

Report to the MDBA by the Review Panel for the Goulburn-Murray Sedimentary Plain SDL Area in Victoria

Introduction

The Murray Darling Basin Authority (MDBA) is responsible for developing and overseeing a planning framework for the management of the Murray-Darling Basin's water resources in the national interest. The Murray-Darling Basin Plan (the Basin Plan) is being rolled out by the MDBA over seven years, from 2012 to 2019, to meet this objective. The Basin Plan is an adaptive framework which aims to achieve a balance between environmental, economic and social considerations. It limits consumptive water use by setting long-term average Sustainable Diversion Limits (SDLs) for all surface water and groundwater resources across the Murray-Darling Basin (the Basin). The SDLs will take effect on 1 July 2019.

The SDLs have been set to establish environmentally sustainable limits on the volume of water that can be extracted for consumptive use from Basin water resources, having regard to water availability, environmental objectives and requirements and socio-economic requirements. Information and knowledge used to inform the setting of SDLs can be expected to improve over time. Therefore, the Basin Plan includes a review mechanism. The MDBA may, in consultation with the Basin States and other interested persons, or at the request of the Murray-Darling Basin Ministerial Council, undertake reviews of the Basin Plan, including in relation to whether there should be changes to the SDLs. The reviews must include an up-to-date assessment of climate change risks, and consider all relevant knowledge about the connectivity of surface and groundwater, the outcomes of environmental watering and the effectiveness of environmental works and measures.

In setting SDLs, there were three groundwater resource units where differing views existed between the MDBA and Basin States as to the magnitude of the appropriate SDL and where the difference of opinion could not be resolved prior to the Basin Plan being passed. These are:

- Western Porous Rock SDL resource unit (NSW);
- Eastern Porous Rock SDL resource unit (NSW); and
- Goulburn-Murray Sedimentary Plain SDL resource unit (Victoria).

Therefore, a mechanism was included under Section 6.06 (Clauses 6 to 9) of the Plan that requires a review of the long-term average SDL and the Baseline Diversion Limit (BDL) for each of these resource units within two years of the commencement of the Plan. The review(s) must consider '*all relevant information about the SDL resource unit, including modelling, State planning and policy arrangements, and an evaluation of the appropriateness of any precautionary factors associated with setting*' the SDL. The Basin Plan also nominates the experts who should be invited to participate in the reviews as the available members of the Independent Expert Scientific Committee on Coal Seam Gas and Coal Mining as well as two individuals with expertise in groundwater or groundwater management nominated by the relevant State.

This report is the deliberations of the Review Panel appointed to the task of reviewing the Goulburn-Murray Sedimentary Plain SDL Area.

Report to the MDBA by the Review Panel for the Goulburn-Murray Sedimentary Plain SDL Area in Victoria

Review Panel Membership

The Review Panel consisted of:

Mr Malcolm Forbes (Chair)
Professor Craig Simmons (IESC; Flinders University)
Dr Jane Coram (IESC; Geoscience Australia)
Prof Peter Cook (CSIRO; Flinders University)
Mr Stuart Richardson (CDM Smith)
Mr Ray Evans (Independent Consultant)
Mr Damien Finlayson (URS)

The Panel was assisted by Alan Wade (Principal Hydrogeologist, Aquade) as an independent expert, facilitator, and the author of the Synthesis Report (see below). The Panel also had the benefit of the presence of MDBA and the Department of Environment and Primary Industries (DEPI) Victoria officials as follows:

Dr Sabine Schreiber (DEPI Victoria)
Mr Simon Baker (DEPI Victoria)
Mr Craig Beverley (DEPI Victoria)
Mr Peter Hyde (MDBA)
Dr Tariq Rana (MDBA)

Background Information

The MDBA, in collaboration with DEPI Victoria commenced the review for the Goulburn-Murray Sedimentary Plain area by establishing the Review Panel and commissioning Alan Wade to prepare a Synthesis Report, the *Goulburn-Murray Sedimentary Plain Groundwater Sustainable Diversion Limit Review Synthesis Report* (the Synthesis Report). The Synthesis Report (Attachment A) is a specially prepared report synthesising existing material to support the deliberations of the Review Panel. It includes explanation of the methodology used by the MDBA and DEPI to evaluate BDLs and SDLs. It summarises currently available information on the Goulburn-Murray area including:

- Hydrogeological characteristics of the area;
- Licensed groundwater extraction in the area;
- General technical information of relevance to how the SDL, BDL and State extraction limit have been evaluated, including:
 - Two numerical models used to inform the SDL; and
 - Summaries of two independent reviews of those models

Review Panel Objectives

The objective of the review is “to review all available information relevant to the determination of SDLs and BDLs of the Goulburn-Murray Sedimentary Plain area.” This should include a review of the science, methods, planning and policies utilised by MDBA and DEPI to evaluate limits on groundwater take.

