</p> <p>Understanding what to do, and when, in response to changing conditions is critical to a successful plan. If clearly and publicly articulated, the inclusion of clear actions and their triggers is more likely to support implementation of the plan.</p>
Is there evidence that there is sufficient time (under a worst case scenario) for actions that are triggered to be implemented in reasonable time to maintain water security, supported by pre-planning and other readiness measures?	<p>Establishes whether the actions and triggers give confidence that service levels will always be maintained - under any climate outcomes - through a hierarchy of responses, which may include preparedness for future infrastructure solutions to ensure their efficient and timely implementation without impacting service levels.</p> <p>This indicator complements the preceding one that establishes the presence of clear actions and triggers, to confirm that the actions are robust under, and adaptable to, a range of scenarios.</p>

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