Australian Government

BIOREGIONAL ASSESSMENTS

PROVIDING SCIENTIFIC WATER RESOURCE INFORMATION ASSOCIATED WITH COAL SEAM GAS AND LARGE COAL MINES

Description of the water-dependent asset register for the Gwydir subregion

Product 1.3 for the Gwydir subregion from the Northern Inland Catchments Bioregional Assessment

25 May 2016

A scientific collaboration between the Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia

The Bioregional Assessment Programme

The Bioregional Assessment Programme is a transparent and accessible programme of baseline assessments that increase the available science for decision making associated with coal seam gas and large coal mines. A bioregional assessment is a scientific analysis of the ecology, hydrology, geology and hydrogeology of a bioregion with explicit assessment of the potential impacts of coal seam gas and large coal mining development on water resources. This Programme draws on the best available scientific information and knowledge from many sources, including government, industry and regional communities, to produce bioregional assessments that are independent, scientifically robust, and relevant and meaningful at a regional scale.

The Programme is funded by the Australian Government Department of the Environment. The Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia are collaborating to undertake bioregional assessments. For more information, visit http://www.bioregionalassessments.gov.au.

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Cover photograph

Gwydir River near Pallamallawa, NSW, 2014

Credit: CSIRO

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Introduction

The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) was established to provide advice to the federal Minister for the Environment on potential water-related impacts of coal seam gas (CSG) and large coal mining developments (IESC, 2015).

Bioregional assessments (BAs) are one of the key mechanisms to assist the IESC in developing this advice so that it is based on best available science and independent expert knowledge. Importantly, technical products from BAs are also expected to be made available to the public, providing the opportunity for all other interested parties, including government regulators, industry, community and the general public, to draw from a single set of accessible information. A BA is a scientific analysis, providing a baseline level of information on the ecology, hydrology, geology and hydrogeology of a bioregion with explicit assessment of the potential impacts of CSG and coal mining development on water resources.

The IESC has been involved in the development of *Methodology for bioregional assessments of the impacts of coal seam gas and coal mining development on water resources* (the BA methodology; Barrett et al., 2013) and has endorsed it. The BA methodology specifies how BAs should be undertaken. Broadly, a BA comprises five components of activity, as illustrated in Figure 1. Each BA will be different, due in part to regional differences, but also in response to the availability of data, information and fit-for-purpose models. Where differences occur, these are recorded, judgments exercised on what can be achieved, and an explicit record is made of the confidence in the scientific advice produced from the BA.

The Bioregional Assessment Programme

The Bioregional Assessment Programme is a collaboration between the Department of the Environment, the Bureau of Meteorology, CSIRO and Geoscience Australia. Other technical expertise, such as from state governments or universities, is also drawn on as required. For example, natural resource management groups and catchment management authorities identify assets that the community values by providing the list of water-dependent assets, a key input.

The Technical Programme, part of the Bioregional Assessment Programme, will undertake BAs for the following bioregions and subregions (see http://www.bioregionalassessments.gov.au/assessments for a map and further information):

- the Galilee, Cooper, Pedirka and Arckaringa subregions, within the Lake Eyre Basin bioregion
- the Maranoa-Balonne-Condamine, Gwydir, Namoi and Central West subregions, within the Northern Inland Catchments bioregion
- the Clarence-Moreton bioregion
- the Hunter and Gloucester subregions, within the Northern Sydney Basin bioregion
- the Sydney Basin bioregion

- the Gippsland Basin bioregion.

Technical products (described in a later section) will progressively be delivered throughout the Programme.

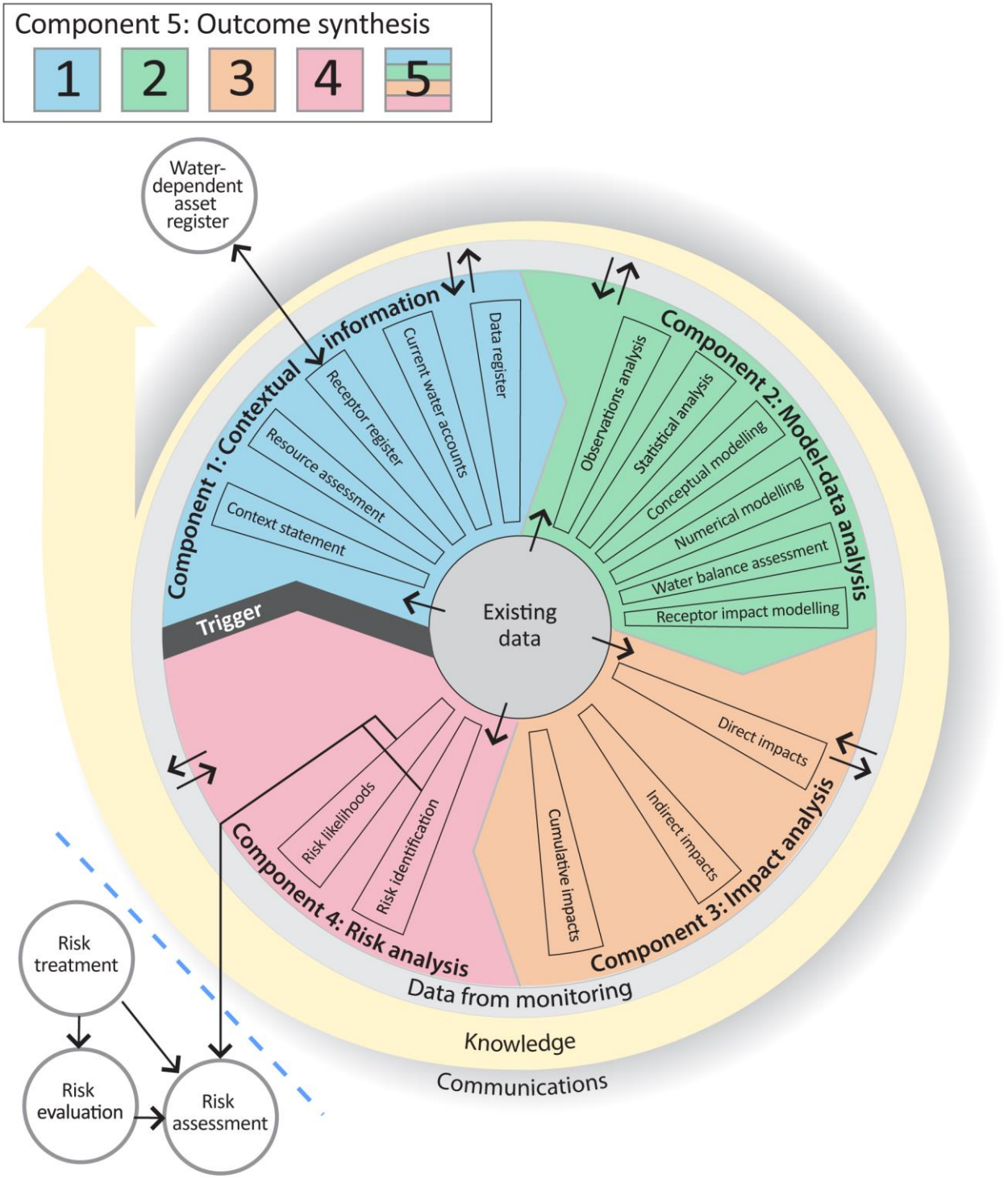

Figure 1 Schematic diagram of the bioregional assessment methodology

The methodology comprises five components, each delivering information into the bioregional assessment and building on prior components, thereby contributing to the accumulation of scientific knowledge. The small grey circles indicate activities external to the bioregional assessment. Risk identification and risk likelihoods are conducted within a bioregional assessment (as part of Component 4) and may contribute activities undertaken externally, such as risk evaluation, risk assessment and risk treatment. Source: Figure 1 in Barrett et al. (2013), © Commonwealth of Australia

Methodologies

The overall scientific and intellectual basis of the BAs is provided in the BA methodology (Barrett et al., 2013). Additional guidance is required, however, about how to apply the BA methodology to a range of subregions and bioregions. To this end, the teams undertaking the BAs have developed and documented detailed scientific submethodologies (Table 1) to, in the first instance, support the consistency of their work across the BAs and, secondly, to open the approach to scrutiny, criticism and improvement through review and publication. In some instances, methodologies applied in a particular BA may differ from what is documented in the submethodologies – in this case an explanation will be supplied in the technical products of that BA. Ultimately the Programme anticipates publishing a consolidated 'operational BA methodology' with fully worked examples based on the experience and lessons learned through applying the methods to 13 bioregions and subregions.

The relationship of the submethodologies to BA components and technical products is illustrated in Figure 2. While much scientific attention is given to assembling and transforming information, particularly through the development of the numerical, conceptual and receptor impact models, integration of the overall assessment is critical to achieving the aim of the BAs. To this end, each submethodology explains how it is related to other submethodologies and what inputs and outputs are required. They also define the technical products and provide guidance on the content to be included. When this full suite of submethodologies is implemented, a BA will result in a substantial body of collated and integrated information for a subregion or bioregion, including new information about the potential impacts of coal resource development on water and water-dependent assets.

Table 1 Methodologies

Each submethodology is available online at http://data.bioregionalassessments.gov.au/submethodology/XXX, where 'XXX' is replaced by the code in the first column. For example, the BA methodology is available at http://data.bioregionalassessments.gov.au/submethodology/bioregional-assessment-methodology and submethodology M02 is available at http://data.bioregionalassessments.gov.au/submethodology/M02. Submethodologies might be added in the future.

Code	Proposed title	Summary of content
bioregional-assessment-methodology	*Methodology for bioregional assessments of the impacts of coal seam gas and coal mining development on water resources*	A high-level description of the scientific and intellectual basis for a consistent approach to all bioregional assessments
M02	*Compiling water-dependent assets*	Describes the approach for determining water-dependent assets
M03	*Assigning receptors to water-dependent assets*	Describes the approach for determining receptors associated with water-dependent assets
M04	*Developing a coal resource development pathway*	Specifies the information that needs to be collected and reported about known coal and coal seam gas resources as well as current and potential resource developments
M05	*Developing the conceptual model of causal pathways*	Describes the development of the conceptual model of causal pathways, which summarises how the 'system' operates and articulates the potential links between coal resource development and changes to surface water or groundwater
M06	*Surface water modelling*	Describes the approach taken for surface water modelling
M07	*Groundwater modelling*	Describes the approach taken for groundwater modelling
M08	*Receptor impact modelling*	Describes how to develop receptor impact models for assessing potential impact to assets due to hydrological changes that might arise from coal resource development
M09	*Propagating uncertainty through models*	Describes the approach to sensitivity analysis and quantification of uncertainty in the modelled hydrological changes that might occur in response to coal resource development
M10	*Impacts and risks*	Describes the logical basis for analysing impact and risk
M11	*Systematic analysis of water-related hazards associated with coal resource development*	Describes the process to identify potential water-related hazards from coal resource development

Technical products

The outputs of the BAs include a suite of technical products presenting information about the ecology, hydrology, hydrogeology and geology of a bioregion and the potential impacts of CSG and coal mining developments on water resources, both above and below ground. Importantly, these technical products are available to the public, providing the opportunity for all interested parties, including community, industry and government regulators, to draw from a single set of accessible information when considering CSG and large coal mining developments in a particular area.

The information included in the technical products is specified in the BA methodology. Figure 2 shows the relationship of the technical products to BA components and submethodologies. Table 2 lists the content provided in the technical products, with cross-references to the part of the BA methodology that specifies it. The red outlines in both Figure 2 and Table 2 indicate the information included in this technical product.

Technical products are delivered as reports (PDFs). Additional material is also provided, as specified by the BA methodology:

- unencumbered data syntheses and databases
- unencumbered tools, model code, procedures, routines and algorithms
- unencumbered forcing, boundary condition, parameter and initial condition datasets
- lineage of datasets (the origin of datasets and how they are changed as the BA progresses)
- gaps in data and modelling capability.

In this context, unencumbered material is material that can be published according to conditions in the licences or any applicable legislation. All reasonable efforts were made to provide all material under a Creative Commons Attribution 3.0 Australia Licence.

Technical products, and the additional material, are available online at http://www.bioregionalassessments.gov.au.

The Bureau of Meteorology archives a copy of all datasets used in the BAs. This archive includes datasets that are too large to be stored online and datasets that are encumbered. The community can request a copy of these archived data at http://www.bioregionalassessments.gov.au.

