Department of Environment and Resource Management

Guideline

Underground Water Impact Reports and Final Reports

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1.0 Executive Summary

This document provides guidance regarding the information (including the types of monitoring) that the department considers relevant for inclusion in an Underground Water Impact Report (UWIR) and a Final Report. By providing clear guidance on the information that needs to be included in these reports up front, the submitted reports are more likely to meet the requirements of the *Water Act 2000* (Water Act) and be approved by the department in a timely fashion. The guideline does not have to be complied with but rather provides guidance. The provisions of the *Water Act 2000* (Water Act) outline the content requirements of an UWIR that must be complied with. The technical terms contained in this guideline are defined in section 7.0.

2.0 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 extraction of underground water by petroleum tenure holders (including coal seam gas tenure holders) where production testing or production is taking place. An UWIR establishes responsibilities for petroleum tenure holders and ensures measures and programs are in place to respond to impacts on underground water. 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 petroleum tenure.

2.2 Why are Underground Water Impact Reports and Final Reports required?

Preparation of these reports will assist with the prediction and management of impacts associated with underground water extraction due to the exercise of water rights by petroleum tenure holders.

Underground Water Impact Reports will:

- identify aquifers that are predicted to be impacted by petroleum tenure holders' exercising their underground water rights (Immediately Affected Areas and Long Term Affected Areas);
- establish obligations to monitor impacts on aquifers and springs;
- impose a strategy to mitigate impacts on any potentially affected springs;
- assist with management of impacts of the exercise of water rights by tenure holders'; and
- establish underground water obligations (make good obligations of the petroleum tenure holder for private water bores).

Final Reports will summarise information about:

- predicted water level declines in the Long Term Affected Area;
- bores in the Long Term Affected Area;
- the spring impact management strategy for potentially affected springs; and
- make good obligations.

A draft of the UWIR or Final Report must be consulted on with the community for a minimum of 20 business days prior to submission to the Department of Environment and Resource Management (DERM). This consultation should commence no later than two months before the report is submitted to DERM.

Following submission of the UWIR or Final Report to DERM for approval, DERM has 60 business days to decide to approve the UWIR or Final Report, or require the report be modified and resubmitted. Within ten days of approving an UWIR or Final Report, DERM 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.

2.3 Who has to prepare an Underground Water Impact Report or a Final Report?

Under Chapter 3 of the *Water Act 2000*, petroleum tenure holders and the Queensland Water Commission (QWC) have responsibilities for the preparation of UWIRs and Final Reports. If the DERM chief executive has declared a cumulative management area (CMA), that is an area that is likely to experience an impact on underground water due to the exercise of underground water rights by two or more petroleum tenure holders, the QWC takes over responsibility for preparing an UWIR for the CMA. This ensures that in areas where impacts may overlap, the QWC as an independent body can prepare a report to oversee and propose mitigation measures for the cumulative impacts as a whole. For petroleum tenures outside of a CMA, the petroleum tenure holder is responsible for preparing an UWIR.

Preparation of Final Reports is the responsibility of petroleum tenure holders, both for petroleum tenures outside of the CMA and for a 'closing CMA tenure'. A closing CMA tenure means a petroleum tenure the area of which is within a CMA for which the holder: (a) has given, before the CMA for the tenure was declared, a notice of closure for the tenure; or (b) gives, within 6 months after the CMA for the tenure is declared, a notice of closure for the tenure. Preparation of Final Reports is the responsibility of the QWC for a CMA tenure other than a closing CMA tenure.

2.4 When do Underground Water Impact Reports and Final Reports need to be submitted?

An UWIR must be submitted by 14 months after:

- The day production testing or production started on a tenure. This is the responsibility of the petroleum tenure holder.
- The day a renewal application for a tenure is granted. This is the responsibility of the petroleum tenure holder.
- 1 December 2010, if production or testing of petroleum had already started on or before that date. This is the responsibility of the petroleum tenure holder.
- The day a CMA is declared. This is the responsibility of the QWC.

A revised UWIR is required for the CMA or petroleum tenure every three years from the date the initial UWIR was approved.

If a notice of closure for a petroleum tenure is given by the holder of the petroleum tenure, a Final Report must be prepared. After the notice of closure is received, the chief executive will issue a notice requiring a Final Report to be prepared within the time period stated in the notice.

3.0 Underground Water Impact Reports

This guideline suggests methods that DERM believes to be appropriate to ensure that underground water resources and bore supplies will be protected from potential impacts resulting from the exercise of petroleum tenure holder's underground water rights. The guideline recommends specific methods for making predictions about the impacts of underground water extractions and for the preparation of UWIRs. However, DERM acknowledges 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 specified in this guideline, the tenure holder will need to consider the potential impacts of underground water extractions and justify the method chosen as being appropriate to the circumstances. Further, it should be noted that 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.

