

Guideline

Water Act 2000

Underground water impact reports and final reports

This guideline is intended to assist resource tenure holders in the development of underground water impact reports and final reports within the framework provided by the Water Act 2000.

Table of contents

1	Executive summary	3
2	Background	3
2.1	What are underground water impact reports and final reports?	3
2.2	What are underground water rights?	4
2.3	Adaptive management of impacts to groundwater: relationship with <i>Environmental Protection Act 1994</i>	4
3	Who has to prepare underground water impact report or a final report and when does it need to be submitted?	6
4	Exemptions from giving an UWIR or final report	9
4.1	Low risk tenures	9
4.2	Mining activities which had commenced prior to 6 December 2016.....	9
4.2.1	Authorised to take underground water under a water licence, associated water licence or permit	9
4.2.2	Otherwise authorised to take underground water	9
4.3	Exemptions to prepare a further underground water impact report.....	10
4.4	What is the submission and assessment process?	10
4.5	What are the requirements for public consultation?	10
5	Underground water impact reports	11
5.1	Completing an underground water impact report.....	12
5.1.1	Part A: Underground water extractions	12
5.1.2	Part B: Aquifer information and underground water flow	13
5.1.3	Part C: Predicted water level declines for affected aquifers	15
5.1.4	Part D: Impacts on environmental values	17
5.1.5	Part E: Water monitoring strategy	21
5.1.6	Part F: Spring impact management strategy	23
5.1.7	Part G: For a CMA assign responsibilities to resource tenure holders	27
6	Final reports	27
6.1	Completing a final report	28
7	References	29
8	Glossary	31

9 Acronyms.....33

Version history

Version	Effective date	Description of changes
1.00	26 March 2013	First published version of the guideline.
2.00	26 March 2013	First version uploaded to the Policy Register.
3.00	6 December 2016	Updated to reflect changes to Chapter 3 of the Water Act as a result of <i>Water Reform and Other Legislation Amendment Act 2014</i> , <i>Water Legislation Amendment Act 2016</i> and <i>Environmental Protection (Underground Water Management) and Other Legislation Amendment Act 2016</i> .
3.01	5 July 2017	Updated to reflect the repeal of the <i>Sustainable Planning Act 2009</i> and the commencement of the <i>Planning Act 2016</i> .
3.02	21 May 2018	The document template, header and footer have been updated to reflect current Queensland Government corporate identity requirements and comply with the Policy Register.

1 Executive summary

This document provides guidance regarding the information required for inclusion in an underground water impact report (UWIR) and a final report to meet the requirements of Chapter 3 of the *Water Act 2000* (Water Act). This guideline also outlines the expectations (including recommended methods) of the Department of Environment and Science (the department) for an UWIR and final report. By proactively providing guidance on the department's expectations for UWIRs and final reports, it is anticipated that submitted UWIRs and final reports will be more likely to meet the requirements of the Water Act; and consequently, be approved by the chief executive in a timely fashion.

It is not a requirement to comply with this guideline when preparing an UWIR or final report. However, the department encourages resource tenure holders that are responsible for preparing an UWIR or final report to consider the guidance included within this document.

Note: Technical terms are defined in the Glossary.

2 Background

2.1 What are underground water impact reports and final reports?

An UWIR is prepared to describe, make predictions about and manage the impacts of underground water extraction by resource tenure holders. An UWIR establishes responsibilities for resource tenure holders and ensures measures and programs are in place to respond to impacts on underground water. UWIRs will:

- identify aquifers that are predicted to be impacted by resource tenure holders' exercising their underground water rights (immediately affected areas (IAA) and long-term affected areas (LTAA));
- establish obligations to monitor impacts on aquifers and springs;
- impose a strategy to mitigate impacts on any spring of interest;
- assist with management of impacts of the exercise of water rights by resource tenure holders; and
- establish underground water obligations (make good obligations of the resource tenure holder for private water bores).

Final reports include similar information to UWIRs but there are some differences in the required inclusions as final reports are produced at the end of a resource tenure. Final reports will summarise information about:

- predicted water level declines in any LTAA;
- bores in any LTAA;
- the spring impact management strategy for any spring of interest; and
- make good obligations.

2.2 What are underground water rights?

UWIRs and final reports are an integral part of the underground water management framework which manages the impacts from resource tenure holders exercising underground water rights.

Underground water rights mean any of the following:

- (a) Underground water rights provided to mineral development licence and mining lease holders in the *Mineral Resources Act 1989*;
- (b) Underground water rights provided to authority to prospect and petroleum lease holders in the *Petroleum and Gas (Production and Safety) Act 2004*; and
- (c) Underground water rights provided to petroleum lease holders in the *Petroleum Act 1923*.

Underground water rights provide the tenure holder with a statutory right to take or interfere with underground water in the area of the tenure if the taking or interference with that water is necessarily and unavoidably obtained in the process of extracting the resource. For example, mine dewatering to the extent necessary to achieve safe operating conditions. This is also known as associated water.

Water that is taken for consumptive uses such as camp water or hydraulic fracturing is known as non-associated water. Resource tenure holders are required (mining lease and mineral development licence holders) or will be required (petroleum lease holders) to obtain a water authorisation under the Water Act before extracting non-associated water in a regulated groundwater area.

2.3 Adaptive management of impacts to groundwater: relationship with *Environmental Protection Act 1994*

Potential impacts on groundwater will be managed through an adaptive management regime through both the *Environmental Protection Act 1994* (EP Act) and the UWIR process in Chapter 3 of the Water Act.

The requirements of section 126A and 227AA of the EP Act are complimentary with the information requirements for an UWIR in section 376 of the Water Act. Section 126A outlines a list of information requirements which must accompany a site-specific environmental authority application where the resource activity or project involves the exercise of underground water rights. Section 227AA requires that this information also be included with an environmental authority amendment application where the proposed amendment involves a change in the exercise of underground water rights. These requirements ensure an upfront assessment of the impacts to environmental values from the exercise of these underground water rights has been undertaken, and that potential impacts are appropriately managed.

It is anticipated that the information supplied with the environmental authority application will be utilised and built upon for the responsible entity's submission of the UWIR. Equally, any relevant information contained in an approved UWIR may be utilised as part of the environmental authority application.

Underground water impact reports and final reports

An environmental authority may be amended in response to the contents of an UWIR. This framework ensures that there is sufficient monitoring, collection and review of information for ongoing adaptive management of groundwater impacts due to the resource sector's statutory right to take underground water.