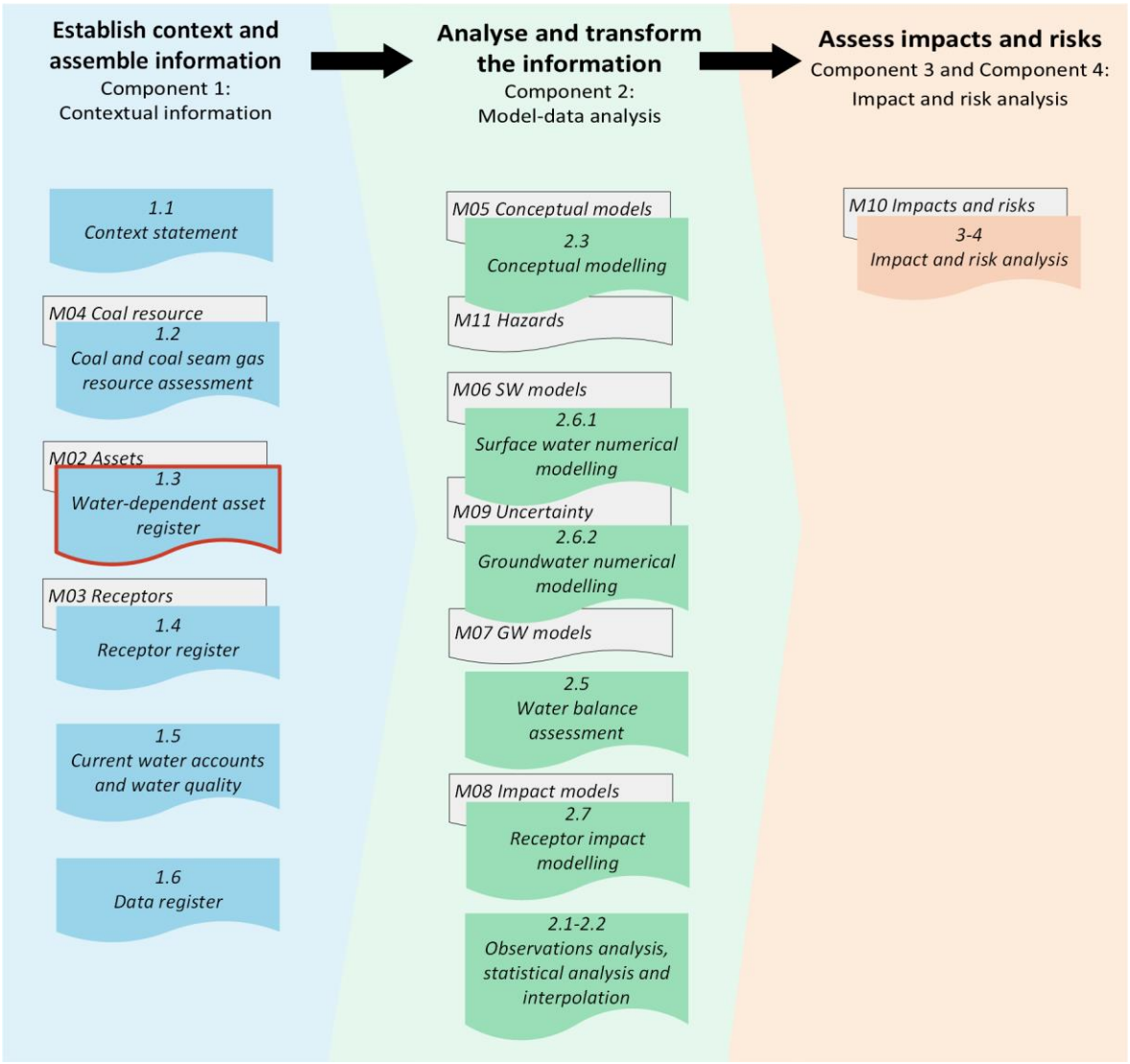

Figure 2 Technical products and submethodologies associated with each component of a bioregional assessment

In each component (Figure 1) of a bioregional assessment, a number of technical products (coloured boxes, see also Table 2) are potentially created, depending on the availability of data and models. The light grey boxes indicate submethodologies (Table 1) that specify the approach used for each technical product. The red outline indicates this technical product. The BA methodology (Barrett et al., 2013) specifies the overall approach.

Table 2 Technical products delivered by the Northern Inland Catchments Bioregional Assessment

For each subregion in the Northern Inland Catchments Bioregional Assessment, technical products are delivered online at http://www.bioregionalassessments.gov.au, as indicated in the 'Type' column[a]. Other products – such as datasets, metadata, data visualisation and factsheets – are provided online. There is no product 2.4; originally this product was going to include two- and three-dimensional representations as per Section 4.2 of the BA methodology, but these are instead included in other products.

Component	Product code	Title	Section in the BA methodology[b]	Type[a]
Component 1: Contextual information for the Gwydir subregion	1.1	Context statement	2.5.1.1, 3.2	PDF, HTML
	1.2	Coal and coal seam gas resource assessment	2.5.1.2, 3.3	PDF, HTML
	1.3	Description of the water-dependent asset register	2.5.1.3, 3.4	PDF, HTML, register
	1.4	Description of the receptor register	2.5.1.4, 3.5	Not produced
	1.5	Current water accounts and water quality	2.5.1.5	HTML-only
	1.6	Data register	2.5.1.6	Register
Component 2: Model-data analysis for the Gwydir subregion	2.1-2.2	Observations analysis, statistical analysis and interpolation	2.5.2.1, 2.5.2.2	Not produced
	2.3	Conceptual modelling	2.5.2.3, 4.3	Not produced
	2.5	Water balance assessment	2.5.2.4	Not produced
	2.6.1	Surface water numerical modelling	4.4	Not produced
	2.6.2	Groundwater numerical modelling	4.4	Not produced
	2.7	Receptor impact modelling	2.5.2.6, 4.5	Not produced
Component 3 and Component 4: Impact and risk analysis for the Gwydir subregion	3-4	Impact and risk analysis	5.2.1, 2.5.4, 5.3	Not produced
Component 5: Outcome synthesis for the Gwydir subregion	5	Outcome synthesis	2.5.5	Not produced

[a]The types of products are as follows:

- 'PDF' indicates a PDF document that is developed by the Northern Inland Catchments Bioregional Assessment using the structure, standards and format specified by the Programme.
- 'HTML' indicates the same content as in the PDF document, but delivered as webpages.
- 'HTML-only' indicates content that is only delivered as webpages (with no accompanying PDF document). This content is developed by the Northern Inland Catchments Bioregional Assessment using the structure, standards and format specified by the Programme.
- 'Register' indicates controlled lists that are delivered using a variety of formats as appropriate.
- 'Not produced' indicates that the product was not developed. A webpage explains why and points to relevant submethodologies (Table 1).

[b]*Methodology for bioregional assessments of the impacts of coal seam gas and coal mining development on water resources* (Barrett et al., 2013)

About this technical product

The following notes are relevant only for this technical product.

- All reasonable efforts were made to provide all material under a Creative Commons Attribution 3.0 Australia Licence.
- All maps created as part of this BA for inclusion in this product used the Albers equal area projection with a central meridian of 151.0° East for the Northern Inland Catchments bioregion and two standard parallels of –18.0° and –36.0°.
- Visit http://bioregionalassessments.gov.au to access metadata (including copyright, attribution and licensing information) for datasets cited or used to make figures in this product.
- In addition, the datasets are published online if they are unencumbered (able to be published according to conditions in the licence or any applicable legislation). The Bureau of Meteorology archives a copy of all datasets used in the BAs. This archive includes datasets that are too large to be stored online and datasets that are encumbered. The community can request a copy of these archived data at http://www.bioregionalassessments.gov.au.
- The citation details of datasets are correct to the best of the knowledge of the Bioregional Assessment Programme at the publication date of this product. Readers should use the hyperlinks provided to access the most up-to-date information about these data; where there are discrepancies, the information provided online should be considered correct. The dates used to identify Bioregional Assessment Source Datasets are the dataset's published date. Where the published date is not available, the last updated date or created date is used. For Bioregional Assessment Derived Datasets, the created date is used.

References

Barrett DJ, Couch CA, Metcalfe DJ, Lytton L, Adhikary DP and Schmidt RK (2013) Methodology for bioregional assessments of the impacts of coal seam gas and coal mining development on water resources. A report prepared for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of the Environment. Department of the Environment, Australia. Viewed 29 June 2016, http://data.bioregionalassessments.gov.au/submethodology/bioregional-assessment-methodology.

IESC (2015) Information guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals. Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development, Australia. Viewed 29 June 2016, http://www.iesc.environment.gov.au/publications/information-guidelines-independent-expert-scientific-committee-advice-coal-seam-gas.

1.3 Description of the water-dependent asset register for the Gwydir subregion

A water-dependent asset has a particular meaning for bioregional assessments; it is an asset potentially impacted by changes in groundwater and/or surface water due to coal or coal seam gas development. Some ecological assets solely depend on incident rainfall and will not be considered as water dependent if evidence does not support a linkage to groundwater or surface water.

This product describes water-dependent assets that have been identified in the bioregional assessment and are listed in the water-dependent asset register (available at http://data.bioregionalassessments.gov.au/product/NIC/GWY/1.3).

1.3.1 Methods

Summary

The water-dependent asset register described in this product is a list of water-dependent assets identified for the bioregional assessment (BA) of the Gwydir subregion. This section details the specific application to the Gwydir subregion of methods described in the companion submethodology M02 (as listed in Table 1) for compiling water-dependent assets (Mount et al., 2015), outlining how the register was compiled. Key concepts and terminology are also explained.

The methods covered include: the process of collecting different groups of assets and assessing their water dependency using multiple lines of evidence, the development and compilation of the water-dependent asset register, and the general determination in defining a preliminary assessment extent (PAE) in BAs. The Gwydir subregion does not have a PAE because the most likely development pathway for the subregion indicates there will be no coal mines nor CSG developments in the subregion. As a result, the water-dependency of assets were considered based on the *whole* subregion should future development occur.

1.3.1.1 Background and context

This product presents information about the water-dependent asset register developed for the Gwydir subregion. The name of the dated snapshot of the asset register this description refers to is the 'Water-dependent asset register and asset list for the Gwydir subregion on 24 August 2015' (see Bruce and O'Grady, 2016). The point-of-truth version of the asset register that this snapshot was extracted from resides in the asset database (Bioregional Assessment Programme, Dataset 1). The asset database and the water-dependent asset register can be updated, so a more current version might be available at http://data.bioregionalassessments.gov.au/product/NIC/GWY/1.3.

Development of the register used methods and processes defined and outlined in the companion submethodology M02 (as listed in Table 1) for compiling water-dependent assets (Mount et al., 2015); their specific application to the Gwydir subregion is described in the following sections.

An *asset* is an entity that has value to the community and, for BA purposes, is associated with a subregion or bioregion. Technically, an asset is a store of value and may be managed and/or used to maintain and/or produce further value. Each asset will have many values associated with it and they can be measured from a range of perspectives; for example, the values of a wetland can be measured from ecological, sociocultural and economic perspectives. A *bioregion* is a geographic land area within which coal seam gas (CSG) and/or coal mining developments are taking place, or could take place, and for which BAs are conducted. A *subregion* is an identified area wholly contained within a bioregion.

A *water-dependent asset* has a particular meaning for BAs; it is an asset potentially impacted, either positively or negatively, by changes in the groundwater and/or surface water regime due to coal resource development. Some assets are solely dependent on incident rainfall and will not be

considered as water dependent if evidence does not support a linkage to groundwater or surface water.

The *water-dependent asset register* is a simple and authoritative listing of the assets within the *PAE* that are potentially subject to water-related impacts. A PAE is the geographic area associated with a bioregion or subregion in which the potential water-related impact of coal resource development on assets is assessed. However, for the Gwydir subregion, the water-dependent asset register contains assets within the *subregion* as there is no PAE (discussed in Section 1.3.1.3). The Gwydir subregion does not have a PAE because the most likely development pathway for the subregion indicates there will be no coal mines nor CSG developments in the subregion. As such, assets within the *whole* of the subregion are considered. The compiling of the asset register is the first step to identifying and analysing potentially impacted assets, which is the goal of the overall BA.

The asset source data are compiled into an *asset database*, including the geographic location, which are designated as *elements* (individual spatial features – points, lines and polygons e.g. components of a larger system) and *assets* (combinations of one or more elements). During the compilation process, assets are classified into three groups: (i) ecological, (ii) economic and (iii) sociocultural. Many assets are obtained from state and national databases and an important group of assets is provided by natural resource management organisations (NRMs) via the BA-purpose-built *Water Asset Information Tool* (WAIT) database. The Office of Water Science liaised with Indigenous knowledge holders about Indigenous sociocultural water-dependent assets (further discussed in Section 1.3.4.1).

For most bioregions and subregions, the *asset list* is created through selection of assets in the asset database that occur within the PAE. However, for the Gwydir subregion, these assets are selected based on the whole of the subregion. The assets in the asset list that pass the BA water-dependency test (discussed in Section 1.3.1.4) are then 'registered' in the water-dependent asset register. A preliminary version of the asset register is presented to experts and organisations with local knowledge at organised workshops (for the Gwydir subregion, this was held in February 2015). Feedback is sought about whether the asset register is complete and correct; appropriate amendments are then made. It is at this stage – when assets have been selected using the PAE (for the Gwydir subregion, assets are selected based on the subregion) and the amended water-dependent assets have been recorded in the database – that the water-dependent asset register is complete for the purposes of producing product 1.3 (description of the water-dependent asset register). Note, however, that the addition of new assets to the asset database, or a review of the status of existing assets in the database, will mean that the asset register may be updated. As this has implications for other BA components, any updates must be documented. The product 1.3 (description of the water-dependent asset register) will not be updated or republished as part of bioregional assessments but an updated version of the asset register (derived from the asset database) may be published at the same time as other products, for example, those associated with Component 3: Impact analysis (Figure 1 and Figure 2).