To achieve this, the Review Panel is tasked to provide recommendations to the MDBA regarding the SDL and BDL. These recommendations are to be based on the Synthesis Report, information presented during the review meeting and other relevant information.

Report to the MDBA by the Review Panel for the Goulburn-Murray Sedimentary Plain SDL Area in Victoria

Panel Deliberations

This report is a summary of the considerations and recommendations from the Review Panel. It should be read in conjunction with the Synthesis Report at Attachment A.

The Review Panel met on Thursday 4 September, 2014 to discuss the Goulburn-Murray Sedimentary Plain area. The Panel considered the information contained in the Synthesis Report at Attachment A and discussed various matters related to the technical content of that report.

The Panel considered and noted the following key issues.

Baseline Diversion Limit (BDL)

The BDL for each groundwater SDL resource unit in the Basin Plan represents the MDBA's determination of the limits on groundwater use under existing water management arrangements and describes the baseline against which SDLs are assessed. The Panel noted that the BDLs are evaluated as follows:

1. where a water management plan or proposed plan exists, the BDL is the plan limits unless the plan limit is greater than the level of entitlement, in which case the BDL is the entitlement;
2. where there is no plan, the BDL is the entitlement along with the effect of any rules managing extraction; and
3. where there is a cross-border agreement for groundwater management, the extraction limit under the agreement is the BDL..

The Panel also noted that the BDL includes an estimate of existing stock and domestic extraction. The Panel considered the local rule that restricts groundwater use to 70% of entitlement in the Katunga Water Supply Protection Area (Katunga WSPA) and noted that the rule had been in place since 2003. The Panel also noted that the BDL was determined at a point in time and that its application needed to be consistent across the Basin. The Panel concluded that the BDL for the Goulburn Murray Sedimentary Plain area should remain at 203.5 GL/yr.

Groundwater Models and criteria relevant to the SDL

In reviewing the SDL for the Goulburn-Murray Sedimentary Plain, the Panel took into account the SRP and NVic models which are different models that both included this area. The Panel noted that the scope of the Synthesis Report was to provide an overview of the modelling and synthesize the main review findings, rather than to include all details of the modelling reports.

As noted in the Synthesis Report, both the SRP and NVic models were considered by external reviewers as fit for purpose. The Panel noted however that the SRP and NVic models have varying model construction and model parameters. This included the hydraulic conductivity for important aquifer layers, recharge, storativity and modelled pumping abstraction. The justification for each model and the inherent variations in model conceptualisation and parameters is lacking in the documentation the Panel considered but is understood to be available.

Outcomes of groundwater abstraction scenarios simulated by both numerical models were assessed against four criteria:

1. Stabilisation of groundwater levels by completion of model run.
2. Stabilisation of extraction (productive base). This effectively means that no model cell can run dry.

Report to the MDBA by the Review Panel for the Goulburn-Murray Sedimentary Plain SDL Area in Victoria

3. Prevention of dewatering of confined aquifers, i.e. prevention of unconfined conditions in formerly confined aquifers (productive base). To meet this criterion the predicted groundwater levels must remain above the top of the confined aquifer.
4. Maintenance of current environmental river flows (key environmental outcome).

Despite the differences in model construction and parameters, both models appeared to be in excellent agreement when evaluated using the four diagnostic criteria used to guide the determination of SDLs. However, given well known model non-uniqueness issues and the unavailability of uncertainty analysis of each model, it is not readily apparent why both models are in such strong agreement for the four diagnostic criteria. It is not clear how surrogacy and model non-uniqueness may be at play, in precise terms, in the models.

This assessment is made more challenging because clear comprehensive water balances for each model were not available to the Panel. A rigorous, quantitative and comparative analysis of the two models is required in order to better understand how each model performs, their reliability, and to determine why both models perform so similarly on the four diagnostic criteria despite significant differences in their model conceptualisation and parameterisation. A detailed water balance should be produced and/or reviewed for both models. A detailed evaluation of both models should be conducted to clearly document and describe the key similarities and differences in model parameterisation and performance, in order to explain, justify and compare model results obtained with respect to the four diagnostic criteria. The analysis should obviously extend well beyond the analysis of the four criteria. A reconciliation of apparent model performance similarity in the presence of large differences in model construct and parameterisation is required to explain this behaviour. Model parameterisation choices should be justified (e.g. by comparison with literature describing aquifer parameters), compared and documented. Key points of difference between model performance should be elucidated and documented.