3 Who has to prepare underground water impact report or a final report and when does it need to be submitted?

Resource tenure holders (petroleum tenure holders and mining tenure holders) and the Office of Groundwater Impact Assessment (OGIA) are referred to in the Water Act as responsible entities. The table below outlines the requirements for submittal of UWIRs and final reports for responsible entities and applicable tenure types:

Responsible entity	Tenure type and area type	Report type	Requirement for report submittal
Petroleum tenure holder	Petroleum lease (PL) and authority to prospect (ATP) outside of a cumulative management area (CMA)	Initial UWIR	<ul style="list-style-type: none"> 14 months after the day production testing or production started on a tenure; or if the obligation to give an UWIR applies because the tenure is renewed—14 months after the day a renewal application for the tenure is granted; or if the chief executive agrees to a longer period, that period.
		Revised UWIR	<ul style="list-style-type: none"> within 10 business days of the three year anniversary of when the first UWIR took effect; or if the chief executive agrees to a later day, that later day.
		Final report	<ul style="list-style-type: none"> within the time period stated in a notice issued by the chief executive following the submittal of a notice of closure by a resource tenure holder.
Mining tenure holder	Mineral development licence (MDL) and mining lease (ML) granted after 6 December 2016 and the MDL and ML holder was not	Initial UWIR	<ul style="list-style-type: none"> before the day the mining tenure holder exercises its underground water rights; or if the chief executive agrees to a longer period, that period.

Guideline
Underground water impact reports and final reports

	required to obtain an associated water licence under section 839 of the Water Act	Revised UWIR	<ul style="list-style-type: none"> • within 10 business days of the three year anniversary of when the first UWIR took effect; or • if the chief executive agrees to a later day, that later day.
		Final report	<ul style="list-style-type: none"> • within the time period stated in a notice issued by the chief executive following the submittal of a notice of closure by a resource tenure holder.
	An existing MDL or ML (granted before 6 December 2016) Or MDL and ML granted after 6 December 2016 and the MDL and ML holder was required to obtain an associated water licence under section 839 of the Water Act	Initial UWIR	<ul style="list-style-type: none"> • if the chief executive decides to direct the resource tenure to submit an UWIR, within the time period stated in a notice issued by the chief executive.
		Revised UWIR	<ul style="list-style-type: none"> • within 10 business days of the three year anniversary of when the first UWIR took effect; or • if the chief executive agrees to a later day, that later day.
		Final report	<ul style="list-style-type: none"> • within the time period stated in a notice issued by the chief executive following the submittal of a notice of closure by a resource tenure holder.
	OGIA	CMA which includes any combination of PL, ATP, MDL or ML	Initial UWIR
Revised UWIR			<ul style="list-style-type: none"> • within 10 business days of the three year anniversary of when the first UWIR took effect; or • if the chief executive agrees to a later day, that later day.

Underground water impact reports and final reports

		Final report	<ul style="list-style-type: none">• within the time period stated in a notice issued by the chief executive following the submittal of a notice of closure by a resource tenure holder.
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4 Exemptions from giving an UWIR or final report

The Water Act outlines circumstances where a resource tenure holder may be exempted from providing an UWIR or final report. These exemptions are explained below.

4.1 Low risk tenures

The Water Regulation may identify circumstances in which a resource tenure is taken to be a low risk¹. If a tenure meets these circumstances, the tenure holder is not required to submit an UWIR while the tenure remains a low risk tenure.

4.2 Mining activities which had commenced prior to 6 December 2016

An UWIR or final report is not required if the resource tenure is a MDL or ML and is not a CMA tenure, and either of the following exemptions applies:

4.2.1 Authorised to take underground water under a water licence, associated water licence or permit

- The resource tenure holder is authorised, under a water licence, associated water licence or water permit; and
- The authorised take or interference with underground water is in the area of the resource tenure; and
- The take or interference happens during the course of, or results from, the carrying out of an authorised activity for the resource tenure.

4.2.2 Otherwise authorised to take underground water

- The resource tenure holder was authorised to take or interfere with underground water in the area of the resource tenure before 6 December 2016; and
- After 6 December 2016 the resource tenure holder takes or interferes with water during the course of, or as the result of, carrying out of an authorised activity for the resource tenure; and
- Had the take or interference occurred before the commencement, the resource holder would have been lawfully authorised to take or interfere with underground water in connection with the activity.

To be clear, despite the exemptions above, if a CMA applies to a MDL or ML, an UWIR is required to be prepared by OGIA. In addition, if the chief executive calls in the resource tenure by notice, then the preparation of an UWIR is required and an information notice will be issued to the resource tenure holder with a stated reasonable timeframe for the UWIR to be submitted. This decision will be subject to internal review and appeal rights.

¹ Currently the Water Regulation 2016 does not prescribe any circumstances in which a tenure is taken to be a low risk resource tenure. As such this exemption cannot be used at this time.

4.3 Exemptions to prepare a further underground water impact report

A resource tenure holder is not required to prepare further UWIRs if the following circumstances apply:

- The resource tenure is not a CMA tenure; and
- The existing approved UWIR:
 - estimated the quantity of water to be taken as zero; and
 - did not predict a decline in the water level of an aquifer of more than the bore trigger threshold at any time.

However if, after the approval of the existing UWIR, the resource tenure holder exercises its underground water rights, the resource tenure holder must notify the chief executive within 10 business days of the exercise of the rights. The chief executive may then direct the resource tenure holder to prepare and consult on an amendment to the existing UWIR.

4.4 What is the submission and assessment process?

A draft UWIR or final report must be consulted on with the community for a minimum of 20 business days prior to submission of the UWIR to the chief executive. For further information in relation to consultation requirements, refer to section 4.5 'What are the requirements for public consultation?'

Once the department receives an UWIR or final report, the department will undertake an assessment to determine whether the requirements of the Water Act have been met. The department has 60 business days from the day of submission to carry out this assessment. Depending on whether the UWIR or final report meets statutory requirements, the chief executive may decide to:

- approve the UWIR or final report, with or without, conditions; or
- require that the UWIR or final report be modified and resubmitted.

Within 10 business days of approving an UWIR or final report, the chief executive must give the responsible entity notice of the decision. An UWIR or final report takes effect on the day stated in this notice. The obligations established by these reports apply as soon as the reports take effect.

Under section 386 of the Water Act, a responsible entity must, within 10 business days after receiving the notice of approval, publish a notice about the approved UWIR or final report in the way required by the chief executive and give a copy of the notice to each bore owner of a water bore within the area to which the UWIR or final report relates. In addition, within 15 business days after receiving the notice of approval, the resource tenure holder must also notify the chief executive that they have complied with their notification obligations. It is an offence for a tenure holder to not comply with these obligations.

4.5 What are the requirements for public consultation?

Under section 381 of the Water Act, before giving the chief executive an UWIR or final report, the responsible entity must consult on the report. Consultation must be undertaken for a minimum of 20 business days.