Following development of the asset register, the connection of the registered assets to coal resource development is assessed using ‘materiality’ tests and, if potentially subject to water-related impacts, assigned *receptors* (after Barrett et al., 2013). A receptor is a point in the

landscape where water-related impacts on assets are measured and/or estimated. The approach to assigning receptors to water-dependent assets is described in the companion submethodology M03 (as listed in Table 1) for assigning receptors to water-dependent assets (O'Grady et al., 2016).

1.3.1.2 Compiling assets and developing the water-dependent asset register

The water-dependent asset register was compiled by assessing the water dependency of assets in the asset list for the Gwydir subregion (Bioregional Assessment Programme, Dataset 1).

1.3.1.2.1 Ecological assets

Two natural resource management organisations (NRMs) nominated assets through the contribution of data to the WAIT database (Australian Government Department of the Environment, Dataset 2). These NRM-nominated assets were added to the asset database (Table 3). All datasets in the asset database and their associated source organisations are listed in Table 4 together with the number of assets and elements.

Table 3 Natural resource management organisations that contributed data to the Water Asset Information Tool database

Organisation	Description in asset database
Gwydir Catchment Management Authority	WAIT_Gwydir
Border Rivers-Gwydir Catchment Management Authority (prepared by Ecological Australia)	WAIT_Border Rivers-Gwydir

Table 4 Datasets for ecological assets in the Gwydir subregion

Dataset[a,b]	Dataset citation	Elements	Assets (asset list)
New South Wales NSW - Regional - CMA - Water Asset Information Tool - WAIT - databases	Australian Government Department of the Environment (Dataset 2)	544	452
Collaborative Australian Protected Areas Database (CAPAD) 2010 - External RESTRICTED (Not current release) - Metadata only	Australian Government Department of the Environment (Dataset 3)	27	27
Directory of Important Wetlands in Australia (DIWA) Spatial Database (Public)	Australian Government Department of the Environment (Dataset 4)	18	2
Ramsar Wetlands of Australia	Australian Government Department of Environment (Dataset 5)	4	4
Environmental Asset Database - Commonwealth Environmental Water Office -RESTRICTED (Metadata only)	Australian Government Department of the Environment (Dataset 6)	14	14
National Groundwater Dependent Ecosystems (GDE) Atlas	Bureau of Meteorology (Dataset 7)	Subsurface: 4,867 Surface: 2,209	Subsurface: 290 Surface: 85
Communities of National Environmental Significance Database - RESTRICTED (Metadata only)	Australian Government Department of the Environment (Dataset 8)	6,431	6

Dataset[a,b]	Dataset citation	Elements	Assets (asset list)
Species Profile and Threats Database (SPRAT) - Australia - Species of National Environmental Significance Database (BA subset - RESTRICTED - Metadata only)	Bioregional Assessment Programme (Dataset 9)	2,371	34
Key Environmental Assets - KEA - of the Murray Darling Basin RESTRICTED (Metadata only)	Murray-Darling Basin Authority (Dataset 10)	Stream: 2,532 Waterbodies: 19	Stream: 36 Waterbodies: 2
Birds Australia - Important Bird Areas (IBA) 2009	Birds Australia (Dataset 11)	1	1
Climate change corridors for Nandewar and the New England Tablelands	Office of Environment and Heritage (OEH) NSW (Dataset 12)	29	13
Ecological assets of the Gwydir wetlands and floodplain 2008 VIS_ID 3923	Office of Environment and Heritage (OEH) NSW (Dataset 13)	1,383	16
NSW Wetlands	NSW Department of Environment, Climate Change and Water (DECCW) (Dataset 14)	716	3
Travelling Stock Route Conservation Values	NSW Department of Environment, Climate Change and Water (DECCW) (Dataset 15)	287	280
Native Vegetation Management (NVM) - Manage Benefits	NSW Department of Environment, Climate Change and Water (DECCW) (Dataset 16)	2,081	4
Great Artesian Basin and Laura Basin groundwater recharge areas	Geoscience Australia (Dataset 17)	4	3
Total		23,537	1,272

[a]The asset database (Bioregional Assessment Programme, Dataset 1) is a collation of all these source datasets. Some assets may be captured in multiple databases. These replicates are retained in each of the overlapping asset databases as boundaries may differ between databases, and to ensure they are assessed separately by each relevant BA and to enable future assessments to potentially aggregate assessment results for the replicated assets across more than one subregion.
[b]Typology and punctuation are given as provided in the metadata for these datasets.

1.3.1.2.2 Economic assets

The datasets used in compiling the economic assets for the Gwydir subregion are shown in Table 5.

Table 5 Datasets for economic assets in the Gwydir subregion

Dataset[a]	Dataset citation	Elements	Assets (asset list)
NSW Office of Water Groundwater licences extract linked to spatial locations NIC v3 20140313	Bioregional Assessment Programme (Dataset 18)	366	10
NSW Office of Water Surface Water Licences in NIC linked to locations v1 20140422	Bioregional Assessment Programme (Dataset 19)	815	16
NSW surface water sharing plans (groundwater and surface water)	NSW Office of Water (Dataset 20)	29	29
NSW groundwater macro plans	NSW Office of Water (Dataset 20)	12	12

Dataset[a]	Dataset citation	Elements	Assets (asset list)
NSW regulated rivers	NSW Office of Water (Dataset 20)	2	2
Total		1224	69

[a]The asset database (Bioregional Assessment Programme, Dataset 1) is a collation of all these source datasets. Some assets may be captured in multiple databases. These replicates are retained in each of the overlapping asset databases as boundaries may differ between databases, and to ensure they are assessed separately by each relevant BA and to enable future assessments to potentially aggregate assessment results for the replicated assets across more than one subregion.

1.3.1.2.3 Sociocultural assets

Indigenous sociocultural assets were sourced from existing Commonwealth heritage databases (Table 6).

Meetings have been held with Indigenous knowledge holders in the Gwydir subregion to gain further understanding of Indigenous cultural water-dependent assets. Where possible and appropriate, and with the agreement of Indigenous knowledge holders, these additional Indigenous water-related values will be published in a separate report. Identified assets will be incorporated into an updated water-dependent asset register (available at http://data.bioregionalassessments.gov.au/product/NIC/GWY/1.3).

Table 6 Datasets for sociocultural assets in the Gwydir subregion

Dataset[a]	Dataset citation	Elements	Assets (asset list)
National Heritage List Spatial Database (NHL) (v2.1)	Australian Government Department of the Environment (Dataset 21)	1	1
Australia, Register of the National Estate (RNE) - Spatial Database (RNESDB) Internal	Australian Government Department of the Environment (Dataset 22)	27	27
Total		28	28

[a]The asset database (Bioregional Assessment Programme, Dataset 1) is a collation of all these source datasets. Some assets may be captured in multiple databases. These replicates are retained in each of the overlapping asset databases as boundaries may differ between databases, and to ensure they are assessed separately by each relevant BA and to enable future assessments to potentially aggregate assessment results for the replicated assets across more than one subregion.

1.3.1.3 Determining the preliminary assessment extent

The impacts from developing the coal resources in a subregion could extend beyond the subregion boundary, or might not extend as far as the subregion boundary due to its remoteness from development. The PAE is the geographic area associated with a bioregion or subregion in which the potential water-related impact of coal resource development on assets is assessed. It is the first step in identifying potentially impacted assets.

There is no PAE for the Gwydir subregion because the most likely development pathway for the subregion indicates there will be no coal mines nor CSG developments in the subregion. Therefore, the subsequent descriptions will consider assets for the *whole* subregion to provide an initial resource should future developments occur (Figure 3).

For more detailed information on coal resources in the Gwydir subregion, see companion product 1.2 for the Gwydir subregion (Pinetown et al., 2014).

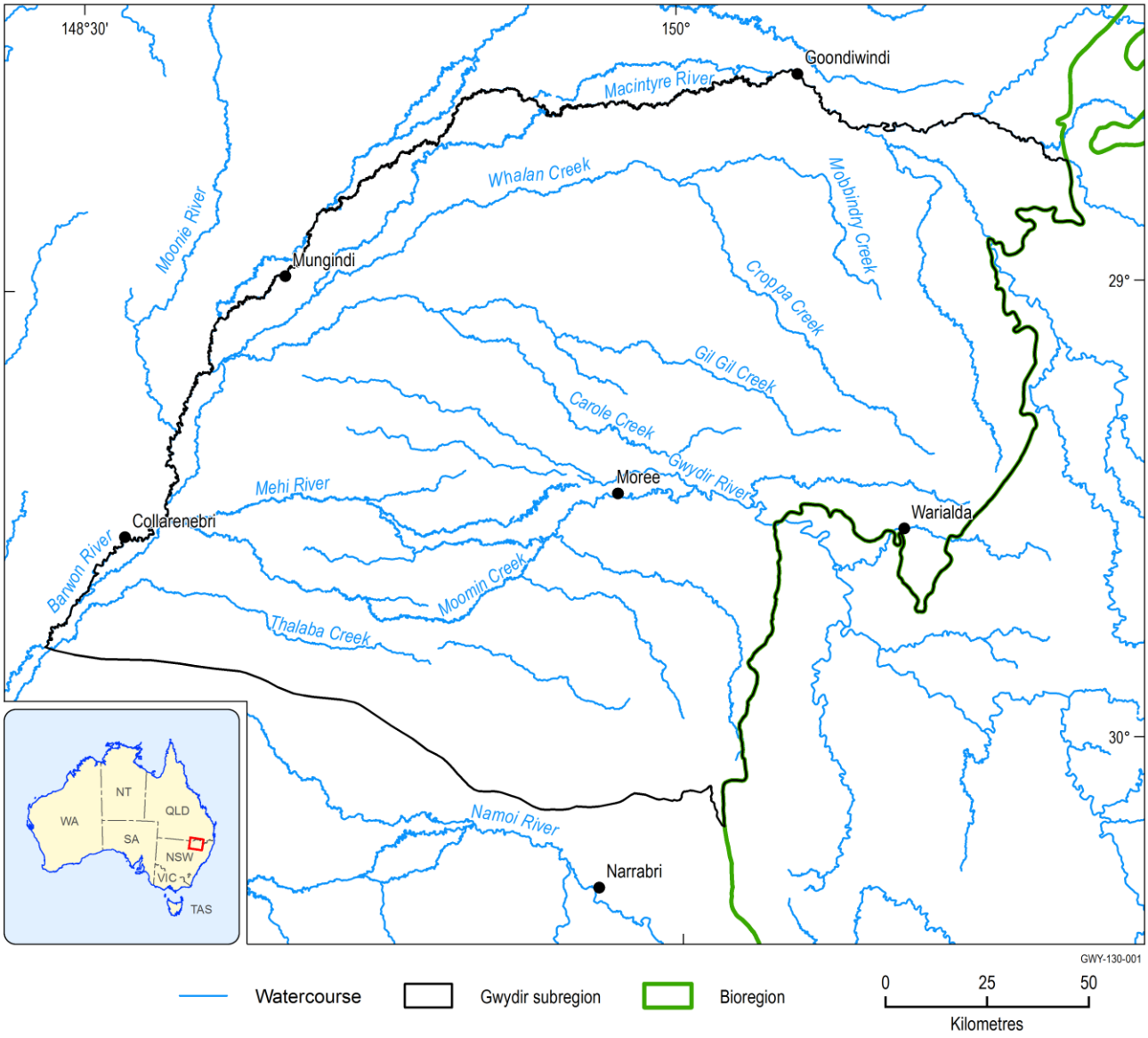

Figure 3 Gwydir subregion

1.3.1.4 Assessing water dependence

Following the compilation of assets into a database, water dependency of assets was assessed in a two-step procedure:

1. Only assets that intersect with the subregion were retained for a further assessment of water dependence (M1 decision).
2. For assets that intersected with the subregion, a preliminary assessment of water dependency was conducted (M2 decision).

Decisions on the preliminary water dependency (M2) were made using the following guiding principles:

1. *Efficiency*. Methods developed to assess water dependency were suitable to application to large numbers of assets and where possible used automated procedures.
2. *Transparency*. All decisions could be justified and included the rationale for inclusion, data sources, dates and responsible persons.

3. *Rigour*. Decision making was based on sound ecological, economic and sociocultural principles and clear logic.
4. *Multiple lines of evidence*. Wherever possible, multiple lines of evidence were simultaneously used to underpin decision making. Three broad groups of evidence were used including (i) naming conventions, (ii) documents describing asset profiles or management (where available) and (iii) simple spatial analysis.
5. *Precaution*. Where only part of an asset was shown to be water dependent, the entire asset was deemed to be water dependent. For example, if it was demonstrated that a nature reserve contained water-dependent assets, such as watercourses, the entire nature reserve was deemed to be water dependent. Where evidence for definitive determinations of water dependence was lacking (for example descriptions of species habitat were incomplete or unclear), assets were assumed to be water dependent.

