



National Groundwater Information System

Data Product Specification

03/12/2024



Revision history

Date	Version	Description
01/11/2024	1.0	Updated contents for Explorer 2024 release
03/12/2024	2.0	Converted to Bureau template format, revised structure so the file is shortened and concise. Updated some contents in tracked changes.

Review status

Date	Version	Description
5/12/2024	2.0	Reviewed (minimal changes from last release).

Release history

Date	Version	Status	Approval
6/12/2024	2.0	Approved	General Manager, Environmental Prediction Services, Community Services Group



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Cover image: Groundwater monitoring point on the Queanbeyan River, Australian Capital Territory | photograph by Lynton Crabb.

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1. Overview

1.1. Data product specification title

National Groundwater Information System (NGIS)

1.2. Reference date

2024-12

1.3. Responsible party

Contact organisation: Bureau of Meteorology

Contact position: National Groundwater Information System

Mail address: GPO Box 1289

Locality: Melbourne

State: VIC

Country: Australia

Postcode: 3001

Electronic mail address: water@bom.gov.au

1.4. Data product specification language

English

1.5. Terms and definitions

NAME	DESCRIPTION
aquifer	Geological formation or group of formations; able to receive, store and transmit significant quantities of water
aquifer boundary	A polygon feature class defining the extent of major aquifers based on age and stratigraphic position (depth) classified as either upper, middle, or lower groupings

bore feature	Point feature class that represents the location of a bore and associated attributes. Multiple independently screened bore pipes are regarded as separate bore features.
bore log	A table with rock or sediment types classified into hydrogeologic units along a borehole. Synonym: hydrostratigraphy log
bore pipe	An independently screened inlet to a bore that can be pumped or monitored separately. A bore can have multiple pipes, each having one or more screens.
construction log	A table with bore construction information along a borehole (e.g. casing and bore screen).
georaster	A catalogue of raster datasets describing properties of hydrogeologic units (e.g. depth or elevation of hydrogeologic unit's top or base, salinity and groundwater level).
geovolume	A three-dimensional multipatch feature class that represents hydrogeologic units as a volume.
hydrogeologic complex	One of the tiers in the National Aquifer Framework. Aggregation and classification of hydrogeologic units according to their age, depositional environment, rock type and whether they behave as an aquifer or aquitard.
hydrogeologic unit	One of the tiers in the National Aquifer Framework. One or more geologic units which have similar hydrogeological characteristics and behaviour.
lithology log	A table with drillers' or geologists' description of rock or sediment types along a borehole.
groundwater management unit	Generic term used to describe regions legislated by States/Territories and other jurisdictions with defined rules for groundwater management.
national aquifer framework	Bureau developed framework for naming and grouping hydrogeologic units from across Australia.

Refer also to terms in the NGIS Data Dictionary and [Australian Water Information Dictionary](#) (AWID).

1.6. Abbreviations and acronyms

NAME	DESCRIPTION
ANGDTS	Australian National Groundwater Data Transfer Standard

ANZLIC	Australian and New Zealand Land Information Council
AWID	Australian Water Information Dictionary
Bureau	Australian Government Bureau of Meteorology
DEECA	Department of Energy, Environment and Climate Action, VIC
DEPWS	Department of Environment, Parks and Water Security, NT
DEW	Department for Environment and Water, SA
DRDMW	Department of Regional Development, Manufacturing and Water, QLD
DWER	Department of Water and Environmental Regulation, WA
DNRE	Department Natural Resources and Environment, TAS
DPIRD	Department of Primary Industries and Regional Development, WA
EPD	Environment and Planning Directorate ACT
FDGC	Federal Geographic Data Committee
GDA94	Geodetic Datum of Australia 1994
IGWGD	Interim groundwater geodatabase, which has now been integrated into the Geofabric and is called Groundwater Cartography.
ISO	International Organization for Standardization
NAF	National Aquifer Framework
NCRIS	National Collaborative Research Infrastructure Strategy
NGIS	National Groundwater Information System

Refer also to terms in the [NGIS Data Dictionary](#) and [Australian Water Information Dictionary](#) (AWID).

1.7. Informal description of data product

The National Groundwater Information System (NGIS) is a geodatabase for storing nationally consistent groundwater data based on ESRI's *ArcHydro for Groundwater* data model. It focuses on bore and bore log (lithology, bore construction and hydrostratigraphy) data. It also includes georasters and geovolumes for selected areas, groundwater management areas and aquifers.

