Australian Government
Bureau of Meteorology

National Aquifer Framework v1.0.1

User Guide

Version number/type	Date of issue
Version 1.0.1	15 August 2016

Published by the Bureau of Meteorology 2016

Table of Contents

List of Tables

List of Figures

Abbreviations

Term	Description
ACT	Australian Capital Territory
the Bureau	Bureau of Meteorology
CC	Creative Commons
CSG	Coal Seam Gas
DOW	Department of Water
GA	Geoscience Australia
GAB	Great Artesian Basin
GU	Geologic Unit
HGC	Hydrogeologic Complex
HGU	Hydrogeologic Unit
IPBA	Information Platform for Bioregional Assessments
NAF	National Aquifer Framework
NGIS	National Groundwater Information System
NSW	New South Wales
NT	Northern Territory
NWC	National Water Commission
SA	South Australia
SKM	Sinclair, Knight, Merz
TRG	Technical Reference Group
v	Version
VAF	Victorian Aquifer Framework
WA	Western Australia
WCD	Water Control District
3D	Three-Dimensional

1 Purpose

The intent of this document is to inform the user about the components of the National Aquifer Framework (NAF); how it was created and how it can be used.

1.1 Project Partners

The NAF was developed by the Bureau of Meteorology (the Bureau) and Sinclair Knight Merz (SKM) with significant input from the following agencies:

- Australian National University
- Department of Economic Development, Jobs, Transport and Resources (Victoria)
- Department of Environment, Land, Water and Planning (Victoria)
- Department of Environment, Water and Natural Resources (South Australia)
- Department of Land Resource Management (Northern Territory)
- Department of Natural Resources and Mines (Queensland)
- Department of Primary Industries, Parks, Water and Environment (Tasmania)
- Department of Water (Western Australia)
- Department of Science, Information Technology and Innovation (Queensland)
- Environment and Planning Directorate (Australian Capital Territory)
- Geoscience Australia
- Murray Darling Basin Authority
- NSW Department of Industry, Skills and Regional Development – DPI Water (New South Wales)
- Water Corporation (Western Australia)

1.2 Licensing and conditions of use

Some The NAF is covered by the Creative Commons (CC) Attribution license. Click on the CC-BY logo below to obtain the terms of that licence, and include the specified attribution when using the NAF:

Data custodian	Licence	Attribution
Bureau of Meteorology		© Bureau of Meteorology

1.3 Support and feedback

The Bureau welcomes feedback on any aspect of the NAF, including proposed changes/ updates. Please direct your comments regarding this document, or the NAF via either:

- Website feedback form: http://www.bom.gov.au/other/feedback
- Email: groundwater@bom.gov.au

The feedback will be collated and considered in the annual NAF review and update process (refer to Section 6 for further information).

2 About the National Aquifer Framework

The NAF is a Bureau initiative which allows for consistent national reporting and analysis of groundwater and aquifer data. The NAF is a nationally agreed common language and terminology for hydrogeologic units. It is a framework that aggregates state-level information on geologic units (GUs), to hydrogeologic units (HGUs), and then to hydrogeologic complexes (HGCs) to the equivalent national terminology. The framework is designed to enable the user to analyse groundwater information at scales from local to regional to national. Refer to the NAF information sheet for further information.

2.1 Objectives of the NAF

The objective of the NAF is to allow consistent national reporting and analysis of groundwater and aquifer data, including the Bureau's National Water Account and Australian Water Resource Assessments. The NAF is also used within the National Groundwater Information System (NGIS) so that a single consistent dataset is created that eliminates cross-border differences in aquifer definition and nomenclature.

The NAF has the following characteristics:

- A three tiered system consisting of:
    - Tier 1 – GUs, the most detailed level of units
    - Tier 2 - HGUs consisting of aggregated Tier 1 units
    - Tier 3 - HGCs consisting of aggregated Tier 2 units
- There is a one to one, or a many to one relationship between the Tier 1 and Tier 2 units and between the Tier 2 and Tier 3 units.
- There is a one to one, or a many to one relationship between the current State/Territory aquifer frameworks and the NAF to allow translation between the two.
- The Tier 2 and/ or Tier 3 units include units which are currently being used or will be used by the Bureau for the National Water Account and/or the Australian Water Resource Assessments.

2.2 Definition of terms

The following definitions of the three tiers of the NAF have been developed to best represent the views of all participants involved in NAF development:

- GU: Smallest mapped or defined geological entity consistent at a national scale.
- HGU: One or more NAF geological units which have similar hydrogeological characteristics and behaviour. For example, different units of similar lithology

and/or provenance in similar geographic areas would be lumped together to form a single HGU.

- HGC: One or more HGUs which can be conceptualised as being part of the same aquifer/ aquitard. It is not the intent that a single HGC is hydraulically homogeneous but rather it has similar broad hydrogeological characteristics and behaves, is conceptualised and/or is managed as one aquifer or aquitard.

The naming convention for hydrogeological complexes (HGCs) is as follows:

<Age> <Rock type> (Aquifer | Aquitard) (Depositional environment)

e.g. Cretaceous Sediments, Jurassic Limestone Aquifer

Where:

<> = Mandatory

() = Optional

<Age> = most appropriate geological age e.g. Tertiary, Mesozoic, Jurassic

<Rock type> = e.g. Sediments, Volcanics, Limestone

(Depositional environment) = e.g. Marine, Alluvial

2.3 Methodology for draft NAF creation

The NAF was developed from existing State/Territory (Jurisdictional) frameworks as summarised in Figure 1. For further information, please refer to the draft NAF methodology report (SKM 2012).