The associated 'Water-dependent asset register and asset list for the Gwydir subregion on 24 August' (Bruce and O'Grady, 2016) provides the details of these water-dependency decisions.

Assets classed in the ecological subgroups 'Surface water features' or 'Groundwater features', or assets with names that include the terms 'waterhole', 'lake', 'lagoon', 'soak', etc., were deemed 'Assumed to be water dependent'. Similarly, assets sourced from the *National atlas of groundwater dependent ecosystems* (GDE Atlas; Bureau of Meteorology, Dataset 7) with a known groundwater dependency (derived from previous field work or possessing a high or moderate potential for groundwater dependency) were assumed to be water dependent (attributed as 'likely'). Assets with a moderate potential for groundwater dependency were attributed as 'possible' and also included in the register. Where assets were identified as having a low probability for groundwater dependence, it was assumed that these assets were unlikely to be groundwater dependent and were not included in the water-dependent asset register.

For many of the remaining assets, water dependency was not obvious. Such assets might include threatened ecological communities listed under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; Australian Government Department of the Environment, Dataset 8) (e.g. 'Weeping Myall Woodlands' Threatened Ecological Community) or assets derived from the Collaborative Australian Protective Areas Database (CAPAD; Australian Government Department of the Environment, Dataset 3) such as the Mount Kaputar National Park.

The water dependency of threatened species' habitat including threatened ecological communities listed under the EPBC Act were assessed by a review of the habitat requirements for each species or community. An important caveat is that the Assessment considers the potential impact of coal resource development on the habitat of the species rather than the species per se. However, it is necessary to present species-based information to best reflect available data. The water dependency of the species habitat was ranked as 'likely', 'possible', 'unlikely' or 'unsure' based on profile descriptions contained within the Species Profile and Threats Database (SPRAT; Bioregional Assessment Programme, Dataset 9). Assets listed as 'likely' are those with a clear and demonstrated link to aquatic ecosystems (e.g. aquatic species). Assets listed as 'possible' may have some overlap with habitat that may be water dependent (e.g. species that may visit riparian areas). Assets listed as 'unlikely' show no evidence of surface water or groundwater dependence

in habitat requirements. Where assets were recorded as 'unsure', the precautionary principle was applied and the asset retained for inclusion in the water-dependent asset register.

For ecological and sociocultural assets such as historic buildings, nature reserves, national parks, important bird areas etc., a spatial analysis using multiple data sources was used to assess the preliminary water dependency of the assets. Water-dependent assets were those that met at least one of the following criteria:

- intersected with existing mapping of the flood inundation 1-in-100 year extent for the Murray-Darling Basin (CSIRO, Dataset 23)
- occurred over shallow groundwater, where shallow groundwater is defined as regions where depth to groundwater is less than 10 m (Geoscience Australia, Dataset 24)
- occurred in regions where depth to groundwater ranged between 10 to 20 m. This criterion considered those assets that may access groundwater intermittently (Geoscience Australia, Dataset 24)
- intersected with existing wetland mapping or riparian networks (Department of Sustainability, Environment, Water, Population and Communities, Dataset 25).

In all cases, assets attributed as 'likely' or 'possible' were flagged as 'on' with respect to M2 and included in the asset register. Assets attributed as 'unlikely' were flagged as 'off' in the asset database and are not included in the preliminary water-dependent asset register.

References

Barrett DJ, Couch CA, Metcalfe DJ, Lytton L, Adhikary DP and Schmidt RK (2013) Methodology for bioregional assessments of the impacts of coal seam gas and coal mining development on water resources. A report prepared for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of the Environment. Department of the Environment, Australia. Viewed 5 March 2015, http://data.bioregionalassessments.gov.au/submethodology/bioregional-assessment-methodology.

Bruce J and O'Grady AP (2016) Water-dependent asset register and asset list for the Gwydir subregion on 24 August 2015. A spreadsheet associated with product 1.3 for the Gwydir subregion from the Northern Inland Catchments Bioregional Assessment. Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia. http://data.bioregionalassessments.gov.au/product/NIC/GWY/1.3.

Mount RE, Mitchell PJ, Macfarlane C, Marston FM, McNamara JM, Raisbeck-Brown N, O'Grady AP, Moran BT and Wang J (2015) Compiling water-dependent assets. A submethodology from the Bioregional Assessment Technical Programme. Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia. Viewed 5 March 2015, http://data.bioregionalassessments.gov.au/submethodology/M02.

O'Grady AP, Mount R, Holland K, Sparrow A, Crosbie R, Marston F, Dambacher J, Hayes K, Henderson B, Pollino C and Macfarlane C (2016) Assigning receptors to water-dependent assets. Submethodology M03 from the Bioregional Assessment Technical Programme. Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia. http://data.bioregionalassessments.gov.au/submethodology/M03.

Pinetown K, Sander R and Hodgkinson J (2014) Coal and coal seam gas resource assessment for the Gwydir subregion. Product 1.2 for the Gwydir subregion from the Northern Inland Catchments Bioregional Assessment. Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia. Viewed 10 September 2015, http://data.bioregionalassessments.gov.au/product/NIC/GWY/1.2.

Datasets

Dataset 1 Bioregional Assessment Programme (2015) Asset database for the Gwydir subregion on 24 August 2015. Bioregional Assessment Derived Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/7350df87-5103-40f5-b82c-42b0fc59a6a5.

Dataset 2 Australian Government Department of the Environment (2015) New South Wales NSW - Regional - CMA - Water Asset Information Tool - WAIT - databases. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/330532aa-66ba-44f5-984b-8a21a99661a0.

Dataset 3 Australian Government Department of the Environment (2010) Collaborative Australian Protected Areas Database (CAPAD) 2010 - External RESTRICTED (Not current release) - Metadata only. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/7b649c6d-fdbf-40e3-b002-db521665af53.

Dataset 4 Australian Government Department of the Environment (2001) Directory of Important Wetlands in Australia (DIWA) Spatial Database (Public). Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/6636846e-e330-4110-afbb-7b89491fe567.

Dataset 5 Australian Government Department of the Environment (2002) Ramsar Wetlands of Australia. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/d65cc156-944d-4961-bfba-eacfd61db63a.

Dataset 6 Australian Government Department of the Environment (2011) Environmental Asset Database - Commonwealth Environmental Water Office - RESTRICTED (Metadata only). Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/29fd1654-8aa1-4cb3-b65e-0b37698ac9a6.

Dataset 7 Bureau of Meteorology (2012) National Groundwater Dependent Ecosystems (GDE) Atlas. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/e358e0c8-7b83-4179-b321-3b4b70df857d.

Dataset 8 Australian Government Department of the Environment (2000) Communities of National Environmental Significance Database - RESTRICTED - Metadata only. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/c01c4693-0a51-4dbc-bbbd-7a07952aa5f6.

Dataset 9 Bioregional Assessment Programme (2014) Species Profile and Threats Database (SPRAT) - Australia - Species of National Environmental Significance Database (BA subset - RESTRICTED - Metadata only). Bioregional Assessment Derived Dataset. Viewed 19 April 2015, http://data.bioregionalassessments.gov.au/dataset/7276dd93-cc8c-4c01-8df0-cef743c72112.

Dataset 10 Murray-Darling Basin Authority (2010) Key Environmental Assets - KEA - of the Murray Darling Basin RESTRICTED (Metadata only). Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/9948195e-3d3b-49dc-96d2-ea7765297308.

Dataset 11 Birds Australia (2009) Birds Australia - Important Bird Areas (IBA) 2009. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/5d488350-83b6-4e71-8d17-687ad8ff9941.

Dataset 12 Office of Environment and Heritage (OEH) NSW (2003) Climate Change Corridors for Nandewar and New England Tablelands. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/d480bd52-c46a-41ae-bab8-0e8d7620160b.

Dataset 13 Office of Environment and Heritage (OEH) NSW (2015) Ecological assets of the Gwydir wetlands and floodplain 2008 VIS_ID 3923. Bioregional Assessment Source Dataset. Viewed 21 September 2015, http://data.bioregionalassessments.gov.au/dataset/d8a08865-a79a-4411-8f99-7bbb730fc58c.

Dataset 14 NSW Department of Environment, Climate Change and Water (DECCW) (1987) NSW Wetlands. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/90476e12-77a2-4970-a0be-942eeb84e95e.

Dataset 15 NSW Department of Environment, Climate Change and Water (DECCW) (2009) Travelling Stock Route Conservation Values. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/198900d5-0d06-4bd0-832b-e30a7c4e8873.

Dataset 16 NSW Department of Environment, Climate Change and Water (DECCW) (2012) Native Vegetation Management (NVM) - Manage Benefits. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/b299e256-1d37-4f89-8c51-93567ebf3753.

Dataset 17 Geoscience Australia (2013) Great Artesian Basin and Laura Basin groundwater recharge areas. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/8c646031-9765-4d7b-97df-a0869d66eabe.

Dataset 18 Bioregional Assessment Programme (2014) NSW Office of Water Groundwater licences extract linked to spatial locations NIC v3 20140313. Bioregional Assessment Derived Dataset. Viewed 27 April 2015, http://data.bioregionalassessments.gov.au/dataset/b0ea1363-4603-463a-b82e-fc586db6b967.

Dataset 19 Bioregional Assessment Programme (2014) NSW Office of Water Surface Water Licences in NIC linked to locations v1 20140422. Bioregional Assessment Derived Dataset. Viewed 27 April 2015, http://data.bioregionalassessments.gov.au/dataset/5f0f242b-3f0f-4c7d-bdb2-5ce7b1af6976.

Dataset 20 NSW Office of Water (2013) NSW Office of Water combined geodatabase of regulated rivers and water sharing plan regions. Bioregional Assessment Source Dataset. Viewed 27 April 2015, http://data.bioregionalassessments.gov.au/dataset/24157c41-c42f-4e1f-a791-a1ad18c8215d.

Dataset 21 Australian Government Department of the Environment (2004) National Heritage List Spatial Database (NHL) (v2.1). Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/26daa8d7-a90e-47f3-982b-0df362414e65.

Dataset 22 Australian Government Department of the Environment (2004) Australia, Register of the National Estate (RNE) - Spatial Database (RNESDB) Internal. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/878f6780-be97-469b-8517-54bd12a407d0.

Dataset 23 CSIRO (2012) Murray-Darling Basin floodplain inundation 1 in 100 year extent. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/01f26038-daed-4ba7-b1d8-efabc749cd17.

Dataset 24 Geoscience Australia (2014) Classified depth to water table for the Great Artesian Basin. Bioregional Assessment Source Dataset. Viewed 6 March 2015, http://data.bioregionalassessments.gov.au/dataset/6eabd9e1-0018-4314-bba4-87d5d1ebc8c3.

Dataset 25 Department of Sustainability, Environment, Water, Population and Communities (2013) Murray-Darling Basin Aquatic Ecosystem Classification. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/a854a25c-8820-455c-9462-8bd39ca8b9d6.

1.3.2 Ecological assets

Summary

Of the 1272 ecological assets in the asset list, 1131 were deemed to be water dependent for the purposes of the bioregional assessment (BA). The water-dependent asset register contains 599 assets in the 'Vegetation' subgroup, 12 in the 'Groundwater feature' subgroup and 520 in the 'Surface water feature' subgroup. Assets in the 'Vegetation' subgroup fell predominantly into two classes: groundwater-dependent ecosystems or habitat. Six communities and 19 threatened species listed under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were identified as water dependent in the Gwydir subregion.

1.3.2.1 Description

This section describes the ecological assets in the asset list that were considered to be water dependent. Of the 1272 ecological assets in the asset list, 1131 were deemed to be water dependent for the purposes of the BA. The water-dependent asset register contains 599 assets in the 'Vegetation' subgroup, 12 in the 'Groundwater feature' subgroup and 520 in the 'Surface water feature' subgroup. A more detailed summary of the distribution of assets according to asset class in the asset list is presented in Table 7.

Table 7 Summary of ecological assets within the Gwydir subregion

Subgroup	Asset class	Not in water-dependent asset register	In water-dependent asset register	Total assets (asset list)
Groundwater feature (subsurface)	Aquifer, geological feature, alluvium or stratum	0	12	12
	Groundwater total	0	12	12
Surface water feature	Floodplain	0	36	36
	Lake, reservoir, lagoon or estuary	0	12	12
	Marsh, sedgeland, bog, spring or soak	0	14	14
	River or stream reach, tributary, anabranch or bend	0	299	299
	Waterhole, pool, rockpool or billabong	0	56	56
	Wetland, wetland complex or swamp	0	103	103
	Surface water total	0	520	520
Vegetation	Groundwater-dependent ecosystem	126	249	375
	Habitat (potential species distribution)	15	350	365
	Vegetation total	141	599	740
Total		141	1131	1272

Data: Bioregional Assessment Programme (Dataset 1)

1.3.2.1.1 Groundwater features

All 12 assets listed in the 'Groundwater feature (subsurface)' subgroup were 'assumed to be water dependent' and included in the water-dependent asset register for further consideration during the assessment (Table 7). The majority of these groundwater features were aquifers identified in the Water Asset Information Tool (WAIT) database for the Gwydir subregion (Australian Government Department of the Environment, Dataset 2). Three assets were identified as Great Artesian Basin (GAB) recharge areas (Geoscience Australia, Dataset 3) and these are located throughout the eastern part of the subregion (Figure 4).

