Department of Climate Change, Energy, the Environment and Water

NSW Water Quality Monitoring Framework

Framework Overview

June 2026

NSW GOVERNMENT

Acknowledgement of Country

Department of Climate Change, Energy, the Environment and Water acknowledges the traditional custodians of the land and pays respect to Elders past, present and future.

We recognise Australian Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to place and their rich contribution to society.

Artist and designer Nikita Ridgeway from Aboriginal design agency – Boss Lady Creative Designs, created the People and Community symbol.

NSW Water Quality Monitoring Framework

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Glossary

Term	Description
AGI	Australian Government Initiative
API	Application Programming Interface
BoM	Bureau of Meteorology
CPHR	Conservation, Programs, Heritage and Regulations (DCCEEW Branch)
Data Custodian	Organisations collecting water quality data and providing it to the Integrating Authority under the Framework.
EPA	NSW Environmental Protection Authority
FAIR	Findable, Accessible, Interoperable and Reusable
Integrating Authority	The group or agency responsible for overseeing the Framework and the integration, sharing and publishing of data.
ISO	International Organisation for Standardisation
NSW DCCEEW	NSW Department of Climate Change, the Environment Energy and Water
MDBA	Murray-Darling Basin Authority
MHL	Manly Hydraulics Laboratory
NSS	Australian Government, National Statistical Service
OCSE	NSW Office of the Chief Scientist and Engineer
Pilot Group/Pilot Stakeholder Agencies	The primary group of agencies involved in the development and implementation phases of the Framework
QA/QC	Quality Assurance/Quality Control
NSW SEED/SEED	NSW Sharing and Enabling Environmental Data (Portal)
Statutory Obligations	Legal duties that are required from the involved organisations/institutes or individuals
Technical Solution	The combination of processes and digital platforms that will enable better data sharing under the Framework.
SPSE	Strategic Policy, Science and Engagement Group (DCCEEW Branch)

1 Executive Summary

The NSW Water Quality Monitoring Framework (the Framework) has been developed to improve the organisation, discoverability and sharing of surface water quality monitoring data for rivers and streams across NSW. The Framework is intended for NSW Government agencies, councils, researchers and organisations involved in the collection, use and sharing of water quality monitoring data.

Water quality data in NSW is collected by a variety of agencies for different statutory, operational and environmental management purposes. This has resulted in fragmented datasets and limited visibility of monitoring programs. These issues reduce the ability to respond effectively to water quality incidents, assess statewide trends, and plan targeted monitoring programs.

The Framework is a pilot project led by the NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) Water Group, developed in consultation with relevant NSW Government agencies and stakeholders, with a target completion date of 30 June 2026.

The Framework is a central component of the NSW Water Quality Governance Roadmap (DCCEEW 2024a) and aligns with the NSW Water Strategy's priorities to improve river, floodplain, and aquifer ecosystem health (Priority 3), through improved monitoring and evaluation (Action 3.4) and a statewide focus on water quality (Action 3.5).

The Framework is also a component of the NSW Government's broader response to the 2023 Office of the Chief Scientist and Engineer's review on the Menindee fish death event (FR7) and aims to strengthen how NSW agencies collect, share and use water quality data. The NSW Government's full response is being delivered through the Restoring the Darling–Baaka River program.

Since its initial development in 2024, the Framework has progressed to the implementation phase. Governance arrangements have been tested with pilot agencies and a prototype technical solution for federated data integration is being trialled using the NSW Sharing and Enabling Environmental Data (NSW SEED) portal.

The Framework emphasises the importance of making water quality monitoring programs discoverable and ensuring the availability of consistent, well-described metadata. This document provides an overview of the Framework.

Key aims

The key aims of the Framework are to:

- Enable data to be used more effectively to manage water quality issues in a timely manner for incident response and broader catchment health.
- Aspire to a future where any person will be able to easily access information on the quality of the water in their local area or area of interest through any connected device.