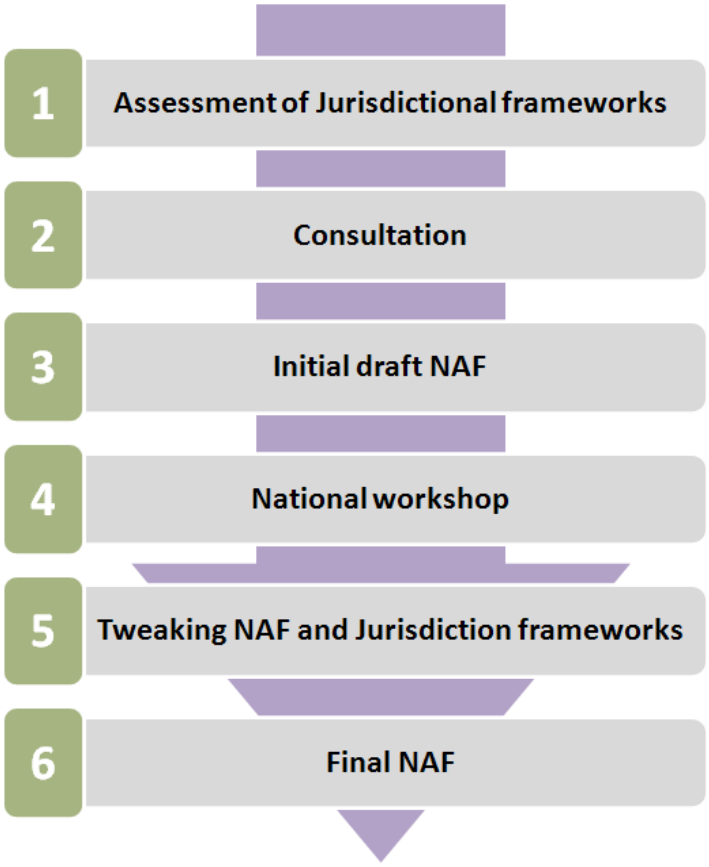


Figure 1 - Diagram summarising the development of the draft NAF (SKM, 2012)

1. Collation and assessment of Jurisdictional frameworks: Each State/ Territory has an aquifer framework – the terminology they use to refer to particular hydrogeologic units. Some States/Territories having a well established framework; other States/Territoris do not have a formal, documented framework. The existing frameworks were sourced from each State/Territory and analysed for inclusion in the NAF. The level of development and detail directed how particular frameworks were incorporated to the NAF.

2. Consultation: States and Territories were consulted through out the development of the NAF to discuss the objectives, method, deliverables, characteristics their established frameworks, definition of terms and use cases. This provided a platform for translating existing State/ Territory aquifer frameworks into a single unified NAF.

Jurisdiction engagement adds a level of legitamcy to the NAF. An initial consultation workshop was held in each Jurisdiction.

3. Initial draft NAF: The initial draft NAF was developed from the Jurisdictional frameworks and the workshops. Initially State/ Territory outcropping GUs were matched with units from Geoscience Australia's Surface Geology of Australia (1:1 million scale) and Australian Stratigraphic Units Database. For units that could not be matched, a new NAF GU was created; this was the case for local alluvial valley units. Relationships were then formed between the NAF GUs, HGUs and HGCs based on existing Jursidictional relationships. For HGUs and HGCs that were cross-jurisdictional, new names were given to standardise the individual names used in each State/ Territory. Tasmania uses a more refined set of GUs than for the rest of Australia; however, as there are no border issues, this was not considered an issue for the NAF and the detailed GUs were retained.

4. National workshop: Representatives of each Jurisdictions, as well as other interested organisations met to discuss the draft NAF and propose changes. The main changes included a consistent naming convention for HGCs, a simplified definition of terms and a mechanism to update the NAF including converting from Jursidictional frameworks.

5. Finalising the draft NAF and Jursidictional frameworks: A final round of adjustments was made to the NAF to implement agreed changes from the workshop and some suggested changes were made to the Jursidictional frameworks, which were needed to maintain a reasonable level of detail in the NAF.

6. Draft NAF released: the NAF spreadsheet was released to the Bureau and other collaborators for internal use.

2.4 Finalising NAF version 1.0

Further work was undertaken by the Bureau to finalise the NAF and officially release it as NAF Version 1.0 (v 1.0) including:

- Negotiating changes to State/Territory frameworks needed to preserve the detail in the NAF. For example, some had highly aggregated inter-jurisdictional units, which would have resulted in highly aggregated NAF units;
- Some States and Territories had recently updated their frameworks e.g. South Australia, Northern Territory and Victoria; the updated frameworks were sourced and integrated with the NAF;

- Western Australia does not have a formalised hydrostratigraphic framework. The Bureau reviewed the hydrostratigraphy available in the WA Department of Water's corporate groundwater database and incorporated these units in the NAF;
- Coal Seam Gas (CSG) emerged as an important issue in 2012/13. In light of this, the NAF was reviewed to ensure that it appropriately resolves the units relevant to CSG, particularly in deeper coal-bearing basins that may be of less interest to groundwater; and
- Geoscience Australia (GA) had done some additional work on the hydrostratigraphy of the Great Artesian Basin (GAB) for the GAB Water Resource Assessment. This new work was incorporated into the NAF.