The analysis should include a rigorous uncertainty analysis of both models. It should point to possible directions and suggestions for future model development and this will be an important outcome of the detailed comparative analysis. The uncertainty analysis should provide a view of how each model handles the prediction of groundwater levels/fluxes under various extraction scenarios, in particular the scenarios that include an extraction regime set at 70 and 100% of the Katunga entitlement. The analysis of the SDL would benefit from a comparison of the performance of the two models in the predictive analysis.

The Panel noted that, whilst these concerns on the models are of specific relevance to the Goulburn-Murray Sedimentary Plain groundwater system, it is a general problem for models presented in the groundwater domain, whether for irrigation, mining or other extractive industries reliant on a groundwater resource. Policy makers need to be aware of the limitations that modelling can provide to determining an SDL without significant improvement in model performance and parameterisation. This is not to say that the SRP and NVic models were not helpful to the Panel in coming to a conclusion on the appropriateness of the SDL. The models were indeed informative to the Panel and it was considered particularly beneficial that there were two different models even though it was intriguing that they performed so similarly using the four diagnostic criteria. The Panel notes that having two models which include coverage of this area and the NSW Murray, has been very useful in appreciating both the effects of groundwater extraction at different rates and the level of uncertainty associated with current groundwater models.

The Panel also discussed the groundwater model SDL compliance criteria. Under the Water Act (s22(1) Item 6), the Basin Plan must include maximum long-term annual average quantities of water that can be taken, on a sustainable basis from:

1. The Basin Water resources as a whole; and

Report to the MDBA by the Review Panel for the Goulburn-Murray Sedimentary Plain SDL Area in Victoria

2. The water resources, or particular parts of the water resources, of each water resource plan area.

SDLs are defined as the maximum long-term annual average quantities of water that can be taken on a sustainable basis. For both groundwater and surface water, SDLs must reflect the environmentally sustainable level of take (ESLT) for a water resource, which is defined as the level at which water can be taken from that water resource without compromising:

- key environmental assets (KEA) of the water resource; or
- key ecosystem functions (KEF) of the water resource; or
- the productive base (PB) of the water resource; or
- key environmental outcomes (KEO) for the water resource.

To meet the ESLT requirements for groundwater, a groundwater SDL must:

1. maintain KEAs that have any dependence on groundwater;
2. maintain base flow groundwater contributions to rivers and streams (this is a KEF);
3. ensure that productive use of the aquifer is sustainable without compromising the hydrogeological integrity of the aquifer (PB); and
4. protect against decreasing groundwater quality, in particular salinisation of the groundwater resource (KEO).

It is not immediately clear how the four groundwater model sustainability criteria relate to the environmentally sustainable level of take (ESLT) assessment criteria (KEA, KEF, PB and KEO) and therefore, how the groundwater models' assessment criteria can be used as indicators of ESLT criteria compliance.

The Panel considered that, due to the relative similarity in the output performance of the two numerical models in the context of the sustainability criteria and despite significant differences in their inputs, it may be warranted to revisit the sustainability criteria. There should be potential to modify these criteria to more clearly align with the ESLT compliance criteria.

The panel notes that predictive groundwater models are used to inform management decisions rather than to provide SDLs. However, the criteria against which numerical model outputs have been evaluated are not the only consideration regarding sustainability of groundwater extraction. Actual observations/measurements of groundwater conditions constitute the primary management tool.

In considering the way forward, the Panel was of the view that as there are points of review in the policy and management rules amongst other issues considered by the Panel (see below), there will be opportunities for further development and refinement of the models. The Panel concluded that further work along the lines suggested above on both the SRP and the Nvic models be undertaken before the next review of the Katunga Groundwater Management Plan. In undertaking the work on the models it will be important that MDBA, Vic DEPI and NSW Office of Water officials work cooperatively and engage appropriate expertise. The Panel notes that there is an opportunity with a rigorous, quantitative and comparative analysis of the SRP and Nvic models to inform future potential management actions, in an area of long-term importance to irrigated agriculture in the Murray Darling Basin.