What the Framework provides

The Framework delivers:

- A federated governance model that clarifies roles and responsibilities for data custodians, data users and the Integrating Authority.
- A data sharing process using existing NSW Government platforms (currently NSW SEED), thus creating a NSW Surface Water Quality Monitoring Catalogue to improve discoverability and accessibility.
- Guidance and governance for the organisation and sharing of NSW Government water quality data (including key routine monitoring programs) that can be followed by other agencies and organisations.
- A statewide monitoring gap analysis to inform future investment and program design.
- Early warning system guidance to support preparedness, coordinated assessment and response to emerging water quality risks through improved inter-agency data exchange, data availability and integration.
- Increased transparency and public access to water quality information.

Supporting Schedules

The Framework is supported by 5 schedules:

- **Schedule A – Data sharing governance model**

Defines governance arrangements and the responsibilities of the Integrating Authority, Data Custodians and Data Users within the federated data model implemented.

- **Schedule B – Data Standards and Protocols**

Provides guidance on preferred data standards, quality assurance and quality control, metadata preparation and data readiness.

- **Schedule C – Data Sharing Process**

Describes processes for sharing metadata and data, including the use of NSW SEED and pathways for data contributions.

- **Schedule D – Monitoring and Gap Analysis**

Identifies priority gaps in the current surface water quality monitoring network to inform future monitoring and investment.

- **Schedule E – Early Warning System**

Provides guidance on developing and refining of early warning systems to support preparedness and response to water quality risks.

Together, these schedules guide agencies in understanding their role, preparing their data, and sharing it through agreed processes. This forms the foundation for improved visibility, accessibility and use of water quality monitoring information across NSW, supporting better decision-making, incident response and long-term waterway health outcomes.

2 Introduction

2.1 Why is a new framework needed?

Water quality data in NSW is collected by many agencies for diverse purposes. This has resulted in fragmented datasets, inconsistent formats, variable quality control standards and limited visibility of monitoring programs. These challenges make it difficult to combine information across regions or agencies, respond effectively to water quality incidents, assess long-term trends, identify priority monitoring gaps or provide the public access to data.

This fragmentation is symptomatic of poorly defined governance arrangements and a lack of supported inter-agency protocols and standards for the transfer and sharing of data between agencies.

Previous reports have identified the need for stronger coordination, open data principles, appointing a leading agency for the management, facilitation and integration of water quality data and to promote best practice in water quality monitoring programs (OCSE 2020).

Development of a framework or guiding strategy has been proposed in multiple government reports over the last decade, with similar models adopted in other states and overseas jurisdictions (Cantor et al., 2018, MHL 2019, OCSE 2020).

Additionally, a framework is a central component of the NSW Water Quality Governance Roadmap (DCCEEW 2024a) and aligns with the NSW Water Strategy's priorities to improve river, floodplain, and aquifer ecosystem health (Priority 3), through improved monitoring and evaluation (Action 3.4) and a statewide focus on water quality (Action 3.5).

2.2 What will the Framework do?

The Framework provides a statewide approach to improving the discoverability, accessibility and use of environmental surface water quality monitoring data for rivers and streams across NSW.

The Framework aspires to a future where any person (decision maker, stakeholder or general public) can easily access water quality information for their local area, or area of interest, through any connected device.

The objectives* of the Framework are to:

- confirm the roles and responsibilities of water quality data stakeholders and agencies in relation to data sharing standards and protocols
- provide guidance for sharing data to ensure a ‘whole of system’ and integrated approach is taken to water data, and that the NSW SEED portal operated by NSW DCCEEW, links with WaterInsights operated by WaterNSW
- identify the priority gaps in water quality monitoring programs and where enhanced water quality monitoring needs to occur

- provide for an early warning system, implemented with WaterNSW, and based on water quality metrics to assist strategies and operations that have the potential to mitigate mass fish death events
- incorporate evaluation and adaptative learning processes and draw on real-time data wherever possible.

**NB: The wording of the objectives above has been changed from its original published form to reflect the evolution of the Framework and feedback from stakeholders. Objectives may be refined further through the implementation of the Framework. Original project objectives can be found in the NSW Water Quality Governance Roadmap (NSW DCCEEW 2024a) and the NSW Government's Response to the Office of the Chief Scientist and Engineer Report (NSW DCCEEW 2024b).*

The Framework provides a coordinated approach to water quality information by:

- enabling data sharing through existing platforms, currently the NSW SEED portal
- promoting discoverability of monitoring programs and datasets through shared metadata and a NSW Surface Water Quality Monitoring Catalogue
- supporting consistent, fit for purpose data standards aligned with national guidance.
- supporting early detection and interpretation of emerging water quality risks through improved access to monitoring information
- collating all components in a dedicated web page with a spatial web viewer and dashboard links.