After these changes were made, the following tasks were undertaken prior to release:

- Review of the NAF v 1.0 by State/Territory lead water agencies through the former NGIS Technical Reference Group (TRG);
- Publishing and promoting the NAF; and
- Development of a plan for maintaining and updating NAF.

2.5 Minor updates

Minor updates are undertaken by the Bureau each year to maintain the currency of the NAF and relationships to Jurisdictional aquifer frameworks (refer to 6. Updating the NAF for further information).

3 Relationship between Jurisdictional aquifer frameworks and NAF

The following information has been adapted and updated from the draft NAF methodology report (SKM 2012):

3.1 Australian Capital Territory

The Australian Capital Territory (ACT) does not have a formal aquifer framework. The Environment and Planning Development Directive will use the NAF as an aquifer framework for the ACT.

3.2 New South Wales

New South Wales (NSW) does not have a biophysical aquifer framework. There is a groundwater management framework that defines groundwater sources and management areas. However, it was not used as the basis for the NAF in NSW because the water sources/areas have a management focus and do not resolve particular hydrostratigraphic units.

NSW Department of Industry, Skills and Regional Development – DPI Water has created a limited number of HGUs and HGCs to populate NGIS case study datasets although they only cover a small portion of the State.

The NSW NAF was developed by including units from frameworks of neighbouring States/Territories and then adding NSW specific units. The 1:1 million scale surface geology was used as the basis for NAF GUs in NSW. There has also been considerable work done to add units from NSW coal-bearing basins.

3.3 Northern Territory

The Northern Territory currently has a two-tiered aquifer framework which includes GUs and HGUs (i.e. the HGC tier is absent). This framework was developed by the Department of Land Resource Management for the NGIS project. A different classification system is used inside and outside their Water Control Districts (WCDs). Inside the WCDs, the GUs are based on the 1:250K scale surface geology whereas outside the WCDs the GUs are based on the 1:2.5 million scale surface geology. Similarly the HGUs are more detailed inside the WCDs and more aggregated outside the WCDs.

3.4 Queensland

Queensland has an existing three tiered aquifer framework developed by the Department of Science, Information Technology and Innovation. The Queensland framework is based on fine scale of surface geology mapping supplemented with non-outcropping units and additional division of the Quaternary alluvial units using location

information. The Queensland framework is the most detailed of the existing state frameworks. When integrating the Queensland framework into the NAF, some aggregation at the HGC level was required to ensure consistency with other Jurisdictions, especially for the fractured rock aquifers.

3.5 South Australia

The South Australian (SA) Department of Environment, Water and Natural Resources recently created a three tiered aquifer framework for SA. The framework focuses on areas of key groundwater resource and does not cover all the HGUs across the State. The framework contains a locational element through the inclusion of groundwater basin information. However, the new framework has not been incorporated into their corporate groundwater database (SA OBSWELL) or the NGIS. Their database uses GUs and very aggregated HGUs (Tertiary Aquifer) that refer to several specific HGUs depending on their location. As a consequence, the NAF for SA has been developed based on a combination of the new SA aquifer framework, the SA OBSWELL units and the 1:1 million scale surface hydrogeology.

3.6 Tasmania

A three tiered aquifer framework for Tasmania has been compiled by the Department of Primary Industries, Parks, Water and Environment based on 1:250K scale state geology to which HGUs and HGCs have been assigned. Tasmania was treated slightly differently in the NAF to the other Jurisdictions in that the 1:250K scale state geology was maintained as the basis for Tasmanian NAF GUs.

3.7 Victoria

The Victorian Aquifer Framework (VAF) was developed by the Department of Environment, Land, Water and Planning. The VAF is based on 1:250K scale surface geology mapping supplemented with non-outcropping units. Therefore there was a larger number of Victorian GUs to be mapped to the NAF GUs. Following this, a relationship between the NAF HGUs and HGCs and Victorian HGUs and HGCs was determined.

3.8 Western Australia

Western Australia (WA) does not have a biophysical aquifer framework. They use their Divertible Water Allocation Information Database (DWAID) to define ‘aquifers,’ which are discrete groundwater resources for groundwater management purposes. The DWAID aquifers were not used as the basis for the NAF in WA because the aquifers have a management focus and do not resolve particular hydrostratigraphic units.

The draft NAF was developed mainly from frameworks of neighbouring states where the same geological unit occurs in WA and from a preliminary aquifer framework drafted by the WA Department for Water (DOW). Further work was undertaken to ensure that all HGUs in WA DOW's corporate groundwater database were represented in the NAF.

4 NAF products

The NAF is available as an Excel spreadsheet. The spreadsheet contains the following worksheets:

- Full NAF
- NAF HGUs
- NAF HGCs

The **Full NAF** worksheet contains a full listing of the NAF (Figure 2) including:

- GUs (highlighted in red),
- HGUs (yellow)
- HGCs (blue)

Each unit is defined by a name and a unique number. There is additional information for the GUs including:

- GU symbol from 1:1 million scale surface geology mapping
- GU symbol from 1:250K scale surface geology mapping (for Tasmanian units only)
- Stratigraphic unit number
- Whether the unit is included in 1:1 million scale surface geology mapping
- Stratigraphic, hierarchy, age and other information for 1:1 million scale units

The description of NAF fields in the spreadsheet is contained in Appendix A. The field names in this spreadsheet are consistent with the equivalent fields in the National Groundwater Information System.