1.3.2.1.2 Surface water features

All 520 assets listed in the 'Surface water feature' subgroup were assumed to be water dependent (Table 7). The main area coverage within the 'Surface water feature' subgroup are 'Floodplain' and 'Wetland, wetland complex and swamp', and these are mostly in the western and north-western parts of the subregion (Figure 4).

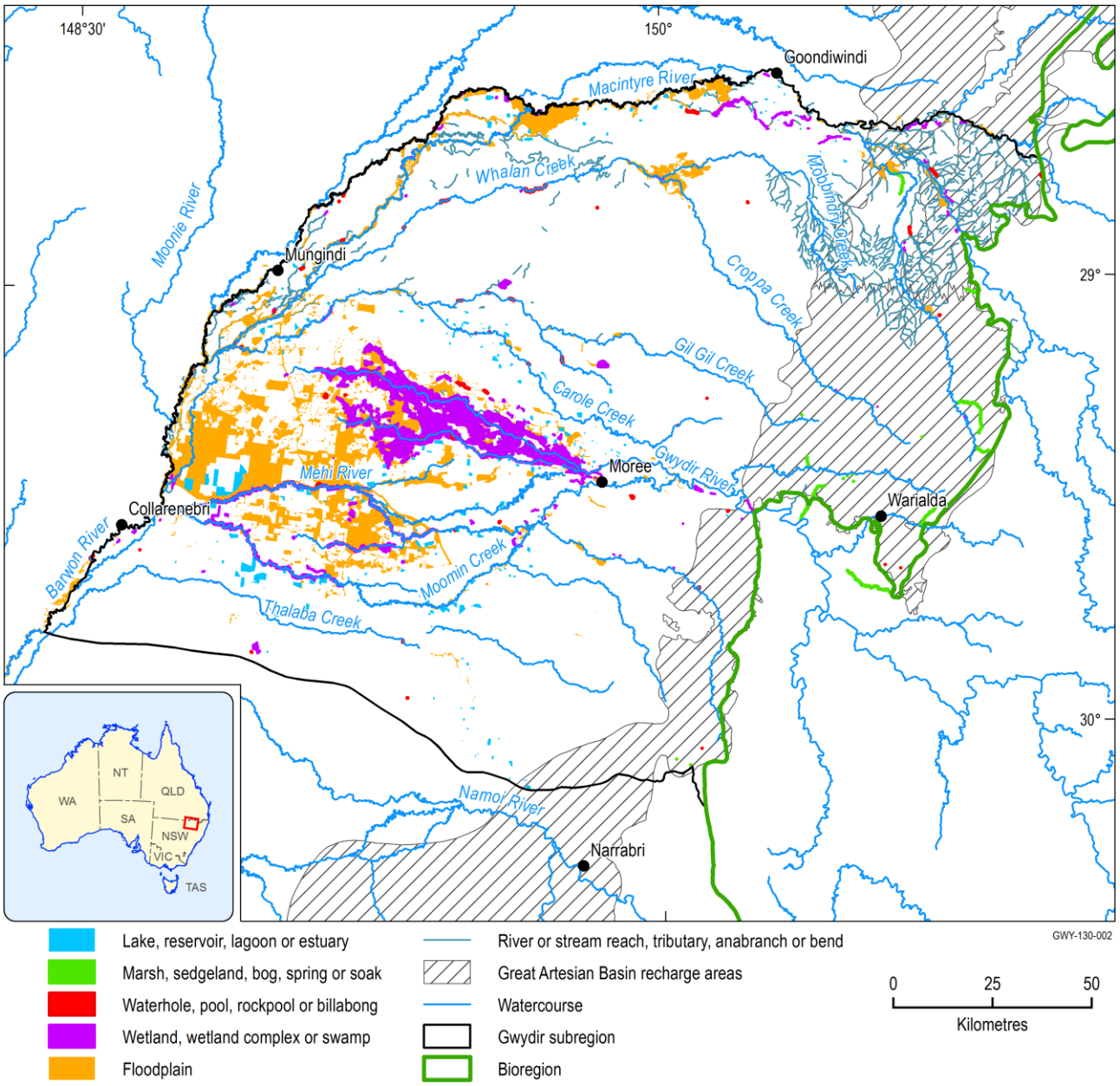

Figure 4 Surface water features and Great Artesian Basin recharge areas in the Gwydir subregion

Some assets are represented multiple times within the asset register. These replicates are retained in each of the overlapping asset databases as boundaries may differ between databases, and to ensure they are assessed separately by each relevant BA and to enable future assessments to potentially aggregate assessment results for the replicated assets across more than one subregion. For example, the Gwydir wetlands, shown as 'Wetland, wetland complex or swamp', are also classified as 'Floodplain' and 'Marsh, sedgeland, bog, spring or soak'.

'River or stream reach, tributary, anabranch or bend' polygons are not shown in the map as they cover the entire subregion.

Data: Bioregional Assessment Programme (Dataset 1); Australian Government Department of the Environment (Dataset 2, Dataset 6, Dataset 7, Dataset 9); Geoscience Australia (Dataset 3); NSW Department of Environment, Climate Change and Water (DECCW) (Dataset 4); Office of Environment and Heritage (OEH) NSW (Dataset 5); Murray-Darling Basin Authority (Dataset 8)

1.3.2.1.3 Vegetation

Assets listed in the 'Vegetation' subgroup consist of two classes: 'Groundwater-dependent ecosystem' or 'Habitat (potential species distribution)'.

Groundwater-dependent ecosystems

All 375 assets identified as groundwater-dependent ecosystems were sourced from the *National atlas of groundwater dependent ecosystems* (GDE Atlas; Bureau of Meteorology, Dataset 10). A breakdown of the ecological assets identified as being dependent on the surface water expression of groundwater and the subsurface water expression of groundwater is given in Table 8 and their spatial distribution is shown in Figure 5 and Figure 6 respectively. Approximately 34% of the assets were excluded from the water-dependent asset register because they were deemed to have a low likelihood of dependence on either surface or subsurface presence of groundwater (Table 8).

Table 8 Breakdown of groundwater-dependent ecological assets in the 'Vegetation' subgroup for the Gwydir subregion

Subgroup	Asset class	Dependency	Not in water-dependent asset register	In water-dependent asset register
Vegetation	Groundwater-dependent ecosystem	Dependent on surface expression of groundwater	19	66
		Dependent on subsurface presence of groundwater	107	183
Total			126	249

Data: Bioregional Assessment Programme (Dataset 1)

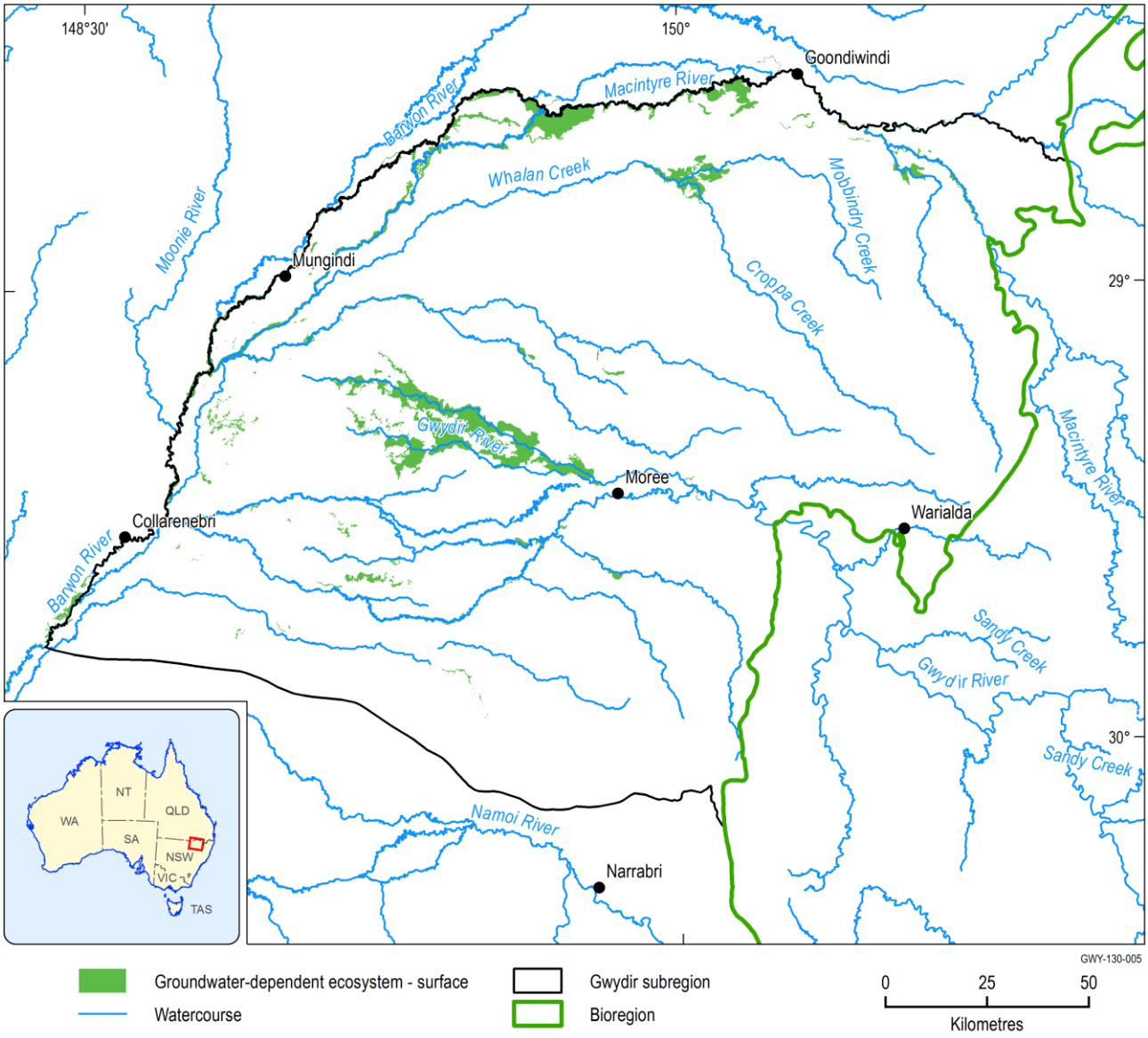

Figure 5 Groundwater-dependent ecosystems that rely on the surface expression of groundwater including surface water channels (surface line features) and vegetation communities (surface area features)

Data: Bioregional Assessment Programme (Dataset 1), Bureau of Meteorology (Dataset 10)