Underground water impact reports and final reports

In accordance with section 382 of the Water Act, the responsible entity must publish a notice about the report in a way required by the chief executive. To determine this, the chief executive will consider the most effective method or combination of methods for informing relevant parties. Methods for publication may include individual notification to each relevant party, publication on the responsible entity's website, or publication in a newspaper that circulates in the area to which the report relates.

The responsible entity must also give a copy of the notice to each owner of a water bore within the area to which the report relates. For an UWIR for the CMA, the OGIA must give a copy of the notice to all resource tenure holders who hold a tenure within the CMA. The notice must state each of the following requirements:

Requirements under section 382(3) of the Water Act
<p>To meet the requirements under section 382(3) of the Water Act, a public notice must state the following:</p> <ul style="list-style-type: none"> • a description of the area to which the report relates; • that copies of the report may be obtained from the responsible entity; • how the copies may be obtained; • that written submissions on the report may be given; • that submissions must be given to the responsible entity; • that a copy of submission must be given to the chief executive; • a day that is at least 20 business days after the notice is published by which submissions may be made; and • where the submissions may be given.

The responsible entity must also:

- give a copy of the report to each person who requests a copy; and
- advise the chief executive that they have complied with the public notification requirements for an UWIR or final report, when submitting the report for assessment.

5 Underground water impact reports

The guideline recommends specific methods for making predictions about the impacts of underground water extractions and for the preparation of UWIRs. However, it is acknowledged that the specific methods recommended may not need to be adopted in all cases. In cases where the tenure holder chooses to use methods other than those recommended in this guideline, the tenure holder will need to consider the potential impacts of underground water extractions and justify why the method chosen is appropriate for the relevant circumstances.

Underground water impact reports and final reports

Further, the statutory requirements for UWIRs as detailed in section 376 of the Water Act must be addressed in all cases. Where the submitted UWIR does not meet the requirements of the Water Act, the tenure holder must justify the reasons for this. If a tenure holder proposes to submit an UWIR that does not meet the requirements of the Water Act, resource tenure holders are encouraged to contact the department prior to the submission of an UWIR to clarify the requirements of the UWIR through a pre-lodgement meeting.

The pre-lodgement process can also be used to clarify other matters such as which combination of tenures can be included within an UWIR and how information previously submitted under the EP Act can be utilised.

An UWIR must contain the information that has been outlined in each of the following parts of this guideline:

- Part A: Information about underground water extractions resulting from the exercise of underground water rights
- Part B: Information about aquifers affected, or likely to be affected
- Part C: Maps showing the area of the affected aquifer(s) where underground water levels are expected to decline
- Part D: An assessment of the impacts to the environmental values from the exercise of underground water rights
- Part E: A water monitoring strategy
- Part F: A spring impact management strategy
- Part G: For a CMA, assignment of responsibilities to resource tenure holders.

5.1 Completing an underground water impact report

5.1.1 Part A: Underground water extractions

Requirements under section 376(a) of the Water Act
<p>To meet the requirements under section 376(a) of the Water Act, an UWIR must include the following:</p> <ol style="list-style-type: none"> 1. the quantity of underground water produced or taken from the area because of the exercise of underground water rights; and 2. an estimate of the quantity of water to be produced or taken because of the exercise of underground water rights for a three year period starting on the consultation day for the report.

Recommended methods and inclusions for Part A are described below:

Quantity of water already produced

The quantity of underground water already produced or taken from each target aquifers/reservoirs in the area must be documented. This should be based on measured data i.e. underground water extraction records. It is recommended that monthly data is collated and the entire available record be presented using tabular and

graphical formats. In addition, information about the methodology used for measuring extraction volumes, the number of extraction wells used and the target aquifers/reservoirs for water extraction should also be included.

If the report is prepared by a mining tenure holder before it exercises its underground water rights, the quantity of water produced or taken from the area would be shown in the report as zero.

Quantity of water to be produced in the next three years

Estimates of underground water extractions expected to occur during the next three years following the report consultation day² should be based on underground water extraction records and/or projected production estimates. The methods used to make these estimates should be reported.

5.1.2 Part B: Aquifer information and underground water flow

Requirements under sections 376(b)(i) to 376(b)(iii) of the Water Act

For each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights, an UWIR must include:

1. A description of the aquifer;
2. An analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers; and
3. An analysis of the trends in water level change for the aquifer because of the exercise of underground water rights.

Recommended methods and inclusions for Part B are described below:

Aquifer descriptions

All aquifers that occur within or adjacent to the tenure boundaries should be described in this section. Information should then be collated to assess whether these aquifers are likely to be affected by the exercise of underground water rights. Descriptions of these aquifers should be based on accepted aquifer nomenclature, for example, aquifer descriptions within the Great Artesian Basin (GAB) should be based on the stratigraphic sequence described in the hydrogeological framework report for the GAB Water Resource Plan area (Department of Natural Resources, Mines and Energy, 2005).

Hydrogeological cross sections should also be included to show:

- potentially affected aquifers;
- the elevations and relative positions of each of these aquifers;
- the location of water bores screened within these aquifers (if known);
- the location of any significant faults that intersect each potentially affected aquifer; and

² Section 362 of the Water Act defines the consultation day as the day a notice is first published about the proposed report.

- available data on current underground water levels.

Multiple cross sections should be included if the above points are unable to be included in a single cross section due to scale or complexity.

In addition, maps should be provided to show the physical extent of each of the potentially affected aquifers.

This should be accompanied by a description of the methodology used to determine aquifer extent, for example, the data used and the interpolation methods used. Ultimately, the assessment of whether aquifers are likely to be affected should be based on predicted drawdown e.g. from underground water modelling.

Underground water flow and aquifer interactions

To assess the movement of underground water, contours of underground water elevations should first be produced to determine general underground water flow directions. Inputs to and outputs from potentially affected aquifers should then be estimated based on available data. This data should include estimates of underground water recharge, estimates of baseflow and underground water extractions.

To assess the connectivity between aquifers, information is needed about aquifer (and aquitard) hydraulic properties. In addition to any available pumping test data and drill stem test data (Hackbarth, 1978), stratigraphic information can be combined with a literature review to estimate hydraulic properties for the aquifers of interest.

Where no pumping test data or drill stem test data is available, pumping tests should be conducted to determine aquifer hydraulic properties.

In addition to hydraulic property information, other approaches are available for assessing interactions between aquifers. By comparing pressure heads, underground water hydrographs and/or underground water chemical composition (e.g. electrical conductivity, major ion chemistry and environmental tracers) between the aquifers of interest, assessments can be made about the connectivity between these aquifers. These approaches should be considered before conclusions are drawn about connectivity between aquifers. Consideration should also be given to natural and anthropogenic preferential flow paths such as faults, abandoned water bores and petroleum wells. Information about interactions between aquifers will be critical for the conceptualisation phase of underground water model development.