The Framework is designed to evolve through adaptive learning, stakeholder feedback and technological improvements, ensuring it remains relevant as monitoring needs and capabilities develop.

These are early steps in a long-term vision to improve data standards, sharing and accessibility and coordinated responses to water quality incidents and risks by agencies.

3 Scope of the Framework

3.1 Core scope

The Framework is intentionally focused on environmental surface water quality in freshwater systems, prioritising parameters that inform aquatic ecosystem health and fish habitat.

The core water quality parameters selected for the Framework are:

- pH
- electrical conductivity
- dissolved oxygen
- turbidity
- water temperature
- nutrients (nitrogen and phosphorus)
- blue-green algae.

This focused scope allows for a broader range of datasets to be examined during the implementation period, providing insight into the diversity of data types and formats used across agencies. Future expansion may include groundwater, estuarine systems, drinking water, pollution incidents, emerging contaminants and additional water quality variables.

Both real-time/telemetered and manually sampled data from established, ongoing monitoring programs are considered. Short-term or event-based sampling programs may be included at the Integrating Authority's discretion.

3.2 Out of scope

The Framework does not:

- replace statutory responsibilities or regulatory functions
- create a new centralised, statewide water quality database
- mandate changes to existing monitoring programs or require additional data collection.
- develop a water quality incident early warning system independently of WaterNSW
- propose an integrated catchment management framework or strategic improvements to monitoring programs
- guarantee prevention of water quality impacts.

These boundaries ensure the Framework remains practical, scalable and supportive of existing agency programs and systems.

4 Structure of the Framework

The Framework provides a structure for the continual improvement of water quality monitoring procedures across NSW. Participation in the Framework is voluntary. It is designed so that any organisation collecting water quality data in NSW can understand how to participate and contribute.

The Framework can be used by any organisation collecting water quality data within NSW to understand their roles, responsibilities and available support mechanisms regarding water quality data, should they seek to contribute it to statewide water quality data.

The overarching aim of the Framework is to provide a process whereby, in the near future, any person will be able to easily access information on the quality of the environmental surface water in their local area, or area of interest, through any connected device.

The conceptual approach of the Framework is outlined below (Figure 1).