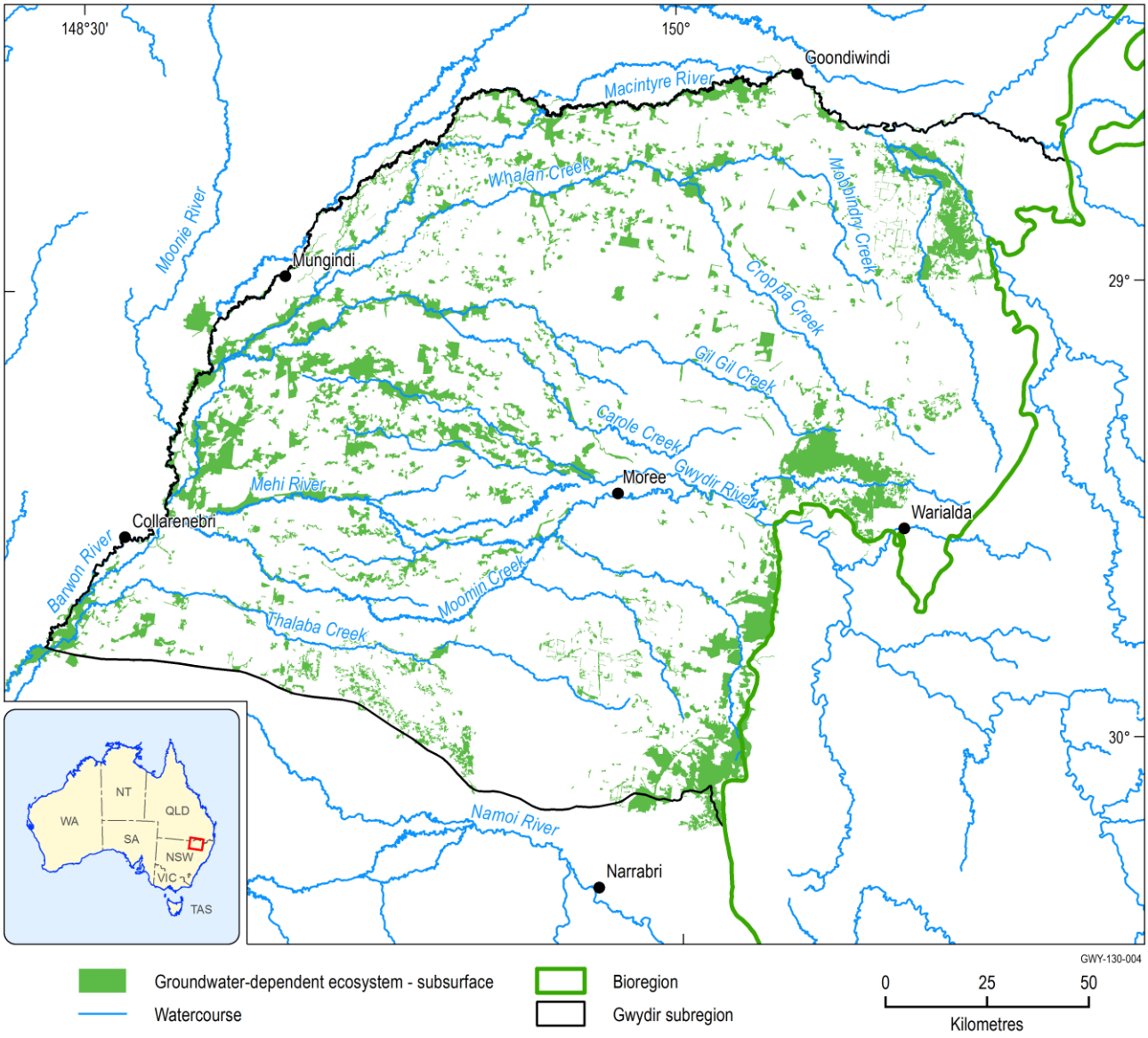

Figure 6 Groundwater-dependent ecosystems that rely on the subsurface presence of groundwater

Data: Bioregional Assessment Programme (Dataset 1), Bureau of Meteorology (Dataset 10)

Habitat (potential species distribution)

Out of a total of 365 assets, 350 assets within the 'Habitat (potential species distribution)' asset class were considered to be water dependent (Table 7).

All assets in Collaborative Australian Protected Area Database (CAPAD) areas (Australian Government Department of the Environment, Dataset 11) and in Important Bird Areas (Birds Australia, Dataset 12) were deemed to be water dependent. Of the NSW Government assets, all assets derived from the NSW climate change corridors (Office of Environment and Heritage (OEH) NSW, Dataset 16), native vegetation management areas (NSW Department of Environment, Climate Change and Water (DECCW), Dataset 15), Travelling Stock Route Conservation Values (NSW Department of Environment, Climate Change and Water, Dataset 14), and Gwydir wetlands and floodplains vegetation data (Office of Environment and Heritage (OEH) NSW, Dataset 5) were deemed water dependent.

The remaining assets were either categorised as 'Threatened ecological communities', or 'Habitat of threatened ecological species'.

Threatened ecological communities

Six communities listed under the EPBC Act occur in the Gwydir subregion, and all were deemed to be water dependent (Table 9). 'White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands Threatened Ecological Community' occurs mainly in the eastern part of the subregion. 'Weeping Myall Woodlands Threatened Ecological Community' and 'Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions Threatened Ecological Community' are found more to the western part, and 'Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community' and associated 'Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community' grow throughout the central area of the subregion. The 'Natural Grasslands On Basalt And Fine-Textured Alluvial Plains Of Northern New South Wales And Southern Queensland' habitats cover most of area in the subregion (Figure 7).

Table 9 Water-dependent threatened ecological communities in the Gwydir subregion listed under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*

Name[a]	Comment
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community	Contains water-dependent assets, occurs over shallow groundwater or on floodplains
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions Threatened Ecological Community	Likely to exhibit both surface water and groundwater dependence
Natural Grasslands On Basalt And Fine-Textured Alluvial Plains Of Northern New South Wales And Southern Queensland	On alluvial plains may exhibit surface water dependence
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community	Contains water-dependent assets or may occur over areas of shallow groundwater
Weeping Myall Woodlands Threatened Ecological Community	Likely to be surface water dependent due floodplain habitat
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Threatened Ecological Community	Box woodlands may be groundwater dependent over areas of shallow groundwater

[a]Punctuation and typography appear as used in the asset list.
Data: Bioregional Assessment Programme (Dataset 1), Australian Government Department of the Environment (Dataset 17)

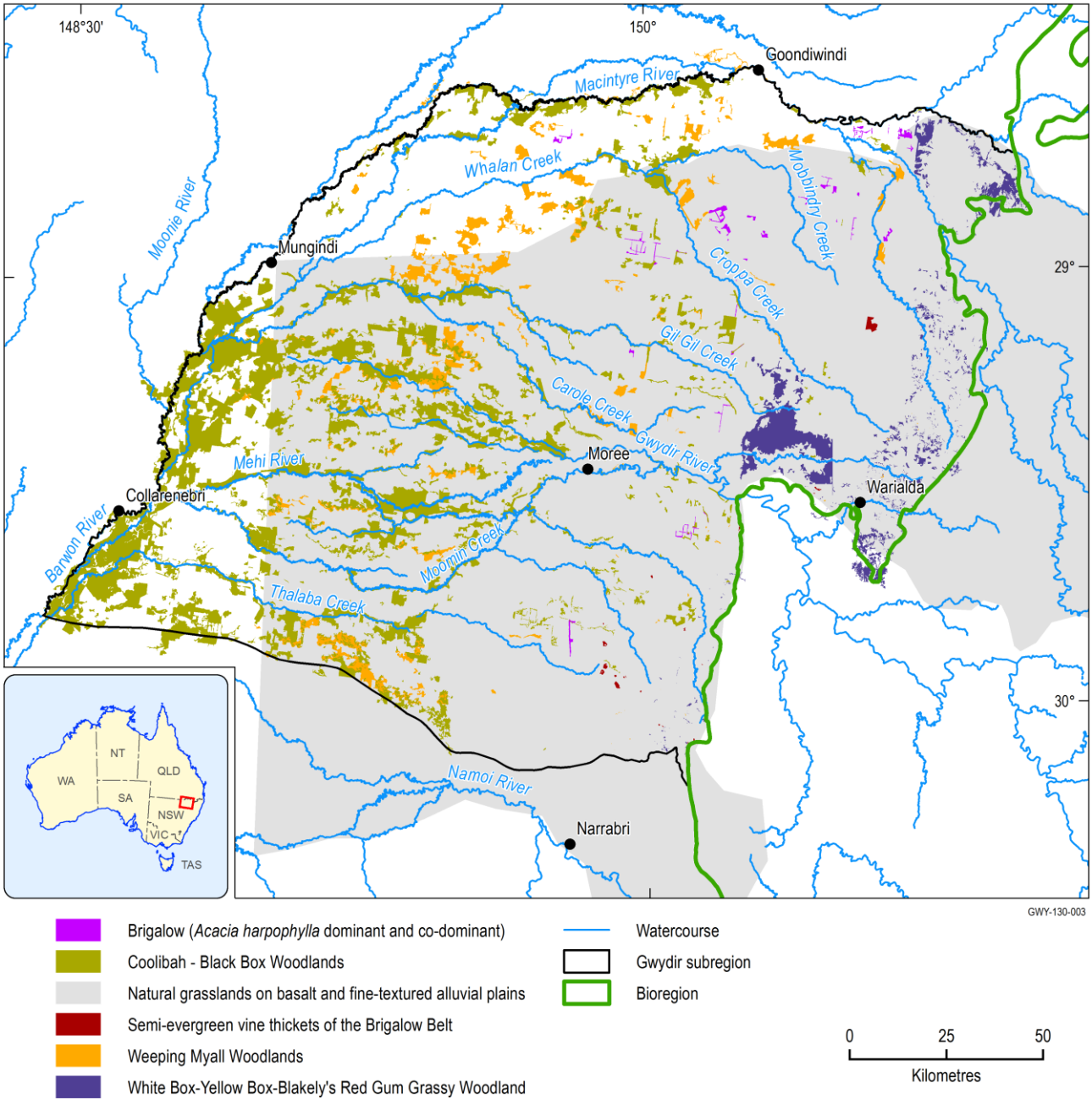

Figure 7 The six threatened ecological communities listed in the Commonwealth's *Environment and Biodiversity Conservation Act 1999* included in the water-dependent asset register

Names in the legend have been shortened. Full names can be found in Table 9.
Data: Bioregional Assessment Programme (Dataset 1), Australian Government Department of the Environment (Dataset 17)

Habitat of threatened ecological species

Thirty-four threatened species listed under the EPBC Act were identified in the Gwydir subregion (Bioregional Assessment Programme, Dataset 13). Of these, 15 were excluded from the water-dependent asset register because a demonstrated surface water or groundwater dependency of the habitat could not be established. The excluded assets include ten plant species, three bird species and two reptile species. Species included in the water-dependent asset register are listed in Table 10.

Table 10 Water-dependent threatened species in the Gwydir subregion listed under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*

Although examples of individual species are listed, bioregional assessments consider the potential impacts to the habitat of the species not the individual species *per se*.

Functional group	Scientific name[a]	Common name[a]	Dependence on surface water	Dependence on groundwater	Comment
Plants	*Homopholis belsonii*	Belson's Panic	Likely	Unlikely	May occur in areas with regular or intermittent flooding
	Callistemon pungens	NA	Likely	Possible	Habitats range from riparian areas dominated by *Casuarina cunninghamiana* subsp. *cunninghamiana* to woodlands and rocky shrublands.
	Cadellia pentastylis	Ooline	Likely	Possible	Ooline occurs in a range of vegetation types including semi-evergreen vine thickets, brigalow-belah, poplar box and bendee communities.
	Swainsona murrayana	Slender Darling-Pea	Likely	Possible	Associated with black box communities
	Lepidium aschersonii	Spiny Pepper-Cress	Likely	Possible	Occurs periodically in wet sites such as gilgai and margins of freshwater and saline marshes and lakes
Birds	*Apus pacificus*	Fork-tailed Swift	Likely	Possible	Occurs over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh
	Rostratula australis	Australian Painted Snipe	Likely	Possible	Inhabits shallow temporary and permanent wetlands
	Monarcha melanopsis	Black-Faced Monarch	Unlikely	Possible	Frequents moist forest, rainforests
	Ardea ibis	Cattle Egret	Likely	Possible	Occurs in temperate grasslands, woodland and wetlands
	Ardea alba	Great Egret	Likely	Possible	Prefers wide range of habitats- inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial
	Erythrotriorchis radiatus	Red Goshawk	Likely	Possible	Riverine forests are also used frequently.
	Anthochaera phrygia	Regent Honeyeater	Likely	Possible	Prefers fertile sites along creek flats, riparian vegetation
	Myiagra cyanoleuca	Satin Flycatcher	Likely	Unlikely	Mainly inhabits eucalypt forests often near wetlands or watercourses

Functional group	Scientific name[a]	Common name[a]	Dependence on surface water	Dependence on groundwater	Comment
	Geophaps scripta scripta	Squatter Pigeon (Southern)	Likely	Possible	Visits waterholes daily
	Neochmia ruficauda ruficauda	Star Finch (Eastern)	Likely	Possible	Occurs mainly in grasslands and grassy woodlands that are located close to bodies of fresh water
	Haliaeetus leucogaster	White-Bellied Sea-Eagle	Likely	Possible	Coastal habitats and terrestrial wetlands and riparian communities
Reptiles	*Anomalopus mackayi*	Five-Clawed Worm-Skink	Likely	Possible	Often associated with floodplain woodland communities
Mammals	*Phascolarctos cinereus*	Koala	Likely	Possible	Koalas are also found in vegetation communities dominated by *Melaleuca* or *Casuarina* species.
	Dasyurus maculatus maculatus	Spot-Tailed Quoll	Likely	Likely	Inland riparian and River Red Gum (*Eucalyptus camaldulensis*) forests

Data: Bioregional Assessment Programme (Dataset 1)
[a]Punctuation and typography appear as used in the asset list.
NA = not available

The asset list and other details are available from the water-dependent asset register and asset list (Bruce and O'Grady, 2016) and the asset database (Bioregional Assessment Programme, Dataset 1).

1.3.2.2 Gaps

There are species listed under NSW's *Threatened Species Conservation Act 1995* and NSW's *Fisheries Management Act 1994* that are *not* listed under the EPBC Act. For example, there are 102 threatened species and 8 threatened ecological communities identified as assets listed under NSW's *Threatened Species Conservation Act 1995* (Office of Environment and Heritage, Department of Premier and Cabinet, Dataset 18). However, there was no spatial information provided with these assets, and thus their water dependencies could not be determined. As a result these assets will not be considered in the current BA. While it is not possible to include new asset databases into this product, further assets may be added to the asset register at a later stage (Mount et al., 2015).