Underground water level trend analysis

Underground water level graphs should be prepared using available data for all of the water bores in the region of interest. Where limited underground water level data is available within the tenure, underground water level data from bores close to the boundaries of the tenure should be presented. For shallow and/or unconsolidated aquifers, underground water level trends should be plotted against rainfall data e.g. cumulative departure from mean rainfall (Okkonen & Klove, 2010; Weber & Stewart, 2004).

To assess underground water level trends, the data should be analysed for time periods before and after the start of resource activities. Linear regressions of the time series data should be completed for the analysis of

trends. Where there is sufficient data available, the underground water level trend analysis should also include non-parametric statistical tests, for example, Mann-Kendall trend analysis (Yue, et al., 2002).

5.1.3 Part C: Predicted water level declines for affected aquifers

Declines in underground water levels in aquifers (including petroleum and gas reservoirs or coal and mineral deposits, such as coal measures, and adjacent aquifers) may occur as a result of underground water extractions by resource operations. Predictions must be made about the magnitude of water level declines in affected aquifers because of the quantity of underground water extracted.

These predictions must be made for:

- water level declines, by more than the applicable bore trigger threshold, within three years following the report consultation day (IAA); and
- water level declines, by more than the applicable bore trigger threshold, at any time (LTAA).

Requirements under sections 376(b)(iv) to 376(e) of the Water Act

To meet the requirements of the Water Act, an UWIR must include the following:

1. Maps showing the IAA and the LTAA (sections 376(b)(iv) and 376(b)(v) of the Water Act);
2. A description of the methods used to produce these maps (section 376(c) of the Water Act);
3. Information about all water bores in the IAA (including the number of bores in the area, maps showing the location of these bores and the authorised use of each bore) (section 376(d) of the Water Act); and
4. A program for conducting an annual review of the accuracy of maps produced and giving the chief executive a summary of the outcome of each review, including a statement of whether there has been a material change in the information or predictions used to prepare the maps (section 376(e) of the Water Act).

Recommended methods and inclusions for Part C are described below:

Maps of affected areas

Maps must be produced to show predicted water level declines for each affected aquifer. These maps must include contours to show where water level declines are greater than the applicable trigger threshold. Contours should be adequately spaced so as to allow the clear interpretation of impacts. For the IAA, maps showing yearly drawdown predictions must be included for the 3-year period starting on the consultation day of the report where possible, estimates of predictive uncertainty (Doherty, 2003) should be provided.

For the LTAA, maps should include contours showing the maximum water level decline predicted.

Methods and techniques used

Descriptions are required of the methods and techniques used to predict water level declines and produce maps showing affected areas. In order to make predictions of underground water drawdown, it is expected that underground water modelling will be required. An underground water model is any computer-based representation of the essential features of the hydrogeological system that uses the laws of science and mathematics. The complexity of the underground water model required will depend on the size of the tenure, the characteristics of the aquifer(s) (i.e. degree of confinement and heterogeneities in hydraulic properties), the magnitude of underground water extractions and the data available for model construction. Where possible, the development of a transient model is recommended as this is the most appropriate model type for simulating changes in drawdown over time.

Detailed information should be supplied about the underground water model, including the model type (e.g. numerical or analytical), the modelling platform, the model inputs, the model boundary conditions, the model assumptions and the details of any sensitivity analysis and/or calibration that was performed. The information about model inputs should include details about the aquifer hydraulic properties, the locations of the bores that were included in the underground water model and the extraction regime that was simulated. Any assumptions applied, including those related to connectivity between aquifers and water balance components, should be described. For guidance on modelling approaches, refer to the Australian groundwater modelling guidelines (Barnett et al, 2012).

Water bores within the immediately affected area

The information about water bores within the IAA should be presented in tables and maps. In addition to information about the number of bores in the area, maps showing the location of these bores and the authorised use of each bore, the following information should be included: a unique bore identifier for each bore; the tenure in which the bore is located; the lot and plan in which the bore is located or some other means of identifying the location of the bore; and the aquifer in which the bore is screened if known (preferably in tabular format).

Initially, this information can be acquired by responsible tenure holders by requesting a search of Department of Natural Resource, Mines and Energy (DNRME) Groundwater Database. This search may identify some petroleum wells or mineral exploration holes which are recorded in the database with a registered number (RN). This search may also identify water bores that are only used for water monitoring. These do not need to be identified in the UWIR as the report only applies to water bores which meet the authorisation requirements of section 363 of the Water Act. That is, water bores must:

- (a) be authorised under the Water Act to take or interfere with water; and
- (b) if the *Planning Act 2016* or repealed *Sustainable Planning Act 2009* or *Integrated Planning Act 1997* required a development approval under that Act in relation to the bore for operational work for the taking or, or interfering with, water—the approval has been granted.

Only water bores that meet these requirements should be identified in the UWIR. Please note there are some areas of Queensland where a water bore may be authorised to take or interfere with water but not require a

Underground water impact reports and final reports

water licence or permit. If a resource tenure holder is uncertain as to whether or not the UWIR should apply to a water bore, the department can assist in coordinating the verification of these water bores.

Bore assessments for IAA bores that are not already the subject of a make good agreement must be conducted less than 60 business days after the UWIR report takes effect, unless the chief executive agrees to a later day.

Review of maps produced

If an UWIR predicted water in any area of an affected aquifer by more than the bore trigger threshold at any time, annual reviews of the accuracy of the affected area maps are required and a program is required for conducting these reviews. Where underground water flow modelling is used to make predictions, the review program should include milestones for updating model inputs, calibrating the model and producing updated maps. Information about aquifer extent and aquifer connectivity may also need to be reviewed.

A summary of the outcome of each review, including a statement of whether there has been a material change in the information or predictions used to prepare the maps must be provided to the department. In most instances, the UWIR conditions approved by the chief executive will require this summary to be submitted within 20 business days after the anniversary day (i.e. the day the UWIR takes effect).

This summary should be presented in a format which suits the amount and detail of information to be discussed. For instance, if there is no material change due to limited activity, it might be suitable to provide the summary in a letter. If the summary identifies material change or discusses more substantial amounts of information, the summary may need to be presented in a report or discussion paper. Please note that a program for conducting an annual review is not required if an IAA and/or LTAA is not predicted.

5.1.4 Part D: Impacts on environmental values

Requirements under sections 376(da) and (db) of the Water Act

To meet the requirements of the Water Act, an UWIR must include the following:

1. a description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights (section 376(da) of the Water Act);
2. an assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights (section 376(db) of the Water Act)—
 - i. for a three year period starting on the consultation day for the report; and
 - ii. over the projected life of the resource tenure.