The Panel noted that there is not an agreed process for selecting a groundwater model for future use, such as the accreditation process for surface water models, and that the MDBA be encouraged to consider such a process for groundwater models.

Sustainable Diversion Limit (SDL) and Local Management Rules

The MDBA and DEPI consider the SDL figure to be more important than the BDL as the SDL

Report to the MDBA by the Review Panel for the Goulburn-Murray Sedimentary Plain SDL Area in Victoria

places an upper limit on groundwater extraction whereas the BDL reflects the groundwater that could be taken at the time of the making of the Basin Plan. The Panel was informed that the SDL can be greater than the BDL and that the SDL can be used anywhere within the Goulburn-Murray Sedimentary Plain SDL area.

The Panel noted that the maximum rate of groundwater extraction in the Goulburn-Murray Sedimentary Plain area has always been considerably less than the current BDL and SDL of 203.5 GL/yr., even during the last drought, and the infrastructure is not in place for higher rates of extraction than this figure. The Panel was also informed that, if the SDL was increased, there would be no impact to current users, i.e. the reliability of their supply would not change.

The Panel noted that there is little difference (approximately 10%) between the SDL figure of 222.9 GL/yr. proposed by DEPI and the current agreed figure of 203.5 GL/yr. in the Basin Plan. This difference is within the model ranges of uncertainty. The primary reason for the difference between the figures is whether 100% of the Katunga entitlement is included, as advocated by DEPI, or 70% of the Katunga entitlement is included, as advocated by MDBA. The Panel also noted that recharge was not an issue warranting further elucidation in this SDL resource unit.

An additional reason for the difference in the SDL figures is an additional 5 GL/yr. being sought by Victoria for the Lower Ovens area. This is currently unassigned, i.e. it is not a listed entitlement. The panel heard that this figure of 5GL/yr. has been identified as a potential groundwater demand for the Wangaratta Township. It is not intended that groundwater be the primary source for Wangaratta. However, a backup groundwater supply may be required in periods of drought.

The Panel, considered that, due to the similarity in the output performance of the two numerical models in the context of the sustainability criteria, despite significant differences in their model conceptualization and parameters, it may be warranted to revisit the sustainability criteria. There may be potential to improve/enhance these criteria.

Despite the differences in the models, the Panel recognized that both models report that the SDL represents a sustainable extraction limit with the extraction points spread across the area. Further, the Panel considers that the proposed extraction limit is within the uncertainties reported for both models. These are standard approaches when considering the outputs and outcomes of numerical groundwater models.

Given these factors, the Panel considered that the local management rules will be a critical component to managing extraction hot spots within the area. Such hot spots currently occur in the Katunga and Lower Campaspe WSPAs for which there are rules in State policies and water management plans. The Panel commented that if in the future there is growth in use in other parts of the Sedimentary Plain, then the State will need to plan for the implementation of local management rules in those areas.

The Panel notes that in Victoria the Water Supply Protection Area (WSPA) process was implemented and remains in place to protect groundwater resources. This process applies to the Katunga WSPA, where licensed allocations represent a significant proportion of the total allocations for the Goulburn-Murray Sedimentary Plain SDL area. Local groundwater management requires review by a committee which includes a majority of groundwater users. They must provide the minister with a management plan. The management plans in Victoria have considerable weight. The Katunga plan utilizes groundwater trigger levels and maintains groundwater levels within a relatively narrow range.

Report to the MDBA by the Review Panel for the Goulburn-Murray Sedimentary Plain SDL Area in Victoria

The objective of a Local Management Plan (LMP) in Victoria is to ensure the equitable sharing of available water between licensed water users, to protect the environment and ensure the long-term sustainability of the water resource in the applicable area. The Panel noted that the monitoring regime is critical in achieving this objective. Key monitoring data are groundwater usage, groundwater levels and groundwater quality. The completeness and accuracy of all three directly affects the capability to meet the plan objective.

The Panel noted that, in contrast to impacts to groundwater levels, impacts to groundwater quality in the aquifers of the Goulburn-Murray Sedimentary Plain, as a result of groundwater extraction from it, are likely to be permanent. The Panel also noted that the groundwater quality in the Katunga area is a corridor of relatively high quality with more saline groundwater laterally adjacent to and above the high quality groundwater. In the Katunga LMP, salinity is monitored in addition to groundwater levels. However, it is understood that there are no thresholds/trigger levels based on salinity at this time.