References

Bruce J and O'Grady AP (2016) Water-dependent asset register and asset list for the Gwydir subregion on 24 August 2015. A spreadsheet associated with product 1.3 for the Gwydir subregion from the Northern Inland Catchments Bioregional Assessment. Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia. http://data.bioregionalassessments.gov.au/product/NIC/GWY/1.3.

Mount RE, Mitchell PJ, Macfarlane C, Marston FM, McNamara JM, Raisbeck-Brown N, O'Grady AP, Moran BT and Wang J (2015) Compiling water-dependent assets. A submethodology from the Bioregional Assessment Technical Programme. Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia. Viewed 21 January 2016, http://data.bioregionalassessments.gov.au/submethodology/M02.

Datasets

Dataset 1 Bioregional Assessment Programme (2015) Asset database for the Gwydir subregion on 24 August 2015. Bioregional Assessment Derived Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/7350df87-5103-40f5-b82c-42b0fc59a6a5.

Dataset 2 Australian Government Department of the Environment (2015) New South Wales NSW - Regional - CMA - Water Asset Information Tool - WAIT - databases. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/330532aa-66ba-44f5-984b-8a21a99661a0.

Dataset 3 Geoscience Australia (2013) Great Artesian Basin and Laura Basin groundwater recharge areas. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/8c646031-9765-4d7b-97df-a0869d66eabe.

Dataset 4 NSW Department of Environment, Climate Change and Water (DECCW) (2010) NSW Wetlands. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/90476e12-77a2-4970-a0be-942eeb84e95e.

Dataset 5 Office of Environment and Heritage (OEH) NSW (2013) Ecological assets of the Gwydir wetlands and floodplain 2008 VIS_ID 3923. Bioregional Assessment Source Dataset. Viewed 10 November 2015, http://data.bioregionalassessments.gov.au/dataset/d8a08865-a79a-4411-8f99-7bbb730fc58c.

Dataset 6 Australian Government Department of the Environment (2001) Directory of Important Wetlands in Australia (DIWA) Spatial Database (Public). Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/6636846e-e330-4110-afbb-7b89491fe567.

Dataset 7 Australian Government Department of the Environment (2002) Ramsar Wetlands of Australia. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/d65cc156-944d-4961-bfba-eacfd61db63a.

Dataset 8 Murray-Darling Basin Authority (2010) Key Environmental Assets - KEA - of the Murray Darling Basin RESTRICTED (Metadata only). Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/9948195e-3d3b-49dc-96d2-ea7765297308.

Dataset 9 Australian Government Department of the Environment (2011) Environmental Asset Database - Commonwealth Environmental Water Office - RESTRICTED (Metadata only). Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/29fd1654-8aa1-4cb3-b65e-0b37698ac9a6.

Dataset 10 Bureau of Meteorology (2012) National Groundwater Dependent Ecosystems (GDE) Atlas. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/e358e0c8-7b83-4179-b321-3b4b70df857d.

Dataset 11 Australian Government Department of the Environment (2010) Collaborative Australian Protected Areas Database (CAPAD) 2010 - External RESTRICTED (Not current release) - Metadata only. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/7b649c6d-fdbf-40e3-b002-db521665af53.

Dataset 12 Birds Australia (2009) Birds Australia - Important Bird Areas (IBA) 2009. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/5d488350-83b6-4e71-8d17-687ad8ff9941.

Dataset 13 Bioregional Assessment Programme (2014) Species Profile and Threats Database (SPRAT) - Australia - Species of National Environmental Significance Database (BA subset - RESTRICTED - Metadata only). Bioregional Assessment Derived Dataset. Viewed 19 April 2015, http://data.bioregionalassessments.gov.au/dataset/7276dd93-cc8c-4c01-8df0-cef743c72112.

Dataset 14 NSW Department of Environment, Climate Change and Water (DECCW) (2009) Travelling Stock Route Conservation Values. Bioregional Assessment Source Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/198900d5-0d06-4bd0-832b-e30a7c4e8873.

Dataset 15 NSW Department of Environment, Climate Change and Water (DECCW) (2012) Native Vegetation Management (NVM) - Manage Benefits. Bioregional Assessment Source Dataset. Viewed 10 November 2015, http://data.bioregionalassessments.gov.au/dataset/b299e256-1d37-4f89-8c51-93567ebf3753.

Dataset 16 Office of Environment and Heritage (OEH) NSW (2011) Climate Change Corridors for Nandewar and New England Tablelands. Bioregional Assessment Source Dataset. Viewed 10 November 2015, http://data.bioregionalassessments.gov.au/dataset/d480bd52-c46a-41ae-bab8-0e8d7620160b.

Dataset 17 Australian Government Department of the Environment (2000) Communities of National Environmental Significance Database - RESTRICTED - Metadata only. Bioregional Assessment Source Dataset. Viewed 21 July 2015, http://data.bioregionalassessments.gov.au/dataset/c01c4693-0a51-4dbc-bbbd-7a07952aa5f6.

Dataset 18 Office of Environment and Heritage, Department of Premier and Cabinet (2013) Spatial Threatened Species and Communities (TESC) NSW 20131129. Bioregional Assessment Source Dataset. Viewed 18 September 2015, http://data.bioregionalassessments.gov.au/dataset/a6664894-1489-46d1-a6ca-16f9ab519a28.

1.3.3 Economic assets

Summary

The water-dependent asset register for the Gwydir subregion has 69 economic water-dependent assets comprising 1224 elements. There are 46 economic assets within the subgroup 'Surface water management zone or area' and 23 economic assets within the subgroup 'Groundwater management zone or area'.

1.3.3.1 Description

There are 69 economic assets comprising 1224 elements within the Gwydir subregion and they are all considered water dependent. The economic assets represent groupings of economic elements. Economic elements are defined as groundwater and surface water 'water access right' and 'basic water right (stock and domestic)'. Within the asset database, elements are grouped by type and spatial location to create assets (see Section 1.3.1.2).

Water access rights are licensed whereas basic water rights (stock and domestic) are share components included in basic landholder rights; both are covered under water sharing plans (WSPs; NSW Department of Primary Industries, 2015). Share components are water access entitlements that are a specified share or volume of water that can be extracted within a specified water management area.

These entitlements are represented spatially by:

- location of surface water offtake points and groundwater bores (point features)
- watercourse segments (line features)
- water access rights that do not require a works approval. These are included in the water-dependent asset register by assigning the water access right to the water source area (polygon features).

In the Gwydir subregion, there are 46 assets (845 elements) within the 'Surface water management zone or area' subgroup comprising 16 water access right and 30 basic water right (stock and domestic) entitlements (Table 11). The locations of the economic surface water assets are shown in Figure 8.

There are 23 assets (379 elements) within the 'Groundwater management zone or area' subgroup comprising 10 water access right and 13 basic water right (stock and domestic) entitlements (Table 11). The locations of the economic groundwater assets are shown in Figure 9. It shows the groundwater access rights as being mainly clustered around Moree with additional locations in the south and east of the subregion.

The asset list and other details are available from the water-dependent asset register and asset list (Bruce and O'Grady, 2016) and the asset database (Bioregional Assessment Programme, Dataset 1).

Table 11 Summary of the economic assets within the Gwydir subregion

Subgroup	Asset class	Number of elements in water-dependent asset register	Number of assets in water-dependent asset register
Groundwater management zone or area (surface area)	Water access right	366	10
	Basic water right (stock and domestic)	13	13
Surface water management zone or area (surface area)	Water access right	815	16
	Basic water right (stock and domestic)	30	30
Total		1224	69

Data: Bioregional Assessment Programme (Dataset 1)

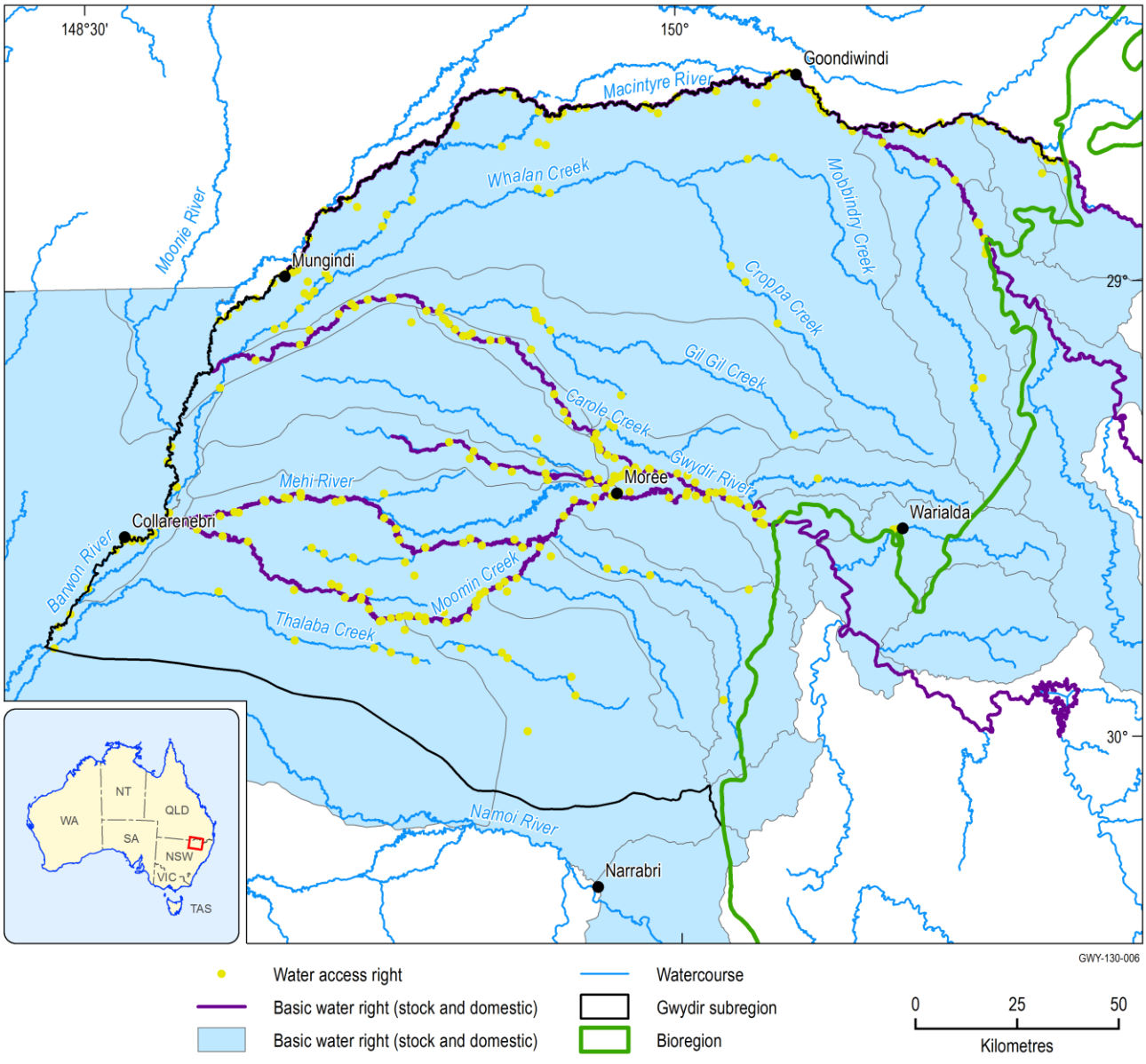

Figure 8 Location of surface water access right and basic water right (stock and domestic) economic assets in the Gwydir subregion

Data: Bioregional Assessment Programme (Dataset 1 and Dataset 3) and NSW Office of Water (Dataset 4)