Recommended methods and inclusions for Part D are described below:

An UWIR is required to include a description of past and predicted impacts on environmental values which result from the exercise of underground water rights. Relevant information submitted under the EP Act requirements can be utilised to address this requirement of an UWIR. In particular, this information builds upon

information submitted as part of environmental authority application requirements under section 126A(2)(d) of the EP Act.

It is acknowledged that there will be uncertainties inherent in predictions of environmental impacts relating to the exercise of underground water rights which are submitted as part of an environmental authority application. This requirement therefore ensures the ongoing scrutiny of such impacts during the operational phase of resource projects. Any changes in impacts, or predicted impacts, identified in the UWIRs may trigger an amendment of the environmental authority to ensure the appropriate management of the impacts.

Identifying and describing environmental values

An environmental value is defined in section 9 of the EP Act to be:

- a) a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or
- b) another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.

Under the Environmental Protection (Water) Policy 2009 (Water EPP), all Queensland waters including groundwater have prescribed environmental values and water quality objectives. For some waterway basins and areas, environmental values and water quality objectives are listed in Schedule 1 of the Water EPP.

Where this is not the case, default environmental values are prescribed under section 6(2) of the policy. These include:

- aquatic ecosystem health for:
 - high ecological value waters;
 - slightly disturbed waters;
 - moderately disturbed waters;
 - highly disturbed waters;
- uses which include:
 - aquaculture and human consumption of aquatic foods;
 - agricultural uses (e.g. stock watering and irrigation)
 - recreational uses (e.g. swimming, wading, boating, fishing and aesthetic)
 - drinking water (raw water supply)
 - industrial uses (e.g. power generation and manufacturing, mining and minerals refining/processing)
 - cultural and spiritual values (aesthetic, historical, scientific, social or other significance of the waters to the present, past, or future generations).

Underground water impact reports and final reports

The Guidelines for Groundwater Quality Protection in Australia (Australian Government, 2013) can also provide further guidance on determining environmental values for groundwater.

When identifying environmental values, the application must also consider potential for underground water to interact with surface water (e.g. baseflow to watercourses) and support groundwater dependent ecosystems.

Groundwater dependent ecosystems (GDEs) are ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services. Ecosystem dependency on groundwater may vary temporally (over time) and spatially (depending on its location in the landscape). GDEs include aquifers, caves, lakes, palustrine wetlands, lacustrine wetlands, rivers and vegetation.

Additional information on GDEs including details of the Queensland GDE mapping method, conceptual models and mapping products are available on the *WetlandInfo* website at <http://wetlandinfo.des.qld.gov.au/wetlands/>.

The Environmental Protection Regulation 2008 section 81A sets the environmental values of wetlands as:

- the health and biodiversity of the wetland's ecosystems
- the wetland's natural state and biological integrity
- the presence of distinct or unique features, plants or animals and their habitats, including threatened wildlife, near threatened wildlife and rare wildlife under the *Nature Conservation Act 1992*
- the wetland's natural hydrological cycle
- the natural interaction of the wetland with other ecosystems, including other wetlands.

For further guidance on the identification and description of GDEs, it is recommended that the responsible entity refer to the EIS information guideline—Groundwater dependent ecosystems (Department of Environment and Science, 2016). Further guidance for aquatic ecological values is also provided in the EIS information guideline—Aquatic ecology (Department of Environment and Science, 2016).

To describe each environmental value further, it is recommended that, where impacts are predicted, the following is described in the context of potential impacts from groundwater level changes:

- source aquifer (noting that this will link to the description of affected aquifers in Parts C and D);
- likely relationship between the value and source aquifer (including hydrogeological and ecological conceptualisations)
- an estimation of the water requirements (e.g. supply for users or ecological water requirements for GDEs)
- availability of the water, including both quality and quantity to meet water requirements of the environmental value;
- sensitivity of the environmental value to a change in water quality and quantity resulting from decline in groundwater levels; and

- any knowledge gaps or uncertainties and any assumptions used to address these.

The department notes that where human use values listed above are sourced from water bores, the information provided in Part A, Part C and Part E would generally meet the requirement for this part.

To support the identification of environmental values, the resource tenure holder may, for the examples of environmental values discussed above, identify those environmental values that are not, or are unlikely to be impacted as a result of underground water rights. For instance, the resource tenure holder may demonstrate that the affected aquifers are geologically isolated from surface water systems and therefore not connected to surface water or any known surface GDEs in the area.

Nature and extent of the impacts on the environmental values

Once the values have been identified and described, the application must also include a description of the nature and extent of the impacts on the environmental values due to the exercise of underground water rights. The applicant is only required to undertake this analysis for environmental values that have been identified as being, or potentially being, impacted due to the exercise of underground water rights. The modelling used to predict water level decline, should be utilised to inform the analysis of impacts to the identified environmental values.

The identification of the potential impacts on environmental values is crucial for an efficient assessment of the UWIR. The potential impact on environmental values may extend beyond the project area to surrounding areas and include potential regional and cumulative impacts.

Assessment of the adverse impacts on environmental values must, for each value, include an assessment of the following aspects:

- the magnitude, relative size or actual extent of any impact in relation to the environmental value being affected by groundwater level changes, particularly a decline in water level;
- the vulnerability or resilience of the environmental value to the predicted impacts considering:
 - the severity of any adverse effect ; and
 - the duration of the effect, for example the impact may be seasonal, or it may end with the activity or extend beyond the cessation of the activity;
- an indication of the level of uncertainty of impacts and any assumptions used to address the uncertainty in any of the data or proposed commitments to protect the environmental values.

It is anticipated that to assess the nature and extent of predicted impacts on environmental values a risk assessment will be required. This will incorporate predictions of impact from the groundwater model, the estimated water requirements of all relevant environmental values, and the sensitivity of these environmental values to a change in water level. This will provide a focus for the monitoring strategy and areas of future research.

In determining the potential impact of the activities, research, investigations, surveys, modelling and monitoring may be required. For GDEs, the impact of changes in groundwater quantity and quality is determined by the degree and nature of their groundwater dependency. Responsible entities should refer to the EIS guideline—Groundwater dependent ecosystems (Department of Environment and Science, 2016) for more information. The definition of waters includes the bed and banks of waters, so assessments also need to consider the nature and extent of impacts on aquatic flora and fauna, including benthos and riparian vegetation.

If the exercise of underground water rights will result in an impact to surface water, the responsible entity should, where relevant, describe the character and resilience of the associated surface water values.