The Bureau of Meteorology maintains the NGIS data model that standardises and spatially-enables groundwater data. The lead water agencies in each State/Territory (plus Water Corporation and Department of Primary Industries and Regional Development in Western Australia and the National Collaborative Research Infrastructure Strategy) either:

- Translate data from their corporate groundwater database into State/Territory NGIS geodatabases; or
- Provide an extract of their database to the Bureau for conversion into a NGIS geodatabase.

The Bureau of Meteorology then collates State/Territory geodatabases into the national geodatabase.

The data product extent is Geographic Australia (as defined by *Acts Interpretation Act 1901*). The product is updated each year following the receipt of updated State/Territory geodatabases at the end of September through the *Water Regulations* (Commonwealth legislation that requires agencies to deliver water data to the Bureau under the *Water Act*).

1.8. Scope identification

Global

1.9. Level

Dataset

1.10. Level description

This is the default root level global scope used by this data product and relates to all data within the product.

1.11. Extent

1.11.1. Description

Data for this scope relates to Australia excluding external territories - Geographic Australia (as defined by *Acts Interpretation Act 1901*).

1.11.2. Geographic extent

West bound longitude: 112.8 ° E

East bound longitude: 154.1 ° E

South bound latitude: -44.0 °

North bound latitude: -8.9 °

1.11.3. Temporal extent

Start date: 1880-01

End date: 2024-11

2. Data product identification

2.1. Title

National Groundwater Information System

2.2. Alternate title

National Groundwater Information System Version 1.7 (December 2024)

2.3. Product ID

ANZCW0503900334

2.4. Abstract

The National Groundwater Information System (NGIS) is a geodatabase for storing nationally consistent groundwater data based on ESRI's *ArchHydro for Groundwater* data model. Contents include:

- aquifers
- bores
- borehole (hydrostratigraphy) logs
- construction logs
- lithology logs
- hydrogeologic units
- 3D bore lines
- 3D construction lines
- groundwater management units
- georasters
- geovolumes

NGIS Version 1.7 uses the NGIS Version 2.3.4 data model. The Bureau of Meteorology maintains the NGIS data model that standardises and spatially-enables the groundwater data. The lead water agencies in each State/Territory (plus Water Corporation and Department of Primary Industries and Regional Development in Western Australia and the National Collaborative Research Infrastructure Strategy) either:

- Translate data from their corporate groundwater database into State/Territory NGIS geodatabases; or
- Provide an extract of their database to the Bureau for conversion into a NGIS geodatabase.

The Bureau then undertakes Quality Assurance/Quality Control (QA/QC) of the State/Territory geodatabases and integrates them into the national geodatabase (refer to 5.2.1 Lineage statement for further information).

2.5. Purpose

Australian groundwater data is held by the lead water agency in each State and Territory with smaller data holdings in other agencies, such as WA Water Corporation, WA DPIRD and NCRIS. Each agency uses a different database in terms of the software, data model and terminology. These databases are not typically spatially-enabled. Consequently significant data collation and pre-processing was traditionally needed prior to spatial and inter-jurisdictional/national analysis.

The NGIS is designed to collate, standardise and spatially-enable groundwater data into a single, national repository. In this way NGIS facilitates spatial and inter-jurisdictional/national analysis of groundwater data. NGIS also provides the contextual and spatial data needed to interpret the time-series groundwater data (level and salinity) submitted to the Bureau through the *Water Regulations* (the Commonwealth legislation that requires named agencies to deliver water data to the Bureau under the *Water Act*).

2.5.1. Use case

Cartographic map production, groundwater hydrogeologic analysis and visualisation.

2.6. Topic category

006 – elevation

007 – environment

008 – geoscientific information

012 – inland waters

2.7. Spatial representation

vector, grid

2.8. Spatial resolution

Spatial denominator: 25,000 – 250,000

Resolution distance: 1 – 10,000 metres

2.9. Geographic bounding box

West bound longitude: 112.8 °

East bound longitude: 154.1 °

South bound latitude: -44 °

North bound latitude: -8.9 °

2.10. Geographic identifier

2.10.1. Identifier authority

ANZLIC – the Spatial Information Council

2.10.2. Identifier code

AUS

2.10.3. Code space (register URL)

ANZLIC Australia

<http://asdd.ga.gov.au/asdd/profileinfo/anzlic-allgens.xml>

2.11. Reference to specification scope

Global

3. Data content and structure

3.1. Description

The NGIS feature classes, tables and raster catalogues are summarised in Table 1.