The **Full NAF** worksheet also contains State/Territory HGU and HGC names corresponding to the NAF GUs. Note that the same GUs can occur in two or more Jurisdictions with a common NAF HGU and HGC name.

The **NAF HGUs** worksheet contains a list of the unique NAF HGU names and numbers, and their corresponding NAF HGC names and numbers.

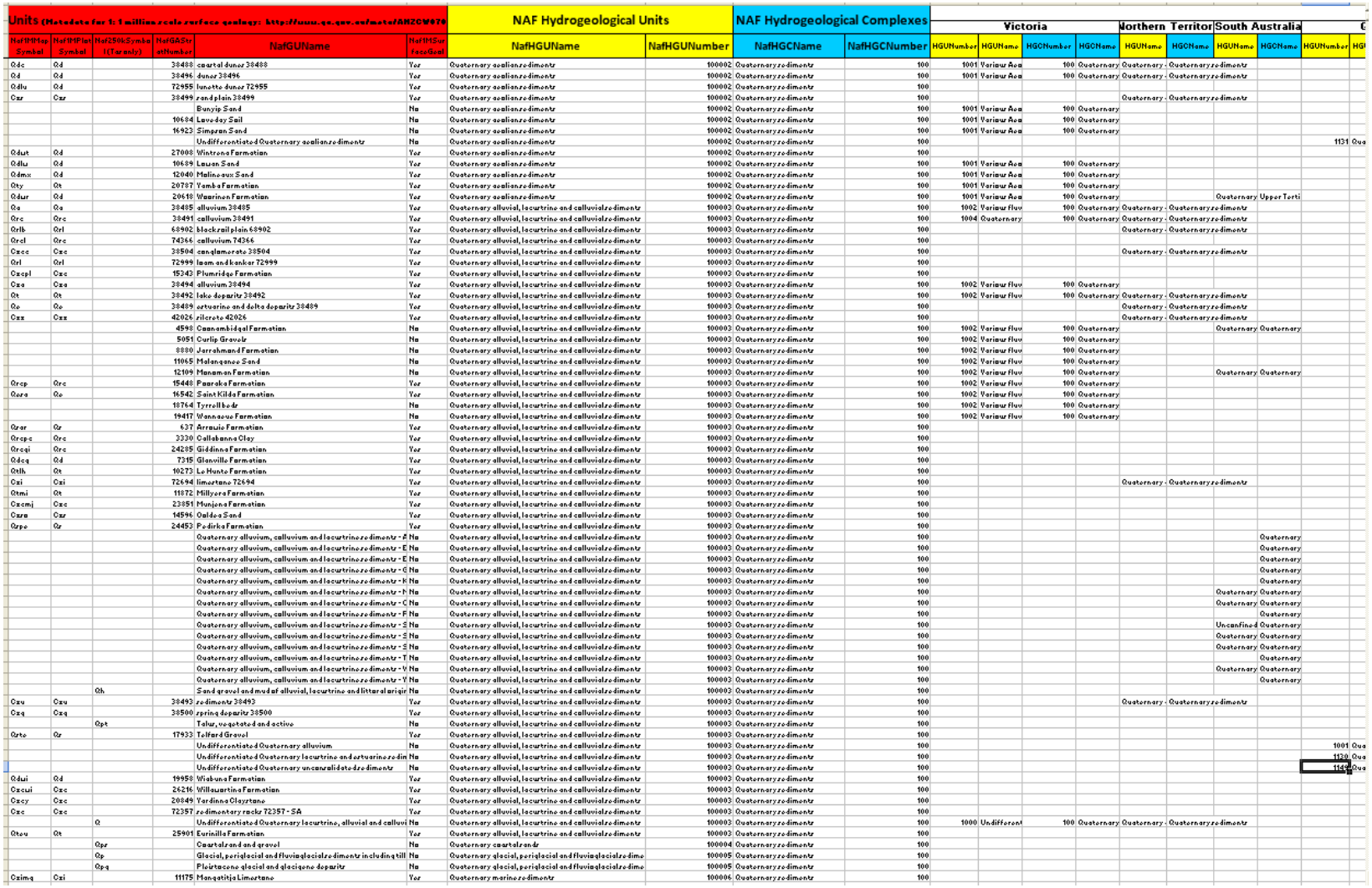
Similarly, the **NAF HGCs** worksheet contains a list of the unique NAF HGC names and numbers.

4.1 Data dictionary

A glossary of NAF terms is available through the Australian Water Information Dictionary at: http://www.bom.gov.au/water/awid/

4.2 Metadata

Appendix A contains descriptions of the fields in the NAF spreadsheet. The descriptions are adapted and updated from the draft NAF methodology report (SKM 2012).