Impacts to formation integrity and surface subsidence

The exercise of underground water rights may result in damage to the physical integrity of confining geological formations and may also result in surface subsidence. The responsible entity should consider factors such as topographic variations and geological complexities when determining if these impacts are likely.

A risk based approach is required for the assessment of impacts from subsidence. Where impacts are predicted, the following should be provided:

- a description of the potential impacts to the physical integrity of confining geological formations;
- surface subsidence predictions presented on maps with appropriate contour increments and a scale appropriate for assessment of surface subsidence impacts;
- a description of the methodology used to make the predictions, including an assessment of the accuracy and precision of the predictions;
- a description of the environmental values of subsided land;
- an analysis of potential subsidence impacts on environmental values;
- a description of the potential changes in the composition of vegetation communities due to areas of permanent ponding or changed drainage caused by subsidence; and
- a subsidence monitoring program including monitoring locations, rationale, methods and frequency.

Relevant information submitted and accepted under the EP Act requirements can be utilised to address this requirement of an UWIR. In particular, this information builds upon information submitted as part of environmental authority application requirements under section 126A(2)(d) of the EP Act.

5.1.5 Part E: Water monitoring strategy

An underground water monitoring strategy is required (section 376(f) of the Water Act) for the IAA and the LTAA. Ongoing underground water monitoring is required to keep track of the quantity of water produced or taken because of the exercise of relevant underground water rights and to monitor changes in underground water levels and the underground water quality. Resource tenure holders are responsible for water monitoring both inside and outside CMAs (the UWIR prepared by the OGIA will identify the responsible tenure holders for monitoring obligations inside CMAs).

Requirements under section 378 of the Water Act

To meet the requirements of the Water Act, an UWIR must include the following:

1. a rationale for the strategy;
2. a timetable for strategy;
3. the parameters to be measured;
4. the locations for taking measurements;
5. the frequency of the measurements;
6. a program for the responsible tenure holder or holders to undertake a baseline assessment for each water bore that is outside the area of a resource tenure, but within the predicted LTAA; and
7. a program for reporting to the OGIA about the implementation of the monitoring strategy.

Recommended methods and inclusions for Part E are described below:

Rationale

The monitoring rationale should include (but not be restricted to):

- an assessment of changes in water levels and water quality because of the exercise of relevant underground water rights;
- supplementation of existing monitoring programs to fill any critical gaps in data; and
- an explanation about how it will improve the understanding about the impacts of underground water extractions on aquifers.

Monitoring strategy

The monitoring rationale should be used to help devise the most appropriate monitoring network, monitoring frequency and monitoring parameters. Where existing underground water monitoring data is available, this should be referred to when describing the monitoring strategy.

The frequency of monitoring should consider the risk of impacts and the characteristics of the formation being monitored (i.e. is the formation slow moving or more dynamic). It is recommended that a higher frequency of monitoring should be adopted initially, particularly at monitoring locations where groundwater is expected to be impacted.

Monitoring of water levels and water quality should be synchronised where possible to provide information about the relationships between these parameters. A strategy is also required for undertaking baseline assessments for bores that are outside of a resource tenure, but within the predicted LTAA.

Timetable

The monitoring timetable should include a table listing: the bores to be monitored (with a unique identifier for each bore); the tenure in which the bore is located (where possible including the block and sub-block in which the bore is located); the date(s) for proposed monitoring and the parameters that will be monitored.

Reporting program

A program for reporting to the OGIA about the implementation of the monitoring strategy must be included in the water monitoring strategy. The recommended reporting frequency is six monthly. The department will be advised when the OGIA receives these reports.

5.1.6 Part F: Spring impact management strategy

Under section 376(g) of the Water Act, a spring impact management strategy is required to determine springs of interest, investigate the risks to these springs and develop a strategy to manage and mitigate these risks. Resource tenure holders are responsible for implementing spring impact management strategies both inside and outside CMAs (the UWIR prepared by the OGIA will identify the responsible tenure holders for spring impact management strategies inside CMAs).

A spring is considered to be a spring of interest if the water level in an underlying aquifer is predicted, in an UWIR or final report, to decline by more than the spring trigger threshold at the location of the spring at any time and the cause of the predicted decline is the exercise of underground water rights. The spring trigger threshold is a decline of water level of 0.2 metres in the source aquifer, unless an alternative spring trigger threshold has been defined by regulation.

For the purposes of a spring impact management strategy a spring includes a spring vent, spring complex or watercourse spring.

Requirements under section 379 of the Water Act

To meet the requirements of the Water Act, an UWIR must include the following:

1. The details of the spring, including its location;
2. An assessment of the connectivity between the spring and the aquifer(s) over which the spring is located;
3. The predicted risk to, and likely impact on, the ecosystem and cultural and spiritual values of the spring because of the decline in water level of the aquifer over which the spring is located;
4. A strategy for preventing or mitigating the predicted impacts outlined above; or if a strategy for preventing or mitigating the predicted impacts is not included, the reason for not including the strategy;
5. A timetable for implementing the strategy; and
6. A program for reporting to OGIA about the implementation of the strategy.

Recommended methods and inclusions for Part F are described below:

Spring inventory

To record the details of each spring, a spring inventory should be developed which includes the details of each spring i.e. spring name, spring type (e.g. recharge, discharge or watercourse) and the spring location. As a first step, the tenure holder should refer to the Queensland Government's Wetland *Info*-GDE website at <http://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/gde-background/#data>—this provides an overview of spring mapping in Queensland and includes instructions to access all relevant data sets.

In addition, tenure holders should refer to the GAB water plan available on the Business Queensland website at <https://www.business.qld.gov.au/industries/mining-energy-water/water/catchments-planning/water-plan-areas/great-artesian-basin>—to find information about the GAB spring register for recharge, discharge and watercourse springs.

The spring inventory should include a field survey to confirm or update the data from these sources. The inventory should be revisited when the UWIR is revised. The location of springs should be presented using maps, with a list of coordinates for each spring. Aerial photographs would assist in showing the extent of vegetation surrounding each spring.

During the spring inventory phase, baseline information should be collected about the springs. The baseline monitoring should include assessments of seasonal variations in ecological, hydrological and hydrochemical characteristics of the springs. This baseline monitoring data is crucial, both for identifying spring values and for assessing the effectiveness of spring management strategies.

Connectivity between the spring and aquifer

The spring impact management strategy must include an assessment of the connectivity between the spring and the aquifer(s) over which the spring is located. Several methods are available to make assessments about “source aquifers” i.e. determinations of the aquifers that are hydraulically connected to springs (EHA, 2009). These methods include assessments of hydrogeology, hydrology and hydrochemistry. Multiple methods should be employed as the application of a single method is unlikely to result in an unequivocal attribution of spring discharge to a source aquifer (EHA, 2009).