UWIRs 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: A water monitoring strategy

Part E: A spring impact management strategy

Part F: For a CMA, assign responsibilities to petroleum tenure holders.

3.1 Completing an Underground Water Impact Report

3.1.1 Part A: Underground water extractions

Section 376(a) of the Water Act states that information must be included about the quantity of underground water produced or taken from the area because of the exercise of underground water rights. In responding to this requirement the UWIR must include the quantity of water already produced and the quantity of water to be produced in the next three years.

Recommended methods and inclusions for Part A are described below:

3.1.1.1 Quantity of water already produced

The quantity of underground water already produced or taken from 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.

3.1.1.2 Quantity of water to be produced in the next three years

Estimates of underground water extractions expected to occur during the three years following the report consultation day[1] should be based on underground water extraction records and projected production estimates. The methods used to make these estimates should be reported.

3.1.2 Part B: Aquifer information and underground water flow

This section must contain:

- a description of each aquifer affected or likely to be affected by the exercise of underground water rights (Section 376(b)(i) of the Water Act);

[1] The consultation day is the day a notice is first published about the proposed report. The notice must be published at least 2 months before an UWIR is given to the chief executive.

- an analysis of the movement of underground water to and from these aquifers, including an analysis of aquifer interactions (Section 376(b)(ii) of the Water Act); and
- an analysis of the trends in water level change for the aquifer because of the exercise of underground water rights (Section 376(b)(iii) of the Water Act).

Recommended methods and inclusions for Part B are described below:

3.1.2.1 Aquifer descriptions

All aquifers that occur within or adjacent to the tenure boundaries should be described in this section, before further information is collated to assess whether these aquifers are likely to be affected. 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 (Queensland Department of Natural Resources and Mines, 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
- available data on current underground water levels.

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.

3.1.2.2 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 and abandoned water bores and petroleum wells. Information about interactions between aquifers will be critical for the conceptualisation phase of underground water model development.

3.1.2.3 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 2010, Webber 2004).

To assess underground water level trends, the data should be analysed for time periods before and after the start of petroleum testing or production. 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 2002).

3.1.3 Part C: Predicted water level declines for affected aquifers

Declines in underground water levels in aquifers (including petroleum and gas reservoirs, such as coal measures, and adjacent aquifers) may occur as a result of underground water extractions by petroleum and gas 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 2, within three years following the report consultation day (Immediately Affected Area); and
- water level declines, by more than the applicable bore trigger threshold, at any time (Long Term Affected Area).

This section must include:

- maps showing the Immediately Affected Area and the Long Term Affected Area (Sections 376(b)(iv) and 376(b)(v) of the Water Act).;
- a description of the methods used to produce these maps (Section 376(c) of the Water Act);
- information about all water bores in the Immediately Affected Area (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
- 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).

[2] Section 362 of the Water Act defines the bore trigger threshold, for an aquifer, as a decline in the water level in the aquifer that is:
(a) if a regulation prescribes the bore trigger threshold for an area in which the aquifer is situated, the prescribed threshold for the area; or
(b) otherwise: 5 m for a consolidated aquifer or 2 m for an unconsolidated aquifer.

Recommended Methods and Inclusions for Part C are Described Below:

3.1.3.1 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. For the Immediately Affected Area, maps showing yearly drawdown predictions should be included. Where possible, estimates of predictive uncertainty (Doherty 2003) should be provided to accompany the maps in this section.

3.1.3.2 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 a natural 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 MDBC guidelines (Middlemis 2000).

3.1.3.3 Water bores within the Immediately Affected Area

The information about water bores within the Immediately Affected Area should be presented in tables and maps. In addition to the information listed at the start of section 3.1.3, 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).

3.1.3.4 Review of maps produced

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.

3.1.4 Part D: Water monitoring strategy

An underground water monitoring strategy is required (Section 376(f) of the Water Act) for the Immediately Affected Area and the Long Term Affected Area. 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. Petroleum tenure holders are responsible for water monitoring both inside and outside CMAs (the UWIR prepared by the QWC will identify the responsible tenure holders for monitoring obligations inside CMAs).

The monitoring strategy must include (Section 378 of the Water Act):

- a rationale for the strategy;
- a timetable for strategy;
- the parameters to be measured;
- the locations for taking measurements;
- the frequency of the measurements;
- 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 petroleum tenure, but within the predicted Long Term Affected Area; and
- a program for reporting to the QWC about the implementation of the monitoring strategy.

Recommended methods and inclusions for Part D are described below:

3.1.4.1 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.

3.1.4.2 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. It is recommended that a higher frequency of monitoring should be adopted initially, particularly at bores 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 petroleum tenure, but within the predicted Long Term Affected Area.