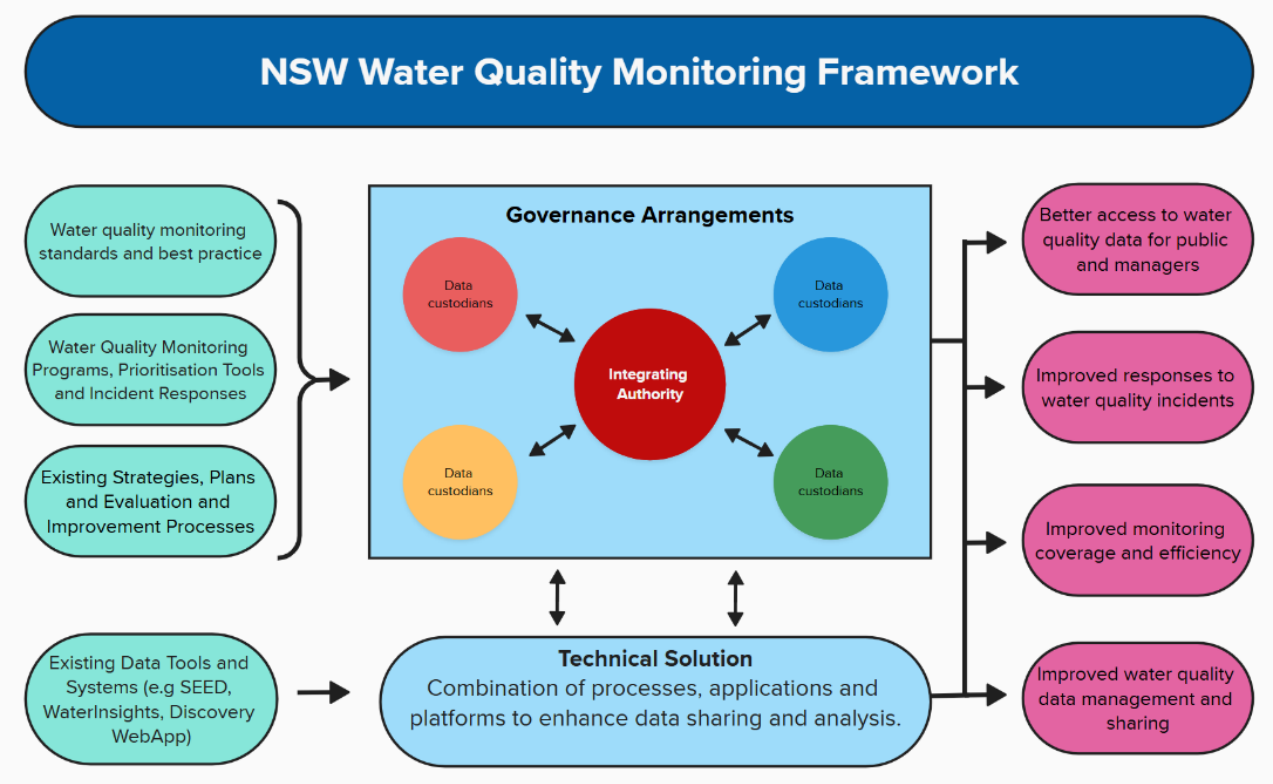

Figure 1: Conceptual model of the NSW Water Quality Framework

The Framework is built around 3 elements:

1. **Existing Practices and Standards**

The Framework builds on and clarifies existing water quality monitoring practices, standards, policies and plans to inform better collection and management of water quality data by agencies and organisations (aqua boxes, left hand side). As new practices, standards, policies and plans emerge in the coming years, these can be integrated into the Framework.

2. Governance Arrangements

The Framework establishes a governance structure to clarify the roles and responsibilities of water quality monitoring organisations in relation to statewide water quality monitoring and improve inter-agency water quality data sharing and transfer (central, top blue box).

This governance structure adopts a federated approach where **data custodians** can exchange data with an **integrating authority** to better inform statewide water quality or enhance their own data resources and capabilities. In this model:

- Data custodians are organisations collecting water quality data for their own purposes.
- The Integrating Authority is the organisation responsible for integrating, sharing and publishing data.

This federated approach was endorsed at a high level by stakeholder agencies working with the project team during the Framework's development phase.

During the pilot phase, the Integrating Authority role has been undertaken by NSW DCCEEW – Water Group. As the Framework evolves, this role may transition to another agency or government unit however, the role's functions and processes will remain unchanged.

3. Technical Solution

Effective data sharing between agencies and the analysis and display of that data requires a technical solution (central, bottom blue box).

Many existing government and non-government data management tools may contribute to this technical solution. The Framework does not seek to create a new central database for water quality, but rather to develop a technical solution that links existing platforms and processes to facilitate access to data and enable the creation of integrated datasets.

A permanent Framework hosting curated water quality data requires a portal with spatial mapping capabilities. Choosing an appropriate data platform to host water quality data is a technical decision driven by architectural policy. The Department is developing, via the Digital Strategy Roadmap, a range of technical solutions over the near to medium-term future. Consequently, formulating a specific data portal or platform architecture is beyond the scope of this pilot project.

For the Pilot Framework solution, a range of existing technologies have been assembled to show proof of concept and demonstrate functionality options. This solution includes the SEED Group for Water Quality, a spatial web map, and a dedicated web page to curate and provide access to related water quality data and information.

5 Framework governance

5.1 Principles

Participation in the Framework is voluntary and is guided by a shared set of principles:

- a commitment to open data and transparency, consistent with the NSW Government's open data framework
- a commitment to the Framework's agreed standards and protocols for data collection, management and publication and to continual improvement and development of these standards
- a commitment to sharing metadata that is discoverable and sufficient for publication
- a commitment to FAIR data principles (findable, accessible, interoperable and reusable)
- a commitment to the vision of any person being able to easily access information on the quality of the water in their local area or area of interest through any connected device.

5.2 Federated governance model

The Framework adopts a federated governance model for the collection and exchange of water quality data and information, involving a single "integrating authority" and multiple "data custodians" (Figure 2).