Units (Metadata for 1: 1 million scale surface geology: http://www.ga.gov.au/metadata-gateway/metadata/record/gcat/ANZCW0703000000)					NAF Hydrogeological Units		NAF Hydrogeological Complexes		Victoria				Northern Territor		South Australia			
NafHMMap Symbol	NafHMPlot Symbol	Naf250kSymbol (Tarzaly)	NafGASymbolNumber	NafGUName	NafSurfaceGeol	NafHGUName	NafHGUNumber	NafHGCName	NafHGCNumber	HGUNumber	HGUName	HGCNumber	HGCName	HGUName	HGCName	HGUName	HGCName	HGUNumber	HGI
Qdc	Qd		38488	coastal dunes 38488	Yes	Quaternary aeolian sediments	100002	Quaternary sediments	100	1001	Various Aeo	100	Quaternary	Quaternary -	Quaternary sediments				
Qd	Qd		38496	dunes 38496	Yes	Quaternary aeolian sediments	100002	Quaternary sediments	100	1001	Various Aeo	100	Quaternary	Quaternary -	Quaternary sediments				
Qdlu	Qd		72955	lunette dunes 72955	Yes	Quaternary aeolian sediments	100002	Quaternary sediments	100										
Qsr	Qsr		38499	sand plain 38499	Yes	Quaternary aeolian sediments	100002	Quaternary sediments	100					Quaternary -	Quaternary sediments				
				Bunyip Sand	No	Quaternary aeolian sediments	100002	Quaternary sediments	100	1001	Various Aeo	100	Quaternary						
			10684	Laverday Sail	No	Quaternary aeolian sediments	100002	Quaternary sediments	100	1001	Various Aeo	100	Quaternary						
			16923	Simpson Sand	No	Quaternary aeolian sediments	100002	Quaternary sediments	100	1001	Various Aeo	100	Quaternary						
				Undifferentiated Quaternary aeolian sediments	No	Quaternary aeolian sediments	100002	Quaternary sediments	100									1131	Qua
Qdut	Qd		27008	Wintrena Formation	Yes	Quaternary aeolian sediments	100002	Quaternary sediments	100										
Qdlu	Qd		10639	Lawan Sand	Yes	Quaternary aeolian sediments	100002	Quaternary sediments	100	1001	Various Aeo	100	Quaternary						
Qdmx	Qd		12040	Malinaux Sand	Yes	Quaternary aeolian sediments	100002	Quaternary sediments	100	1001	Various Aeo	100	Quaternary						
Qty	Qt		20787	Yamba Formation	Yes	Quaternary aeolian sediments	100002	Quaternary sediments	100	1001	Various Aeo	100	Quaternary						
Qdur	Qd		20618	Woorinen Formation	Yes	Quaternary aeolian sediments	100002	Quaternary sediments	100	1001	Various Aeo	100	Quaternary			Quaternary	Upper Terti		
Qa	Qa		38485	alluvium 38485	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary	Quaternary -	Quaternary sediments				
Qrc	Qrc		38491	colluvium 38491	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1004	Quaternary	100	Quaternary	Quaternary -	Quaternary sediments				
Qrlb	Qrl		68902	blacktrail plain 68902	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100					Quaternary -	Quaternary sediments				
Qrcl	Qrc		74366	colluvium 74366	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qccc	Qcc		38504	conglomerate 38504	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100					Quaternary -	Quaternary sediments				
Qrl	Qrl		72999	loam and kankar 72999	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qccpl	Qcc		15242	Plumridge Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qca	Qca		38494	alluvium 38494	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary						
Qt	Qt		38492	lake deposits 38492	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary	Quaternary -	Quaternary sediments				
Qe	Qe		38489	estuarine and delta deposits 38489	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100					Quaternary -	Quaternary sediments				
Qcz	Qcz		42026	silcrete 42026	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100					Quaternary -	Quaternary sediments				
			4598	Cannambidgal Formation	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary			Quaternary	Quaternary		
			5051	Curlip Gravels	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary						
			8880	Jarrahmand Formation	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary						
			11065	Malanganee Sand	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary						
			12109	Manaman Formation	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary			Quaternary	Quaternary		
Qrcp	Qrc		15448	Paaraka Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary						
Qsra	Qs		16542	Saint Kilda Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary						
			18764	Tyrrellvale	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary						
			19417	Wanaaeue Formation	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1002	Various Fluv	100	Quaternary						
Qrar	Qr		637	Arrawie Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qrcpc	Qrc		3330	Callabonna Clay	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qrcgi	Qrc		24285	Giddinna Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qdcg	Qd		7315	Glanville Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qtlh	Qt		10273	Le Hunte Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qzi	Qzi		72694	limestone 72694	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100					Quaternary -	Quaternary sediments				
Qtmi	Qt		11872	Millyera Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qzcmj	Qzc		23851	Munjena Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qzra	Qzr		14596	Oaldea Sand	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qrpe	Qr		24453	Pedirka Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
				Quaternary alluvium, colluvium and lacustrine sediments - F	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100								Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - E	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100								Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - E	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100								Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - G	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100								Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - H	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100								Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - I	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100							Quaternary	Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - C	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100							Quaternary	Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - F	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100								Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - S	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100							Unconfined	Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - S	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100							Quaternary	Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - S	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100							Quaternary	Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - T	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100								Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - W	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100							Quaternary	Quaternary		
				Quaternary alluvium, colluvium and lacustrine sediments - Y	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100								Quaternary		
		Qh		Sand gravel and mud of alluvial, lacustrine and littoral origin	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qzu	Qzu		38493	sediments 38493	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100					Quaternary -	Quaternary sediments				
Qzq	Qzq		38500	spring deposits 38500	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
		Qpt		Talus, unconsolidated active	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qrtc	Qr		17933	Telford Gravel	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
				Undifferentiated Quaternary alluvium	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100									1001	Qua
				Undifferentiated Quaternary lacustrine and estuarine sedim	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100									1139	Qua
				Undifferentiated Quaternary unconsolidated sediments	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100									1140	Qua
Qdui	Qd		19958	Wiabuna Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qzcui	Qzc		26216	Willaurtina Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qzcy	Qzc		20849	Yardinna Claystone	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
Qzc	Qzc		72357	sedimentary rocks 72357 - SA	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
		Q		Undifferentiated Quaternary lacustrine, alluvial and colluvi	No	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100	1000	Undifferent	100	Quaternary	Quaternary -	Quaternary sediments				
Qtou	Qt		25901	Eurinilla Formation	Yes	Quaternary alluvial, lacustrine and palluvial sediments	100003	Quaternary sediments	100										
		Qpr		Coastal sand and gravel	No	Quaternary coastal sands	100004	Quaternary sediments	100										
		Qp		Glacial, periglacial and fluvioglacial sediments including till	No	Quaternary glacial, periglacial and fluvioglacial sediments	100005	Quaternary sediments	100										
		Qpg		Pleistocene glacial and glacigene deposits	No	Quaternary glacial, periglacial and fluvioglacial sediments	100005	Quaternary sediments	100										
Qzimq	Qzi		11175	Mangatitja Limestone	Yes	Quaternary marine sediments	100006	Quaternary sediments	100										