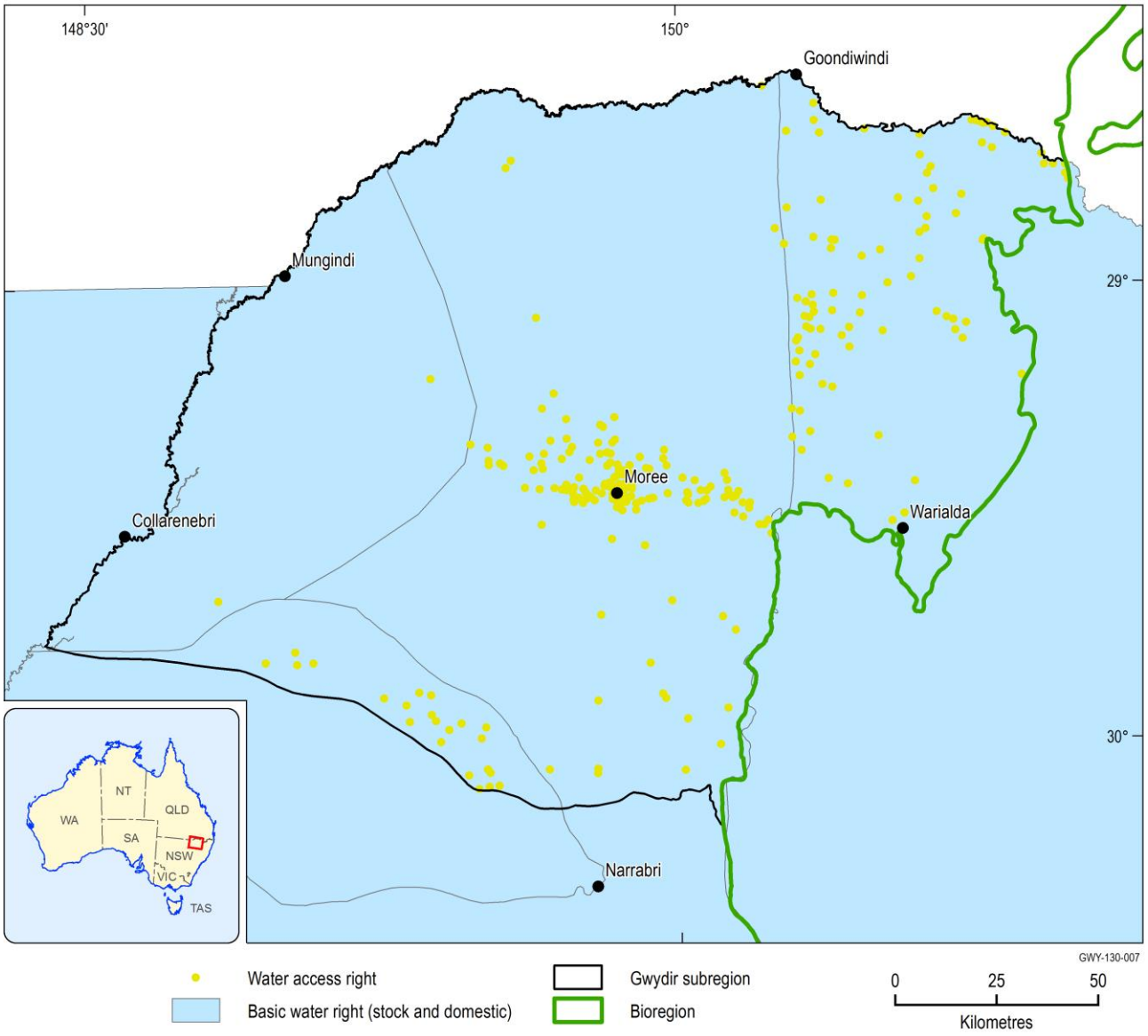

Figure 9 Location of groundwater water access right and basic water right (stock and domestic) economic assets in the Gwydir subregion

Data: Bioregional Assessment Programme (Dataset 1 and Dataset 2) and NSW Office of Water (Dataset 4)

1.3.3.2 Gaps

Many of the economic asset polygons in NSW include a negligible portion of the entire asset polygon within the subregion, which is mostly an artefact of the geographic information system (GIS) overlaying process. Therefore, many of these NSW economic assets are included in the asset database, even if only a negligible portion of a polygon overlaps within the subregion.

Floodplain harvesting has been identified in other NSW bioregions as an economic asset. Floodplain harvesting water storages are in the process of being digitised by the NSW Office of Water, but were not available for inclusion in the water-dependent asset register at this time.

The surface water access entitlement data received from NSW Office of Water do not include details of the river reach where the offtake was located; instead they include the water source and water management zone associated with the WSP. A water source can be any set of rivers, aquifers or lakes and the like, which are defined by a gazetted WSP to be a water source.

Therefore, when the elements are aggregated into the assets, water access entitlements are grouped together across the water source area (a large polygon). This will need to be taken into account if a future analysis intends to assign receptor locations as the water source may include multiple river reaches and branches.

References

Bruce J and O'Grady AP (2016) Water-dependent asset register and asset list for the Gwydir subregion on 24 August 2015. A spreadsheet associated with product 1.3 for the Gwydir subregion from the Northern Inland Catchments Bioregional Assessment. Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia. http://data.bioregionalassessments.gov.au/product/NIC/GWY/1.3.

NSW Department of Primary Industries (2015) Water sharing plans website. NSW Department of Primary Industries. Viewed 23 September 2015, http://www.water.nsw.gov.au/Water-management/Water-sharing-plans/Water-sharing.

Datasets

Dataset 1 Bioregional Assessment Programme (2015) Asset database for the Gwydir subregion on 24 August 2015. Bioregional Assessment Derived Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/7350df87-5103-40f5-b82c-42b0fc59a6a5.

Dataset 2 Bioregional Assessment Programme (2014) NSW Office of Water Groundwater licences extract linked to spatial locations NIC v3 20140313. Bioregional Assessment Derived Dataset. Viewed 27 April 2015, http://data.bioregionalassessments.gov.au/dataset/b0ea1363-4603-463a-b82e-fc586db6b967.

Dataset 3 Bioregional Assessment Programme (2014) NSW Office of Water Surface Water Licences in NIC linked to locations v1 20140422. Bioregional Assessment Derived Dataset. Viewed 27 April 2015, http://data.bioregionalassessments.gov.au/dataset/5f0f242b-3f0f-4c7d-bdb2-5ce7b1af6976.

Dataset 4 NSW Office of Water (2013) NSW Office of Water combined geodatabase of regulated rivers and water sharing plan regions. Bioregional Assessment Source Dataset. Viewed 27 April 2015, http://data.bioregionalassessments.gov.au/dataset/24157c41-c42f-4e1f-a791-a1ad18c8215d.

1.3.4 Sociocultural assets

Summary

There are 28 sociocultural assets in the Gwydir subregion and all of these are water dependent. They comprise 12 Indigenous sites, 10 heritage sites and 6 recreation areas. Mount Kaputar National Park covers the largest area of all assets in the subregion and is shared with the Namoi subregion.

1.3.4.1 Description

There are 28 sociocultural assets in the asset list for the Gwydir subregion with one of these coming from the National Heritage List (Australian Government Department of the Environment, Dataset 2) and the remainder being identified in the Register of the National Estate (Australian Government Department of the Environment, Dataset 3). They comprise 12 Indigenous sites, 10 heritage sites and 6 recreation areas. All 28 sociocultural assets are water dependent. The Gwydir subregion asset workshop (held in February 2015) did not nominate any additional sociocultural assets. Table 12 shows the breakdown of sociocultural assets.

The Indigenous assets include Wearmatong, Tikitere, Banarway, Bunna Bunna carved tree sites, the Warialda Axe Grinding Grooves site, Old Toomelah Cemetery, Moree Spa Baths, Euraba Mission, Boobera Lagoon Aboriginal Place and Berrygill Creek area. Larger Indigenous heritage areas include the Graman and the Terry Hie Hie Aboriginal areas (Figure 10).

The 10 heritage-classed sociocultural assets include Mount Kaputar National Park, which covers the largest area of all assets in the subregion and is shared with the Namoi subregion (Figure 10). The remaining heritage sites include six locations in Moree (such as the Mellor House) and the Tramby Graves.

The asset list and other details are available from the water-dependent asset register and asset list (Bruce and O'Grady, 2016) and the asset database (Bioregional Assessment Programme, Dataset 1).

Table 12 Number of water-dependent sociocultural assets according to subgroup and class in the Gwydir subregion

Subgroup	Asset class	Number of assets
Cultural	Heritage site	10
	Indigenous site	12
Social	Recreation area	6
Total		28

Data: Bioregional Assessment Programme (Dataset 1)

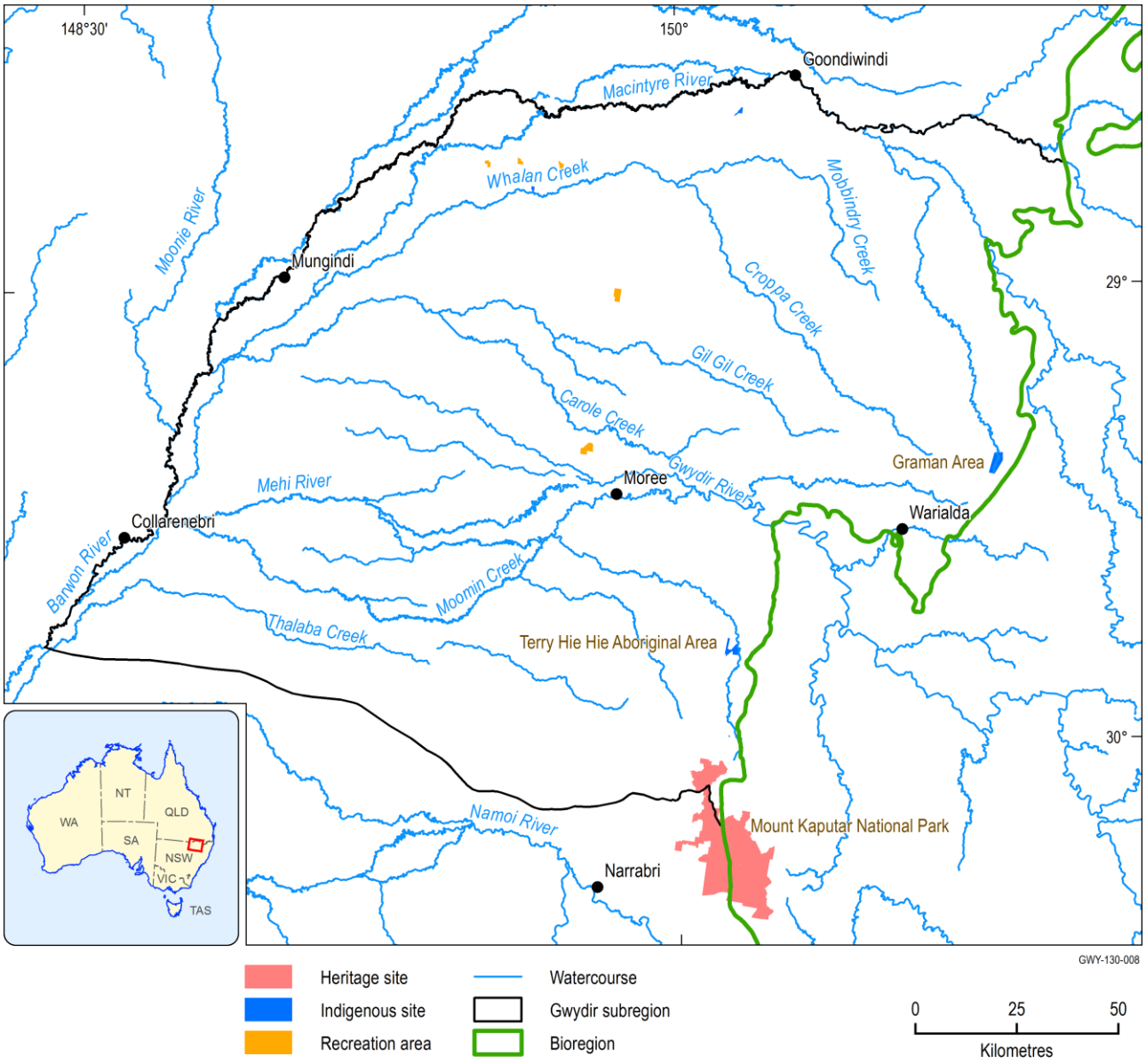

Figure 10 Location of sociocultural assets in the Gwydir subregion

Data: Bioregional Assessment Programme (Dataset 1), Australian Government Department of the Environment (Dataset 2, Dataset 3)

1.3.4.2 Gaps

Meetings have been held with Indigenous knowledge holders in the Gwydir subregion to gain further understanding of Indigenous cultural water-dependent assets. Where possible and appropriate, and with the agreement of Indigenous knowledge holders, these additional Indigenous water-related values will be published in a separate report. Identified assets will be incorporated into an updated water-dependent asset register and/or incorporated into later technical products.

References

Bruce J and O'Grady AP (2016) Water-dependent asset register and asset list for the Gwydir subregion on 24 August 2015. A spreadsheet associated with product 1.3 for the Gwydir subregion from the Northern Inland Catchments Bioregional Assessment. Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia. http://data.bioregionalassessments.gov.au/product/NIC/GWY/1.3.

Datasets

Dataset 1 Bioregional Assessment Programme (2015) Asset database for the Gwydir subregion on 24 August 2015. Bioregional Assessment Derived Dataset. Viewed 15 September 2015, http://data.bioregionalassessments.gov.au/dataset/7350df87-5103-40f5-b82c-42b0fc59a6a5.

Dataset 2 Australian Government Department of the Environment (2014) National Heritage List Spatial Database (NHL) (v2.1). Bioregional Assessment Source Dataset. Viewed 13 April 2015, http://data.bioregionalassessments.gov.au/dataset/26daa8d7-a90e-47f3-982b-0df362414e65.

Dataset 3 Australian Government Department of the Environment (2014) Australia, Register of the National Estate (RNE) – Spatial Database (RNESDB) Internal. Bioregional Assessment Source Dataset. Viewed 13 April 2015, http://data.bioregionalassessments.gov.au/dataset/878f6780-be97-469b-8517-54bd12a407d0.

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