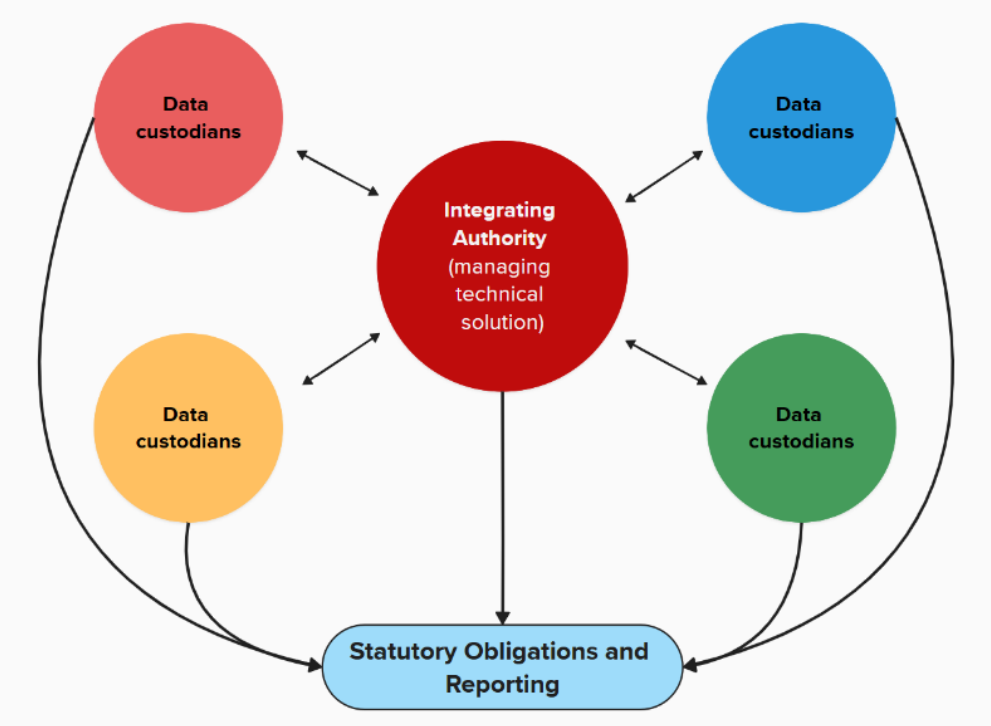

Figure 2: Water Quality Monitoring Framework governance model

Under this model, data custodians are agencies or groups that collect water quality data through their own programs, while the Integrating Authority is a designated agency or organisation responsible for the management, exchange, and integration of data through the agreed technical solution. This approach enables data custodians to maintain ownership and management of their data while participating in a centralised system for discovery and sharing.

This federated governance arrangement, together with the supporting technical solution, is intended to improve the sharing of quality assured water quality data and metadata between Framework participants. This may also allow data custodians and the Integrating Authority to fulfill their reporting and statutory obligations with more complete and holistic datasets.

Importantly, the Framework does not replace existing inter-organisational work programs or arrangements (for example, between WaterNSW and the Water Group) but works to align with them. The Framework does not propose any additional water quality data collection work for data custodians and seeks only 'routine' water quality data obtained through ongoing works programs.

Additionally, the Framework does not grant the Integrating Authority any power to direct data custodians to change their water quality monitoring programs or practices. However, the Integrating Authority may provide recommendations to improve data collection, storage, and data transfer practices.

5.2.1 Why have we chosen this model?

This governance model is adapted from the Commonwealth Government's statistical data integration framework developed as part of the National Statistical Service's Guide for Data Integration Projects Involving Commonwealth Data for Statistical and Research Purposes (Australian Government, National Statistical Service, 2017).

As the Framework seeks to integrate data from multiple sources to answer questions about water quality, the data integration model closely aligns with the project's needs.

The Guide's data integration model supports data sovereignty for data custodians, coming with clearly defined roles, rights and responsibilities that can be adapted or expanded to suit specific needs. Additionally, the Guide provides pre-existing terminology and approaches relating to data management and privacy controls.