Figure 2 - NAF spreadsheet

5 Using the NAF

The NAF can be used to standardise State/ Territory hydrostratigraphy terminology. This allows for consistency in multi-jurisdictional groundwater assessments (refer to Section 5.1 for an example application). The NAF can also be used to generalise hydrostratigraphy for broad scale analysis (refer to Section 5.2 for an example application).

5.1 Standardising inter-jurisdictional terminology

The NAF has been used to standardise State/ Territory hydrostratigraphy terminology for the Murray Hydrogeological Basin, which covers parts of Victoria, NSW and SA (Figure 3).

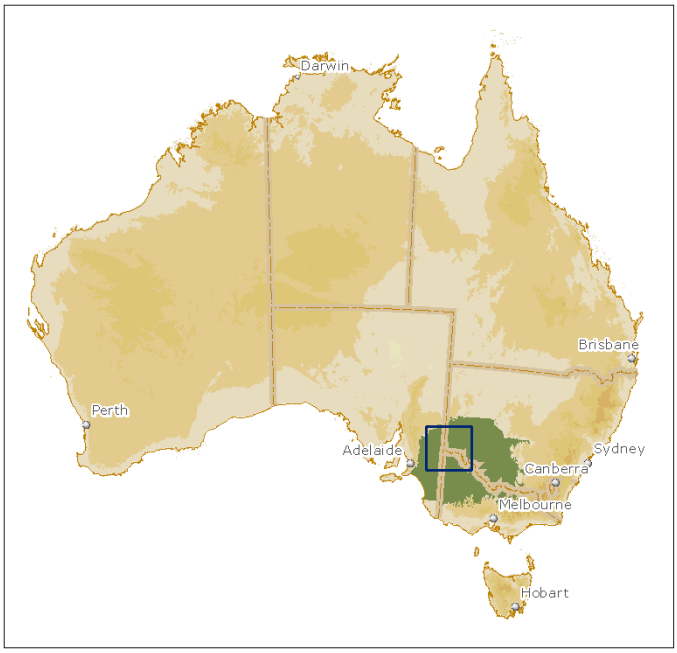


Figure 3 - Map of the Murray Hydrogeologic Basin in Australia and location of Figures 4 and 5

Figure 4 shows bores in the Murray Hydrogeological Basin near the intersection of the three states – Victoria, NSW and SA. The colour of the bore indicates the HGU that each bore is monitoring. Prior to applying the NAF, each state uses its own nomenclature and eight HGUs are identified. The bores appear to be monitoring multiple unconnected HGUs.

Figure 5 shows the same bores after the NAF has been applied. There are only three HGUs that occur in each State. The standardised hydrostratigraphy allows for cross-

border interpretation of groundwater flow, potentiometric surfaces and groundwater modelling.