Table 1 - Feature classes, tables and raster catalogues included in NGIS

Name	Format
NGIS_Bore	Point feature class
NGIS_LithologyLog	Table
NGIS_BoreholeLog	Table
NGIS_ConstructionLog	Table
NGIS_HydrogeologiUnit	Table
NGIS_BoreLine	3D line feature class
NGIS_ConstructionLine	3D line feature class
NGIS_Aquifer	Polygon feature class
NGIS_ManagementZone	Polygon feature class

NGIS_GeoVolume	Multipatch feature class
NGIS_GeoRasters	Raster catalogue

3.2. Feature datasets

NGIS contains the following feature datasets:

3.2.1. Core

The feature dataset that contains the core NGIS feature classes including bore points, bore lines and construction lines.

3.2.2. Hydrostratigraphy

The feature dataset that contains hydrostratigraphy feature classes e.g. GeoVolumes.

3.2.3. Feature classes

NGIS contains the following feature classes:

3.2.4. NGIS_Bore

A point feature class that represents the locations of bore features and associated attributes. For the purpose of NGIS, a bore feature is defined as having a single x, y and z location:

- Multiple independently screened inlets or pipes (i.e. that can be pumped and/or metered separately) are regarded as a separate bore feature.
- Multiple holes associated with the same jurisdictional bore identifier are regarded as a separate bore feature.

3.2.5. NGIS_BoreLine

3D line feature class that represents the hydrogeologic units along a borehole. The feature class uses both State/Territory terminology to describe hydrogeologic units as well as the National Aquifer Framework.

3.2.6. NGIS_ConstructionLine

3D line feature class that represents the construction information (e.g. hole, casing, screen, packing material and cement) for a borehole.

3.2.7. NGIS_ManagementZone

Groundwater management areas are identified by lead and/or regional water agencies in each State and Territory for management and reporting purposes. Groundwater management areas boundaries are created by lead water agencies on the basis of natural catchment or aquifer boundaries, as well as administrative and management boundaries. These jurisdictional datasets have been integrated into a single national dataset by the Bureau for use in groundwater products.

3.2.8. NGIS_Aquifer

A delineation of the extents of the principal aquifers throughout Australia, and categorisation into upper, middle or lower aquifer groupings based on age and stratigraphic position (depth).

3.2.9. NGIS_GeoVolume

A multipatch feature class representing the geometry of hydrogeologic units or complexes. It is currently populated with hydrogeologic units and complexes for selected areas in Western Australia and South Australia as well as for interjurisdictional areas, including the Great Artesian Basin, Murray Basin and the Otway Basin.

3.2.10. Raster datasets

NGIS contains the following raster datasets:

3.2.11. NGIS_GeoRasters

A catalogue of raster datasets describing properties of hydrogeologic units or complexes e.g. depth to/elevation of top or base. It is currently populated with the elevation of the top and base of hydrogeologic units and complexes for selected areas in Victoria, Western Australia, South Australia and the Northern Territory, as well as the Murray Basin, Great Artesian Basin and the Otway Basin.

3.2.12. Tables

NGIS contains the following tables:

3.2.13. NGIS_LithologyLog

A table with driller's or geologist's description of the rocks and sediments intercepted by a borehole.

3.2.14. NGIS_BoreLog

A table with strata classified into hydrogeological units along a borehole i.e. hydrostratigraphy log. The table uses both State/Territory terminology to describe hydrogeologic units as well as the National Aquifer Framework.

3.2.15. NGIS_ConstructionLog

A table describing bore construction information (e.g. hole, casing, screen, packing material and cement) along a borehole.

3.2.16. NGIS_HydrogeologicUnit

A reference table describing hydrologic units using State/Territory terminology, their properties, their relationship to hydrogeologic complexes (where applicable) and their relationship to National Aquifer Framework units.

3.2.17. Relationship classes

NGIS contains the following relationship classes:

3.2.18. BoreHasBoreholeLogs

Relationship class that defines which bores (2D point feature class) have bore/hydrostratigraphy logs (table).

3.2.19. BoreHasConstructionLogs

Relationship class that defines which bores (2D point feature class) have construction logs (table).

3.2.20. BoreHasLithologyLogs

Relationship class that defines which bores (2D point feature class) have lithology logs (table).

3.2.21. BoreHasBoreLines

Relationship class that defines which bores (2D point feature class) have bore lines (3D lines feature class depicting hydrostratigraphy logs).

3.2.22. BoreHasConstructionLines

Relationship class that defines which bores (2D point feature class) have construction lines (3D lines feature class depicting construction logs).