An additional benefit of this framework is the separation between data collection agency roles and data analysis agency roles, supporting the recommendations of a "data agnostic" approach for statewide water quality monitoring and analysis (OCSE 2020).

Federated models are also being used or explored by other agencies and organisations using similarly large volumes of environmental data from multiple data sources (Cantor et al., 2018, MDBA 2022).

6 Guidance for agencies

Detailed guidance for participating agencies is provided by 5 schedules.

- Schedule A – Data sharing governance model
- Schedule B – Data Standards and Protocols
- Schedule C – Data Sharing Process
- Schedule D – Monitoring and Gap Analysis
- Schedule E – Early Warning System

6.1 Schedule A: Data sharing governance model

Schedule A details the governance arrangements, roles and responsibilities for government agencies and external collaborators for the collection, management and sharing of water quality data in NSW.

The roles and responsibilities of the Framework are adopted from the Guide for Data Integration Projects Involving Commonwealth Data for Statistical and Research Purposes (Australian Government, National Statistical Service, 2017) and are general in nature.

The Framework defines **3 key roles**, each with associated actions and responsibilities. These are described in detail in Schedule A, Section 4.4, Table 1.

Key roles:

1. **Integrating Authority:** Responsible for overseeing the Framework, managing the technical solution, and facilitating data integration and publishing.
2. **Data Custodians:** Agencies that collect water quality data and provide it to the Integrating Authority in alignment with agreed standards.
3. **Data Users:** Stakeholders, including other government agencies and the public, who access the data for decision-making and research.

6.2 Schedule B: Data Standards and Protocols

Schedule B provides guidance to water quality monitoring agencies and organisations to support the development and improvement of their data collection, management, and sharing practices. This includes guidance on preferred data standards, quality assurance/quality control (QA/QC) principles and metadata preparation.

The Framework aim is to improve the discoverability, consistency, transparency and usability of water quality data across NSW. The Framework does not aim to establish a singular standard for all agencies to adhere to. Imposing such a requirement would be costly and time consuming for data custodians and would eliminate valuable methods designed for bespoke purposes. The standards outlined in Schedule B are advisory only.

6.3 Schedule C: Data Sharing Process

Schedule C presents a preliminary data sharing process to facilitate the transfer, quality assurance and public sharing of water quality data and monitoring program information (metadata).

Schedule C describes:

- the process for sharing metadata and data
- use of NSW SEED metadata and data quality statements
- pathways for departmental and third-party contributions
- the role of the Integrating Authority in supporting quality and discoverability.

The emphasis is on program discoverability first, with data sharing occurring where appropriate and feasible.

Currently, the primary data sharing platform is NSW SEED. A final technical solution may use a combination of existing platforms, for example, NSW SEED or WaterInsights, and new or emerging data management technologies.

6.4 Schedule D: Monitoring and Gap Analysis

Schedule D presents a baseline assessment of current surface water quality monitoring coverage and identifies priority spatial, parameter and capability gaps to inform future monitoring and investment. This overview of water quality monitoring gaps is only focused on the parameters within the scope of the Framework.

Analysis was drawn from multiple reviews, technical assessments, and stakeholder input to identify instances where current water quality monitoring systems may be limited in their ability to support timely, integrated, and risk-informed decision-making.

6.5 Schedule E: Early Warning System

Schedule E provides guidance for water quality monitoring agencies and organisations on developing and improving their practices and processes for water quality early warning systems.

An early warning system refers to a coordinated set of monitoring, assessment and communication processes designed to support preparedness and decision making under uncertainty.

Early warning systems do not prevent all incidents. Rather, they are designed to improve situational awareness and decision making under conditions of uncertainty and variability. Improved access to consistent, high quality monitoring data enables better preparedness for emerging water quality risks.

7 Implementation and continuous improvement

The Framework is being implemented through a staged approach involving pilot agencies, prototype processes and continuous improvement. Key characteristics of implementation include:

- collaboration with participating agencies throughout design and delivery
- use of existing systems and capabilities to minimise costs and disruption
- regular review and improvement as new information and feedback become available.

The Framework is intended to evolve over time as technology, user needs and monitoring capabilities develop. It represents the beginning of a long-term commitment to improving water quality program discoverability, data standards, sharing and enabling more coordinated responses to water quality incidents and risks across NSW.

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