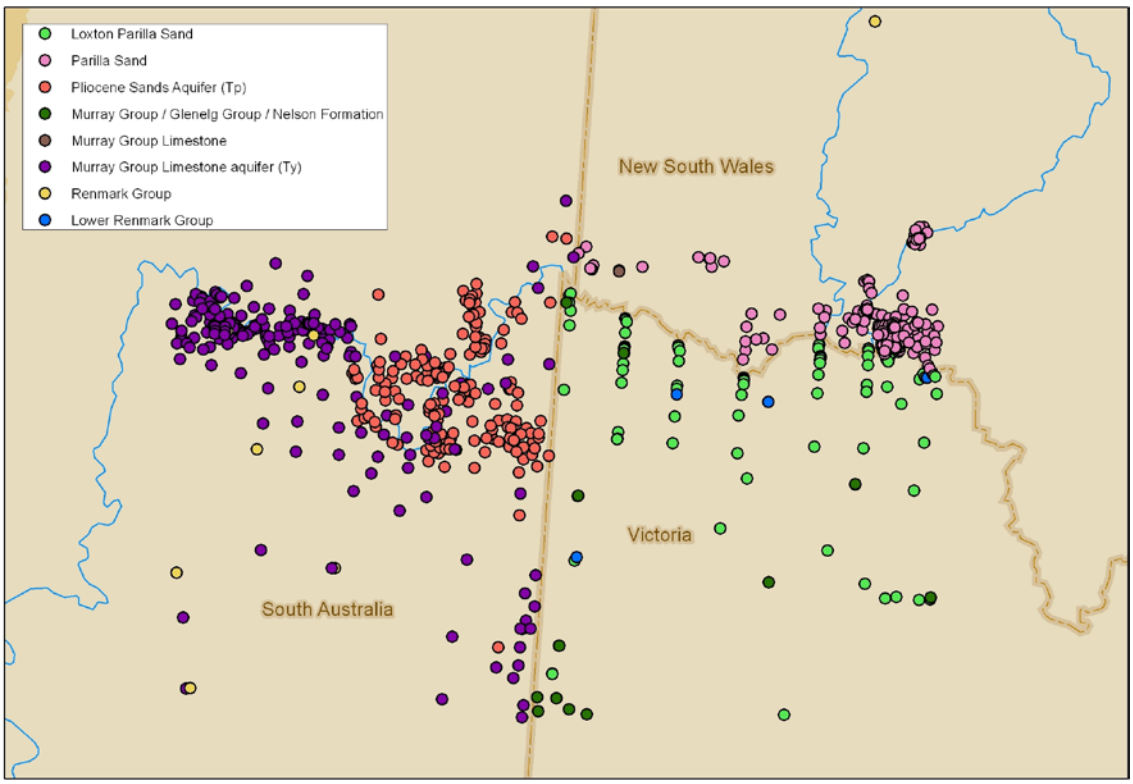


Figure 4 - Map of bores in the Murray Hydrogeological Basin showing the screened hydrogeologic unit using Jurisdictional terminology

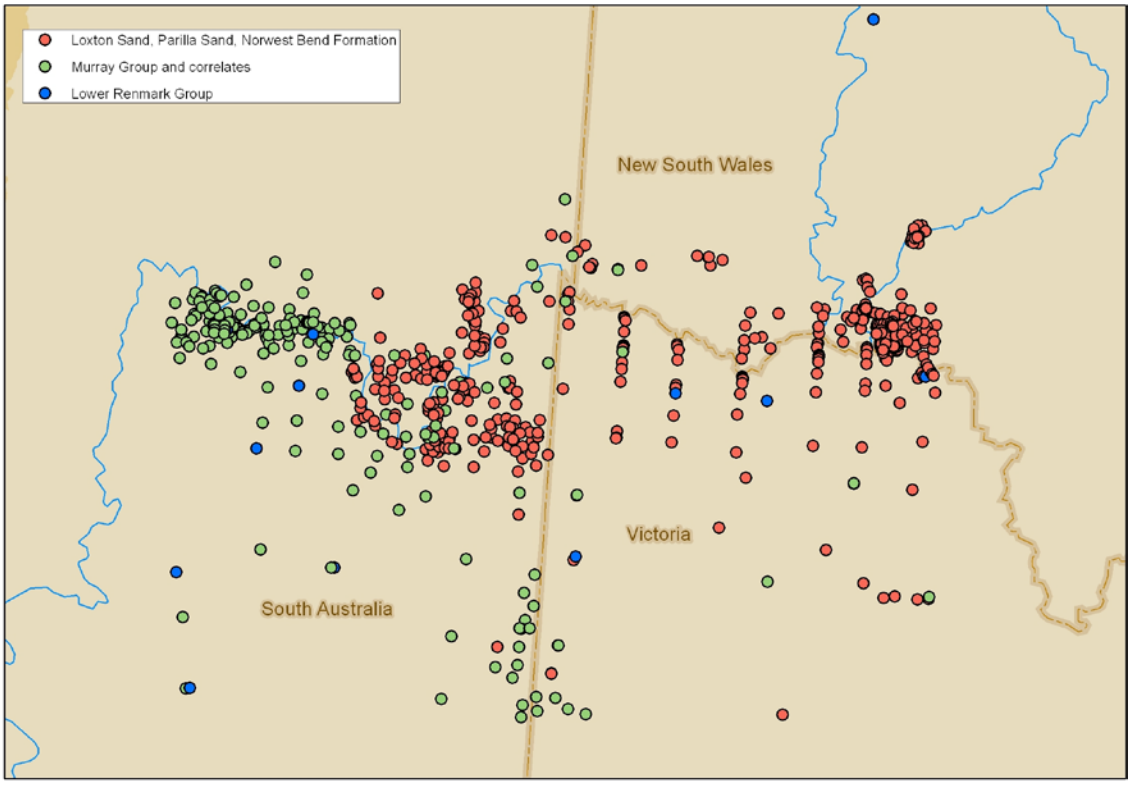


Figure 5 - Map of bores in the Murray Hydrogeological Basin showing the screened hydrogeologic unit standardised using the NAF

5.2 Generalising hydrostratigraphy using HGCs

As the NAF has three tiers, it can be used to generalise hydrostratigraphy for broad scale analysis. The VAF has been used in a similar way for the Victorian State Wide 3D Aquifer Surface Development Project (GHD, 2012). The VAF Aquifers (equivalent to NAF HGCs) were used as the basis for mapping 3D surfaces across Victoria (Figure 6). The 3D aquifer surfaces were generated to support understanding about the distribution of aquifers and aquitards to assist in groundwater resource management.