Hydrogeological assessments aim to gather information about possible source aquifers. Spring locations should be compared with geological and hydrogeological maps (noting the occurrence of springs within outcrop areas of specific formations). Information about subsurface geometry of aquifers is also required to identify physical pathways by which water can travel through aquifer(s) to a spring.

Hydrological assessments involve investigations of spring discharge. The temporal pattern of underground water discharge from springs should be examined in relation to temporal changes in underground water levels (and extraction) in underlying aquifers. Comparisons should also be made between spring discharge surface elevations and potentiometric surface values for underlying aquifers. A spring can only discharge at a site where the potentiometric surface of its source aquifer is at or above the ground surface (EHA, 2009).

Hydrochemical methods involve comparisons of the chemical composition of the water in the spring with the chemical composition of the water in the underlying aquifers. Similarities in the concentrations of major ions, minor elements and environmental tracers would suggest connectivity between the spring and the aquifer(s).

Spring values

The spring impact management strategy must include information about the predicted risk to and potential impacts on the ecosystem, cultural and spiritual values of springs of interest. The likelihood of impacts will be influenced by the level of development, the drawdown in the source aquifer of individual springs, the degree of aquifer connectivity and the potentiometric surface at individual springs.

Springs will have ecosystem values where they support groundwater dependent ecosystems dependent on the surface expression of groundwater for example, palustrine wetland (e.g. swamps), lacustrine wetland (e.g. lakes), riverine wetland (e.g. streams) and estuarine and near-shore marine. The department acknowledges that the requirement to identify spring values should be addressed under Part D.

Management of impacts

To manage potential impacts on springs of interest a strategy to prevent or mitigate these impacts must be developed. If a strategy for preventing or mitigating the predicted impacts on the spring is not included in the report, the reason for not including the strategy must be stated.

The strategies should be based on practical options and be derived from site specific environmental assessments, environmental best practice and proven research and/or justification in science, legislation, guidelines, etc. Where knowledge gaps are identified or there is a level of uncertainty in any of the data, the knowledge gaps, uncertainty and any assumptions used to address these should be clearly stated to allow the department to consider the adequacy of the assessment in the context of existing knowledge.

Indigenous heritage values should also be managed according to the requirements of the *Queensland Heritage Act 1992*, *Aboriginal Cultural Heritage Act 2003* or *Torres Strait Islander Cultural Heritage Act 2003*.

Strategies for avoiding, mitigating and managing the predicted impacts on ecosystem, cultural and spiritual values must include:

- objectives which define the outcomes that are intended to be achieved (i.e. avoiding, mitigating and managing the predicted impacts) and a description of unavoidable impacts to environmental values
- measures (specific methods/procedures/tools) to be implemented to demonstrate how the objectives will be achieved
- indicators relevant to protection of the environmental values (i.e. indicators are the values that are to be measured to gauge whether the objectives are being achieved and are used to be used in auditing the performance of measures)
- a program for monitoring the indicators; and

Underground water impact reports and final reports

- a reporting program which includes triggers for the review of the strategies, and identifies additional data, assessment, analysis and reporting requirements.

Appropriate indicators, standards and control strategies can be determined from existing legislation, regulations, federal, state and local government policy, Environmental Protection Policies, model conditions, results of environmental impact assessment, results from research, investigations, surveys, monitoring, modelling, community consultation, technical guidelines and any other guidelines including those from international agencies.

For environmental values, a specified acceptable degree of departure from a reference condition is generally used for ecological stressors and biological indicators, and in respect of toxic substances, guidance based on relevant aquatic toxicity studies. The degree of departure from natural condition and level of ecosystem protection afforded from toxic substances is based on the level of ecosystem protection prescribed for the relevant waters.

Under the Environmental Protection (Water) Policy 2009, there are four levels of ecosystem protection, namely high ecological value, slightly disturbed, moderately disturbed and highly disturbed. Guidance on how water quality objectives are applied in each case is described in the Queensland Water Quality Guidelines 2009 (Department of Environment and Science, 2013). These guidelines provide water quality objectives for various water types for Queensland regions/sub regions. Where waters are listed under Schedule 1 of the Water EPP, the Water EPP scheduling documents provide environmental values and water quality objectives.

The Australian Water Quality Guidelines (ANZECC and ARMCANZ, 2000), the Australian Drinking Water Guidelines (National Health and Medical Research Council, 2011) and the Guidelines for Managing Risks in Recreational Water (National Health and Medical Research Council, 2008) are also relevant and should be consulted.

The spring monitoring program should:

- track changes against pre-development conditions by collecting sufficient data to assess background/baseline conditions, seasonal variations and recharge/discharge behaviours;
- to an appropriate extent, extend monitoring beyond the predicted impact areas to confirm that impacts are not occurring beyond these areas;
- supplement existing monitoring programs to fill any critical gaps in data;
- contain a rationale that includes (but is not restricted to):
 - a methodology for the number, location and placement of monitoring sites for each indicator and standard to be monitored;
 - an explanation about how it will improve the understanding about the impacts of underground water extraction on identified environmental values and water quality; and
 - maps to demonstrate the purpose and location of monitoring points including co-ordinates details;

- include monitoring bores constructed in accordance with the minimum construction requirements;
- include drilling logs and construction details of all monitoring bores and where vibrating wire piezometers are installed, depths and construction details of each piezometer should be provided;
- Methods of groundwater sampling should comply with the latest edition of the Queensland Monitoring and Sampling Manual (Department of Environment and Science, 2010), AS/NZS 5667:11 1998 Water Sampling Guidelines—Part 11: Guidance on sampling groundwater (Technical Committee EV/8, 1998), and the Australian Government’s Groundwater Sampling and Analysis—A Field Guide (Sundaram, et al., 2009) as relevant and as may change from time to time;
- manage water quality monitoring in accordance with the relevant National Water Quality Management Strategy (NWQMS) guideline: Australian Guidelines for Water Quality Monitoring and Reporting (AWQG) (ANZECC and ARMCANZ, 2000); and
- provide a description and supporting rationale of any alternative or additional monitoring methodologies.

Timetable for strategy

The timetable should include dates for implementing prevention and/or mitigation measures for specific springs.

The timetable should also include dates for baseline monitoring and dates for continued spring monitoring so that the effects of the spring impact monitoring strategy can be assessed.

Reporting program

The spring impact management strategy must include a program for reporting to the OGIA about the implementation of the spring impact management strategy. The recommended reporting frequency is six monthly.