3.2.23. HGUHasBoreLines

Relationship class that defines which hydrogeologic units (listed in reference table) are included in bore lines (3D line feature class depicting hydrostratigraphy logs).

3.2.24. HGUHasGeoRasters

Relationship class that defines which hydrogeologic units (listed in reference table) have georasters (rasters representing geometry of hydrogeologic units).

3.2.25. HGUHasGeoVolumes

Relationship class that defines which hydrogeologic units (listed in reference table) have geovolumes (multipatch feature classes representing geometry of hydrogeologic units).

3.3. Feature information

3.3.1. Application schema

National Groundwater Information System (NGIS) Data Model Version 2.3.4:

[Data Model \(206kB\)](#)

3.3.2. Feature catalogue

National Groundwater Information System (NGIS) Data Dictionary Version 2.3.4:

[Data Dictionary \(1.16MB\)](#)

3.4. Reference to specification scope

Global

4. Reference systems

4.1. Spatial reference system

Name: GDA94 / Australian Albers

Code: EPSG:3577

Code space: <http://spatialreference.org/ref/epsg/3577/>

4.2. Temporal reference system

Gregorian calendar

4.3. Vertical reference system

Metres AHD

4.4. Reference system scope

Global

5. Data quality

5.1. Data quality scope

Scope code: Dataset

Extent: Australia (excluding external Territories)

Scope description: Dataset

5.2. Data quality lineage

5.2.1. Lineage statement

The Bureau maintains the data model that defines the structure of the NGIS geodatabase. The lead water agencies in each State/Territory (plus Water Corporation and Department of Primary Industries and Regional Development in Western Australia and the National Collaborative Research Infrastructure Strategy) either:

- Translate data from their corporate groundwater database into State/Territory NGIS geodatabases; or
- Provide an extract of their database to the Bureau for conversion into a NGIS geodatabase.

Some agencies have done additional analysis to produce georasters and geovolumes depicting the hydrostratigraphy. The Bureau then performs QA/QC on the State/Territory geodatabases and collates them into the national geodatabase.

5.2.2. Data sources

Each State/Territory lead water agency sources groundwater data from their corporate groundwater database. The agencies and their groundwater databases are listed in Table 2.

Table 2 - NGIS data providers and their corporate groundwater databases

Jurisdiction	Agency	Database Name	Database format
ACT	EPD	-	Excel
AUST	NCRIS	-	CSV
NSW	WaterNSW	Groundwater Data System (GDS)	Hydstra
NT	DEPWS	NT	Aquarius
QLD	DRDMW	GWDB	Oracle
SA	DEW	SA GEODATA	Oracle
TAS	DNRE	GWIMS	Aquarius
VIC	DEECA	Groundwater Management System	Hydstra
WA	DPIRD		
WA	DWER	WIN	Hydstra
WA	Water Corporation	Groundwater Office	Repository of groundwater/boredata (Smallworld)

5.2.3. Processing steps

Bore and bore logs

The following work was undertaken to incorporate bore and bore log data in NGIS:

- Field mapping exercise to map between fields in the State/Territory groundwater databases and the NGIS data model;
- Terminology mapping exercise to match terms used in the State/Territory groundwater databases and the ANGDS;
- Standardise groundwater data based on the field and terminology mapping for inclusion into the NGIS data model. Most agencies established scripts to automate this work (refer to Table 3 for further information);
- Further GIS processing to convert bore (hydrostratigraphy) and construction log tables into 3D lines using Aquaveo's ArcHydro for Groundwater tools;
- Automated and manual QA/QC; and
- Population of ANZLIC compliant metadata.

Table 3 - NGIS data providers and their automations systems

Jurisdiction	Agency	Level of automation	Method of automation
ACT	EPD	Low	NA
AUST	NCRIS	Low	NA
NSW	WaterNSW	High	SQL, Python
NT	DEPWS	Low	NA
QLD	DRDMW	High	Python
SA	DEW	High	SQL, Python
TAS	DNRE	High	SQL, Python
VIC	DEECA	High	SQL, Python
WA	DPIRD	Low	NA
WA	DWER	High	SQL, Python

WA	Water Corporation	High	Python
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Georasters and geovolumes

Georasters and geovolumes have been produced for the interjurisdictional Great Artesian Basin, Murray Basin and Otway Basin along with selected areas in Victoria, Northern Territory, South Australia and Western Australia. The state-based models were undertaken by the relevant jurisdictional lead water agencies. The 3D model for four regions were developed as collaborations between the Bureau and other agencies:

- Great Artesian Basin – geovolumes were generated by the Bureau in collaboration with Geoscience Australia, who created the georasters
- Murray Basin – the Bureau produced the georasters and geovolumes in collaboration with the relevant state lead water agencies
- Otway Basin – the Bureau in collaboration with the SA and VIC lead water agencies integrated SA and VIC georasters and generated geovolumes
- Gippsland Basin – geovolumes were produced by the Bureau in collaboration with the Geological Survey of Victoria, who supplied the georasters

Georasters for the elevation of the top and base of hydrogeologic units were created using a range of methods, such as:

- Spatial interpolation of point data from bore (hydrostratigraphy) logs. This approach was used in the Murray Basin, Victoria and Northern Territory. Different interpolation methods and pre- and post- processing were used in each State/Territory.
- Conversion of layers from groundwater flow models. DWER used this method for several case study areas in Western Australia.

Geovolumes were created from georasters using [Aquaveo's ArcHydro for Groundwater tools](#).

Groundwater management areas

Groundwater management areas are identified by lead and/or regional water agencies in each State and Territory for management and reporting purposes. Groundwater management areas boundaries are created by lead water agencies on the basis of natural catchment or aquifer boundaries, as well as administrative and management boundaries. These jurisdictional datasets have been integrated into a single national dataset by the Bureau for use in groundwater products.

Aquifers

The Bureau created the aquifer dataset by collating and standardising aquifer boundaries from a range of national and state/territory GIS datasets. Australia was first divided into several major provinces based on Geoscience Australia's Geological Provinces layer ([Australian Geological Provinces, 2013.01 edition—Province Full Extent](#)). Figure 1 shows the main provinces used to

guide the grouping of the aquifer boundaries into meaningful hydrogeological areas. Nine provinces, for which GIS aquifer boundaries exist, are identified across Australia and are separated by bedrock highs shown in brown in Figure 1.

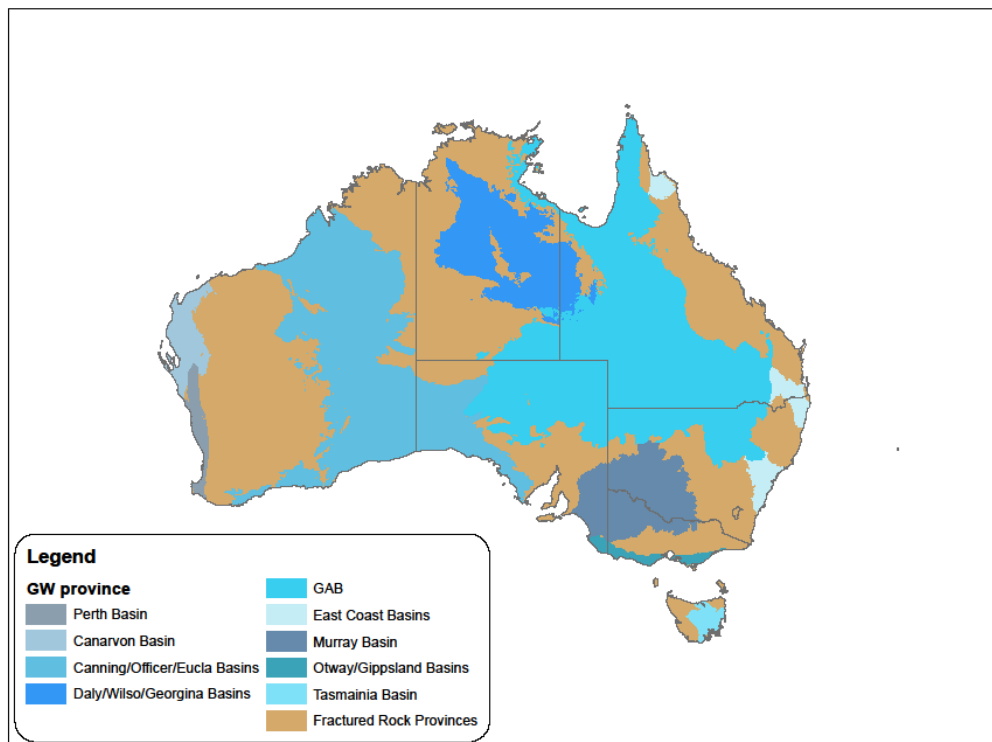


Figure 1 - Groundwater provinces across Australia

Secondly a [simplified stratigraphic table](#) was created to display how the National Aquifer Framework (NAF) Hydrogeological Units (HGUs) are separated into upper, middle, lower and bedrock. The table further divides the 9 provinces into 20 basins (and sub basins where needed) and bedrock highs. It also shows the relevant NAF Hydrogeological Complex's (HGCs), which provides information about the age, depositional environment and rock type. This table only shows some of the more complex hydrogeological provinces or basins in Australia. The datasets used to create the National Aquifer Boundary dataset is included in the [methodology documentation](#).