The Panel considers that the monitoring regime for the Katunga LMP should be reviewed and consideration given to:

- Whether groundwater salinity monitoring should be upgraded in any of the following ways:
 - Number of sample locations;
 - Sampling frequency; or
 - Integrity of sampling.
- The implementation of groundwater salinity trigger levels
- Whether the groundwater level monitoring network and frequency of data collection is adequate
- Whether the level of certainty regarding groundwater usage is adequate.

In undertaking this work, the Panel is of the view that an improved understanding of the groundwater fluxes in the region (particularly the Katunga area) in the context of potential salinity impacts will be important.

The Panel concluded that the SDL could be increased to 222.9 GL/yr as suggested by the DEPI once assurances were made by Victoria that they can demonstrate that the resource will be managed via State policies and plans in such a way that impacts on groundwater users and salinity are limited to acceptable levels. The Panel is of the view that water levels and quality will need to be constantly monitored and that the current monitoring regime be reviewed and that at key review points, such as the 5 year review of the Katunga WSPA, advantage is taken of the rigorous and quantitative comparative analysis of the SRP and NVic models and their further refinement and development.

SDL Area Boundary

The Panel noted that the change in the definition of the sedimentary plain/highland boundary would not make a significant difference to the licensed allocations or extraction limits in the two areas. The panel was in agreement with the new definition of the boundary between the Goulburn-Murray Sedimentary Plain and the Goulburn-Murray Highlands, proposed by DEPI and described in the Synthesis Report.

Uncertainty and Precision of Extraction Limits

The Panel noted there is uncertainty associated with evaluating diversion limits. It is a long-term objective to reduce that uncertainty but it was recognized that there will always be a limitation on their accurate determination. It was noted that the BDL and SDL are specified in the Plan with considerable precision, i.e. to four significant figures. However, the Panel notes that it is appropriate

Report to the MDBA by the Review Panel for the Goulburn-Murray Sedimentary Plain SDL Area in Victoria

to specify the BDL with a high level of precision as it reflects entitlement at a particular point in time.

Accumulated Groundwater Credits

The Panel noted that, in the Basin Plan, if groundwater is not used it is accumulated from year to year. In Victoria there are limits to the magnitude and duration of carryover. The Panel noted that the MDBA should implement limits in the magnitude and/or duration of the accumulated groundwater credits.

NSW/Victoria Cross Border Interaction

The Riverine Plain groundwater flow system, which includes the Goulburn-Murray Sedimentary Plain SDL Area, crosses jurisdictional boundaries. Consumptive use of the groundwater within each jurisdiction is controlled through each jurisdiction's water planning and management regime in isolation from the other. The Panel noted that there was interaction between pumping centred on Deniliquin and the Katunga areas. The Panel concluded that the MDBA should foster the work of the "cross-jurisdictional NSW/Vic groundwater working group" to better integrate the long term sustainable management of the Riverine Plain groundwater system across both sides of the NSW/Victoria border. The Panel noted that models have been developed that could assist with this (see above).

Panel Recommendations

The Panel recommends that:

1. the current agreed BDL for the Goulburn-Murray Sedimentary Plain of 203.5 GL/yr. be retained.
2. In relation to the SDL, the MDBA could consider :
 - Changing the SDL for the Goulburn-Murray Sedimentary Plain from 203.5GL/yr. to 222.9 GL/yr. as suggested by DEPI, once assurances were made by Victoria that it can demonstrate that the resource will be managed via State policies and plans in such a way that impacts on groundwater users and salinity are limited to acceptable levels; and
 - improving the understanding of groundwater fluxes in the region (in particular the Katunga area) in the context of potential salinity impacts.
3. The revised definition proposed by DEPI for the sedimentary plains/highland boundary be adopted and the area changed accordingly.
4. The criteria used to assess groundwater model outputs be reviewed to more clearly align with the specified environmentally sustainable level of take (ESLT) assessment criteria,
5. The MDBA should investigate and address the issue of excess SDL credits.
6. Conduct a rigorous, quantitative and comparative analysis of the SRP and NVic models to inform future potential management actions, including any actions under Recommendation 2 above.
7. The MDBA actively fosters the work of the 'cross jurisdictional NSW/Vic groundwater working group' to use modeling and other information to obtain a more robust understanding of the interaction of groundwater take and management decisions

Report to the MDBA by the Review Panel for the Goulburn-Murray Sedimentary Plain SDL Area in Victoria

across borders and the consequences to the long term sustainability of the connected groundwater systems.