3.1.4.3 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. Bore assessments for Immediately Affected Area 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.

3.1.4.4 Reporting Program

A program is required for reporting to the QWC about the implementation of the monitoring strategy. The recommended reporting frequency is six monthly. DERM will be advised when the QWC receives these reports.

3.1.5 Part E: Spring impact management strategy

Springs are points in the landscape where underground water naturally discharges at the surface (i.e. without the need for a water bore). There is potential for springs to be affected by water level declines in connected aquifers. 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. A spring is considered to be potentially affected if the water level in the 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. Under section 376(g) of the Water Act, a spring impact management strategy is required to determine potentially affected springs, investigate the risks to these springs and develop a strategy to manage and mitigate these risks. Petroleum tenure holders are responsible for implementing spring impact management strategies both inside and outside CMAs (the UWIR prepared by the QWC will identify the responsible tenure holders for spring impact management strategies inside CMAs).

This section must include (for each potentially affected spring) (Section 379 of the Water Act):

- the details of the spring, including its location;
- an assessment of the connectivity between the spring and the aquifer(s) over which the spring is located;
- 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;
- the options available to prevent or mitigate any impacts;
- a strategy for preventing or mitigating the predicted impacts; or if a strategy for preventing or mitigating the predicted impacts is not included, the reason for not including the strategy;
- a timetable for implementing the strategy; and
- a program for reporting to the QWC about the implementation of the strategy.

Recommended methods and inclusions for Part E are described below:

3.1.5.1 Spring inventory

The spring inventory should include the details of each spring i.e. spring name, spring type (e.g. recharge, discharge or watercourse) and spring location. Useful websites for obtaining this information include:

1. The Queensland Government Information Service (http://dds.information.qld.gov.au/DDS/Search.aspx) where you can download Queensland Wetland Data – Springs as and ESRI Shape File or a Map Info Tab File (search for “springs”).
2. The Wetland*Info* Website (http://www.epa.qld.gov.au/wetlandinfo/site/index.html) where you can download KML and PDF maps and find information about specific wetlands.
3. The Great Artesian Basin Resource Operation Plan Spring Register (http://www.derm.qld.gov.au/wrp/gab.html) where you can find information about the locations of 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 (section 3.1.5.3) and for assessing the effectiveness of spring management strategies.

3.1.5.2 Connectivity between the spring and aquifer

An assessment of the connectivity between the spring and the aquifer(s) over which the spring is located is required. 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).

3.1.5.3 Spring values

Information is required about the risk to and potential impacts on the ecosystems of potentially affected springs. These risks and impacts should be assessed using Environmental Values (EVs), by first selecting appropriate indicators. Indicators for EVs include biological indicators such as the diversity of wetland dependant native species and the presence of threatened species (listed under the EPBC Act), and physico-chemical indicators such as spring discharge rates, pH, dissolved oxygen and electrical conductivity.

It is expected that locally derived guidelines for water quality will be required for potentially affected springs. If locally derived guidelines are available, for example, in the form of Water Quality Objectives, Healthy Water Management Plans or Water Quality Improvement Plans, these should be referred to. For the development of locally derived guidelines, the Queensland Water Quality Guidelines (DERM, 2009) recommend collection of a minimum of 18 samples at a reference site over a 12-24 month period. Further Information about selecting appropriate ecological indicators, determining the appropriate level of protection and developing locally derived guidelines can be obtained from the Queensland Water Quality Guidelines (DERM, 2009) and the National Water Quality Guidelines (ANZECC, 2000).

Information is also required about the cultural and spiritual values for each potentially affected spring. Cultural and spiritual values encompass any relevant aesthetic, historical, scientific, social or other significance to past, present or future generations. To determine if the springs hold cultural and spiritual values, local indigenous representatives should be contacted in the first instance.

Once the spring values have been identified and suitable indicators have been selected, management goals should be developed for spring values using the selected indicators. These management goals should be quantitative measures or narrative statements that can be used to assess whether spring values are maintained. Management goals also reflect the desired levels of protection for the spring values. Information about indicators and management goals should be referred to when making assessments about the risk to and impact on spring values because of a decline in water level of the aquifer over which the spring is located.

3.1.5.4 Management of impacts

To manage potential impacts on springs, the options available to prevent or mitigate any impacts need to be documented and a strategy to prevent or mitigate these impacts needs to be developed. A suitable strategy for mitigating impacts might include measures such as injection of suitably treated water into source aquifers near springs, or offsetting measures. To measure the success of the spring impact management strategy, quantitative performance indicators relating to the defined management goals are required in addition to continued monitoring of potentially impacted springs. 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 (see Table 1).

3.1.5.5 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.

3.1.5.6 Reporting program

A program is required for reporting to the QWC about the implementation of the management strategy. The recommended reporting frequency is six monthly.