Figure 6 - Map of HGCs in southwestern Victoria

6 Updating the NAF

6.1 Currency

NAF v 1.0 was completed in April 2013 and will remain current until the next scheduled release in December 2013. An updated NAF will reflect any changes in the Jurisdictional aquifer frameworks that are received through the Water Regulations in September 2013 and developments in Australian hydrostratigraphy.

6.2 Update frequency

Each year in September through the Water Regulations, any updates made to the State/Territory Frameworks will be received. These updated frameworks will be incorporated with the NAF.

6.3 Update process

The NAF update process is outlined below:

1. The Bureau will provide ongoing assistance as necessary for each Jurisdiction to further develop their aquifer frameworks with particular emphasis on Jurisdictions with less mature frameworks.

2. Updated Jurisdictional aquifer frameworks will be delivered to the Bureau through the Water Regulations by the end of September each year. An updated framework is only required if changes have been made by the Jurisdiction. At this time, any recent hydrostratigraphy work carried out by other agencies such as GA, CSIRO, universities, state agencies and geological surveys will be collated. This will also include hydrostratigraphy work undertaken as part of the Bioregional Assessments for Coal Seam Gas and Coal Mining.

3. The Bureau's NAF project team will collate all updated aquifer frameworks and use them to update the NAF.

4. The updated NAF will be released as a new version at the same time as the annual update of the NGIS database. The new version will be uploaded to the website.

6.3.1 Assumptions for NAF update process

The NAF update process is based on the following assumptions:

- HGUs included in each Jurisdiction's NGIS database will reflect any changes to the HGUs in the updated frameworks received; and
- Future developments to Jurisdictional frameworks will be consistent with the NAF where possible.

Appendix A – Description of fields in NAF spreadsheet

Table 1 - Description of NAF GU fields in the NAF spreadsheet

Field Name	Mandatory	Data Type	Description
NafGU Name	Yes	text	Name of Geological Unit (e.g. Formation name)
Naf1MMapSymbol, Naf1MPlotSymbol	No	text	Map and plot symbol used in the Geoscience Australia 1:1 million scale surface geology dataset
Naf250kSymbol (Tas only)	No	text	Map symbol used in Tasmanis's 1:250,000 scale surface geology dataset. Only valid for Tasmanian units.
Naf1MSurfaceGeol	Yes	Yes/No	Whether the unit appears on the Geoscience Australia 1:1 million scale surface geology dataset
Naf1GAStratNumber	No	integer	Stratigraphic number in the Australian Stratigraphic Units Database (managed by Geosciences Australia)
SUPERGROUP*, GROUPNAME*, SUBGROUP*, FORMATION*, MEMBER, BED, SUPERSUITE, SUITE, STATUS, USAGE, MIN,GEOAGE, MAX_GEOAGE, TIME_SCALE, MIN_NUMAGE, MINAGEMETH_, MAX_NUMAGE, MAXAGEMETH, FORM_TYPE, LITHGROUP1, LITHGROUP2, LITH_DESC*, SRC_DATE, CAPT_DATE, MOD_DATE, INT_METHOD, CONFIDENCE, LOC_QUAL,	No	Text; integer	Refer to Geoscience Australia website for metadata for these fields: http://www.ga.gov.au/meta/ANZCW0703013575.html *These fields when defined for a Tasmanian unit have metadata from Mineral Resources Tasmania: http://www.mrt.tas.gov.au/portal/page?_pageid=35,832323&_dad=portal&_schema=PORTAL

LOC_ACC, MINAGE*, MAXAGE*			
ProvName	No	text	Geological Provence name sourced from the State/Territory aquifer frameworks
Era_Name, Period_Name, Epoc_Name	No	text	These fields are sourced from the Tasmanian Aquifer Framework which is based on the Mineral Resources Tasmania 1:250,000 scale surface geology.

Table 2 - Description of NAF HGU fields in the NAF spreadsheet

Field Name	Mandatory	Data Type	Description
NafHGUNumber	Yes	integer	National Aquifer Framework Hydrogeological Unit Number
NafHGUName	Yes	text	National Aquifer Framework Hydrogeological Unit Name

Table 3 - Description of NAF HGC fields in the NAF spreadsheet

Field Name	Mandatory	Data Type	Description
NafHGCNumber	Yes	integer	National Aquifer Framework Hydrogeological Complex Number
NafHGCName	Yes	text	National Aquifer Framework Hydrogeological Complex Name

Table 4 - Description of State/Territory HGU fields in the NAF spreadsheet

Field Name	Mandatory	Data Type	Description
HGUNumber	Yes	integer	State/ Territory Hydrogeological Unit Number
HGUName	Yes	text	State/ Territory Hydrogeological Unit Name

HGUCode	No	Text	State/ Territory Hydrogeological Unit Code

Table 5 - Description of State/Territory HGC fields in the NAF spreadsheet

Field Name	Mandatory	Data Type	Description
HGCNumber	No	integer	State/ Terrotory Hydrogeological Complex Number
HGCName	Yes	text	State/ Territory Hydrogeological Complex Name
HGCCode	No	Text	State/ Territory Hydrogeological Complex Code

References

GHD (2012) Report on the development of State-wide 3D aquifer surfaces, May 2012. Department of Sustainability and Environment.

SKM (2012) National Aquifer Framework Version 1.0 – method and outcomes, May 2012. Bureau of Meteorology.