5.2.4. Quality Assurance/Quality Control

Additional QA/QC was undertaken by the Bureau. The process is automated using Groundwater Data Quality (GDQ), an internal web-based application that automates and simplifies the steps needed to QA/QC, standardise, integrate and publish State/Territory NGIS data into a national dataset. QA/QC checks and standardisation include:

- compliance with the current NGIS data model e.g. datasets, fields, and coded value domains;
- for acceptable field values e.g. terms from the ANGDTs.

5.2.5. Integration into the national geodatabase

After the QA/QC process, the validated State/Territory geodatabases are loaded into the national NGIS geodatabase. NAF hydrogeologic units and complexes are appended to the NGIS datasets using the NGIS-NAF tool. The accompanying ANZLIC compliant metadata is manually updated.

5.3. Quality scope

Global

6. Data capture

6.1. Data capture statement

All bores and bore logs held in State/Territory groundwater databases and supplied to the Bureau of Meteorology in the NGIS data model.

6.2. Data capture scope

Global

7. Data maintenance

7.1. Maintenance and update frequency

NGIS will be updated each year with State/Territory data received through the Water Regulations (Commonwealth legislation that requires agencies to deliver water data to the Bureau of Meteorology). State/Territory agencies deliver their NGIS geodatabases in October-November. The updated national geodatabase will be released by the Bureau after QA/QC and integration.

7.2. Other maintenance information

The product may be updated more frequently, if deemed necessary, to incorporate new or updated data.

7.3. Maintenance scope

Global

8. Portrayal information

Bibliographic reference to portrayal catalogue: Not applicable.

Portrayal scope: Global

9. Data Product Delivery

Delivery format name: ESRI ArcGIS File Geodatabase

Version 1.7 | December 2024

Format version: ArcGIS v10.8.1

Language used within the dataset: English

Full name of the character coding standard used: Utf8

Units of delivery: National dataset

Estimated size of a unit in the specified format: 2.83GB

Medium name: By email request to water@bom.gov.au

Delivery scope: Global

10. Licensing and access constraints

Licensed for use under [Creative Commons Australia Attribution](#)

Refer to <http://www.bom.gov.au/water/groundwater/ngis/copyright.shtml> for attribution information.

11. Metadata

11.1. Metadata format

Metadata compliant with ANZLIC Metadata Profile Version 1.1 of AS/NZS ISO 19115 was produced for this data product. The metadata profile is available at dataset level. Feature level metadata is provided within the ArcGIS ArcCatalog's FGDC Stylesheet for all feature types included within this product and describes the lineage of features.

11.2. Metadata encoding

ArcGIS FGDC and ANZLIC compliant feature metadata.

11.3. Data product metadata

An ISO 19115 compliant XML file of the NGIS metadata statement accompanies the NGIS geodatabase and is viewable using either the ArcGIS ISO 19139 ArcCatalog metadata style sheet or the ANZMet Lite Version 1.0 metadata creation tool available from:

<http://www.anzlic.gov.au/resources/metadata>

This metadata has been published to data.gov.au website:

<http://data.gov.au/dataset/national-groundwater-information-system>

12. References

Aquaveo ArchHydro for Groundwater (3.3.0) tools: <http://www.aquaveo.com/archydro-groundwater>

Bureau of Meteorology (2024) National Aquifer Framework:
[National Aquifer Framework](#)

Bureau of Meteorology (2016) National Aquifer Framework User Guide:

http://www.bom.gov.au/water/groundwater/naf/documents/NAF_user_guide.pdf

Bureau of Meteorology (2024) NGIS Data Dictionary:

<http://www.bom.gov.au/water/groundwater/ngis/documents/NgisDataDictionary.pdf>

Bureau of Meteorology (2024) NGIS Schema Diagram:

<http://www.bom.gov.au/water/groundwater/ngis/documents/NgisDiagram.pdf>

ESRI (2011) ArcHydro for Groundwater data model:

http://www.archydrogw.com/ahgw/Arc_Hydro_Groundwater_Data_Model