3.1.6 Part F: For a CMA assign responsibilities to petroleum tenure holders

If the Commission is responsible for preparing the UWIR or Final Report, the UWIR must:

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

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

4.0 Final Reports

Section 374 of the Water Act states that if a notice of closure for a petroleum tenure is given by a petroleum 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 to:

- for a CMA tenure other than a closing CMA tenure, the QWC as responsible entity for the cumulative management area; or
- for a closing CMA tenure or other petroleum tenure – the holder of the petroleum tenure.

4.1 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 (Immediately Affected Area);
- a summary about underground water bores in the Immediately Affected Area;
- 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 QWC).

In addition, a Final Report must include the following additional information:

- a summary about underground water bores in the Long Term Affected Area (including the number of bores and the location and authorised use or purpose of each bore);
- 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;
- 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
- 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.

5.0 Requirement for Consultation

Before giving the chief executive an UWIR or Final Report, the responsible entity must consult on the report (Section 381 of the Water Act).

The requirements for the public notice are as follows (as stated in Section 382 of the Water Act):

(1) The responsible entity must:

(a) publish a notice about the proposed Underground Water Impact Report or Final Report:

(i) in a newspaper circulating generally throughout the area to which the report relates; and

(ii) if the entity has a website, on the entity's website; and

(b) give a copy of the notice to each owner of a water bore within the area to which the report relates.

(2) The responsible entity for a cumulative management area must also give a copy of the notice to each holder of a CMA tenure within the area, other than the holder of a closing CMA tenure.

(3) The notice must state each of the following:

(a) a description of the area to which the report relates;

(b) that copies of the report may be obtained from the responsible entity;

(c) how the copies may be obtained;

(d) that:

(i) written submissions on the report may be given; and

(ii) the submissions must be given to the responsible entity; and

(ii) a copy of the submissions must be given to the chief executive;

(e) the day that is at least 20 business days after the notice is published by which the submissions may be made;

(f) where the submissions may be given.

(4) The responsible entity must:

(a) comply with subsections (1) and (2) at least two months before an Underground Water Impact Report is given to the chief executive; and

(b) give a copy of the report to each person who requests a copy.

6.0 References

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7.0 Definitions/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

A decline in water level in an aquifer prescribed by regulation, or otherwise 5 m for consolidated aquifers and 2 m for unconsolidated aquifers.

Consolidated Aquifer

An aquifer consisting predominantly of consolidated sediment. The term includes geological formations such as sandstone, fractured mudstone and basalt.

Consultation Day

The consultation day is the day a notice is first published about the proposed report.

Cumulative Management Area (CMA)

If the chief executive considers an area containing two or more petroleum 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 from wells.

Final Report

A report that must be completed if a notice of closure for a petroleum tenure is given by a petroleum tenure holder.

Hydraulic Properties

Quantitative measures of an aquifer's ability to store and transmit water.

Immediately Affected Area

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

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.

Make Good Obligations

The make good obligations of a petroleum tenure holder for an immediately affected area bore are:

- 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.

Petroleum Tenure Holder

The holder of an authority to prospect or petroleum lease issued under either the *Petroleum Act 1923* or the *Petroleum and Gas (Production and Safety) Act* 2004.

Potentially Affected Spring

A spring is considered to be potentially affected if the water level in the aquifer is predicted to decline by more than the spring trigger threshold (0.2 m, unless otherwise prescribed by regulation) at the location of the spring at any time and the cause of the predicted decline is the exercise of underground water rights.

Potentiometric Surface

A surface that represents the level to which water will rise in tightly cased wells.

Pumping Test

A pumping test involves pumping a well at a certain rate and recording the drawdown (decline) of water level in the pumping well and in nearby observation wells over a certain time period. Pumping tests are conducted to determine performance characteristics of a well and to determine the hydraulic properties of the aquifer.

Recharge

Water that percolates through the unsaturated zone and reaches the saturated zone.

Responsible Entity

The responsible entity is responsible for the preparation of an UWIR and Final Report. The responsible entity is the QWC (for a cumulative management area, other than an area that is within a closing CMA tenure), or the holder of the petroleum tenure (for a closing CMA tenure or a petroleum tenure other than a CMA tenure).

Source Aquifer

The primary aquifer contributing to spring discharge.

Spring

A point in the landscape where underground water naturally discharges at the surface (i.e. without the need for a water bore).

Stratigraphic

The arrangement and succession of geological strata.

Water Level

For artesian water – the level to which the water would, if it were tapped by a water bore and the water were contained vertically above the surface of the land, rise naturally above the surface of the land; or

For subartesian water – if the aquifer were tapped by a water bore, the level of water in the water bore tapping the aquifer.

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