5.1.7 Part G: For a CMA assign responsibilities to resource tenure holders

If OGIA is responsible for preparing the UWIR or final report, the UWIR must:

- propose a responsible tenure holder for each report obligation; and
- for each IAA, propose a responsible tenure holder who must comply with any make good obligations for water bores within the IAA.

Report obligations may include obligations relating to Part E and F of the UWIR.

6 Final reports

Section 374 of the Water Act states that if a notice of closure for a resource tenure is given by a resource tenure holder, a final report must be produced. The chief executive must, as soon as practicable after the notice of closure is received, give a notice requiring a final report to be given for the tenure for:

- a CMA tenure other than a closing CMA tenure, the OGIA as responsible entity for the CMA; or
- a closing CMA tenure or other resource tenure—the holder of the resource tenure.

6.1 Completing a final report

Section 377 of the Water Act states that the final report must include the information required for an UWIR with the exception of:

- an estimate of the quantity of water to be produced in the next three years;
- a map showing the area of the aquifer where the water level is predicted to decline by more than the trigger threshold in the next three years (IAA);
- a summary about underground water bores in the IAA;
- a program for conducting annual reviews of the accuracy of maps produced and giving the chief executive a summary of the outcome of each review; and
- a list of the proposed responsible tenure holders (if the responsible entity is the OGIA).

Requirements under section 377 of the Water Act

In addition, a final report must include the following additional information to meet the requirements of the Water Act:

1. a summary about underground water bores in the LTAA (including the number of bores and the location and authorised use or purpose of each bore);
2. a summary about how the make good obligations of the responsible tenure holder for each water bore to which the final report relates have been complied with by the holder over the term of the tenure;
3. a summary of the make good obligation of the responsible tenure holder for each water bore that have not yet been complied with by the holder and a plan about how these obligations will be complied with; and
4. statements about any matters outlined in previous strategies that have not yet been complied with, along with a timetable of planned actions to address these outstanding matters.

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Underground water impact reports and final reports

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8 Glossary

Aquitard	A low-permeability unit that can store underground water and also transmit it slowly from one aquifer to another.
Baseflow	The water in a stream that comes from underground water.
Bore trigger threshold	Bore trigger threshold has the meaning in section 362 of the Water Act and means a decline in water level in an aquifer prescribed by regulation, or otherwise 5 metres for consolidated aquifers and 2 metres for unconsolidated aquifers.
Consolidated aquifer	Consolidated aquifer has the meaning in section 362 of the Water Act and means an aquifer consisting predominantly of consolidated sediment. The term includes geological formations such as sandstone, fractured mudstone and basalt.
Consultation day	Consultation day has the meaning in section 362 of the Water Act and means the day a notice is first published about the proposed report.
Cumulative management area (CMA)	Cumulative management area has the meaning in schedule 4 and section 365 of the Water Act and means an area declared to be a cumulative management area under section 365. If the chief executive considers an area containing two or more resource tenures may be affected by the exercise of underground water rights by the tenure holders, the chief executive may, by a gazette notice, declare the area to be a cumulative management area.
Drawdown	A lowering of the water table of an unconfined aquifer or the potentiometric surface of a confined aquifer caused by extraction of underground water.
Hydraulic properties	Quantitative measures of an aquifer's ability to store and transmit water.
Immediately affected area (IAA)	Immediately affected area has the meaning in section 387 of the Water Act and means the area of an aquifer where the water level is predicted to decline, because of the exercise of underground water rights, by more than the bore trigger threshold within three years after the consultation day for the report.
Long term affected area (LTAA)	Long term affected area has the meaning in section 387 of the Water Act and means the area of an aquifer where the water level is predicted to decline, because of the exercise of underground water rights, by more than the bore trigger threshold at any time.

Underground water impact reports and final reports

Make good obligations	<p>Make good obligations has the meaning in section 409 of the Water Act and means the obligations of resource tenure holder for an immediately affected area bore, which are:</p> <ul style="list-style-type: none"> • undertaking a bore assessment of the bore, • entering into a make good agreement with the bore owner, • complying with the make good agreement, and • if asked to vary the make good agreement, negotiating a variation of the make good agreement.
Recharge	Water that percolates through the unsaturated zone and reaches the saturated zone.
Resource tenure holder	Resource tenure holder has the meaning in section 364 of the Water Act and means the holder of an authority to prospect or petroleum lease issued under either the <i>Petroleum Act 1923</i> or the <i>Petroleum and Gas (Production and Safety) Act 2004</i> or the holder of a mineral development licence or mining lease issued under the <i>Mineral Resources Act 1989</i> .
Potentiometric surface	A surface that represents the level to which water will rise in tightly cased wells.
Responsible entity	Responsible entity has the meaning in section 368 of the Water Act and means the entity responsible for the preparation of an UWIR and final report. The responsible entity is the OGIA (for a cumulative management area, other than an area that is within a closing CMA tenure), or the holder of the resource tenure (for a closing CMA tenure or a resource tenure other than a CMA tenure).
Source aquifer	The primary aquifer contributing to spring discharge.
Spring	<p>A spring has the meaning in schedule 4 of the Water Act and means—</p> <ul style="list-style-type: none"> (a) if a feature is identified on the watercourse identification map as a spring—the feature identified on the map; or (b) otherwise—the land to which water rises naturally from below the ground and the land over which the water then flows.

Spring of interest	A spring of interest has the meaning in section 379 of the Water Act and means a spring that overlays an aquifer in which water level is predicted to decline by more than the spring trigger threshold (0.2m, unless otherwise prescribed by regulation) at the location of the spring at any time and the cause of the predicted decline is, or is likely to be, the exercise of underground water rights.
Stratigraphic	The arrangement and succession of geological strata.
Water level	Water level of an aquifer has the meaning in section 362 of the Water act and means— <ul style="list-style-type: none"> • if the aquifer was tapped by an artesian bore—the level to which the water would rise naturally above the surface of the land at the location of the bore if the water was contained vertically above the surface of the land; or • if the aquifer were tapped by a subartesian bore—the level of the water in the bore.

9 Acronyms

ATP	Authority to prospect
CMA	Cumulative management area
CSG	Coal seam gas
DNRME	Department of Natural Resource, Mines and Energy
EIS	Environmental impact statement
EP Act	<i>Environmental Protection Act 1994</i>
GAB	Great Artesian Basin
GDEs	Groundwater dependent ecosystems
IAA	Immediately affected area
LTAA	Long term affected area
MDL	Mineral development licence
ML	Mining lease

Guideline

Underground water impact reports and final reports

NWQMS	National Water Quality Management Strategy
OGIA	Office of Groundwater Impact Assessment
PL	Petroleum lease
UWIR	Underground water impact report [under the <i>Water Act 2000</i>]
Water EPP	Environmental Protection (Water) Policy 2009

Disclaimer

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