

Northern Victoria Irrigation Renewal Project
Assessment of Hydrological Changes from the operation of the
NVIRP modernised GMID – Surface Water & Groundwater
Hydrology



Advice from the
NVIRP Expert Review Panel
to the
Secretary of the Department of Sustainability &
Environment

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1. INTRODUCTION

1.1 This Advice

This advice is in relation to two hydrological technical reports which aim to quantify the likely changes in both the surface water and groundwater as a result of the future operation of the Northern Victoria Irrigation Renewal Project (NVIRP) modernisation. These two reports are referred to throughout this advice as the "Surface Water Report" (Technical Report #1) and the "Groundwater Report" (Technical Report #2) and together as the hydrological reports, or a simpler abbreviation of these terms.

1.2 Context

A delegate of the Minister for the Environment, Heritage and the Arts determined on 6 November 2009 that the proposed NVIRP action referred to the Federal Government under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to be considered a Controlled Action. The proposed NVIRP action is "the modified operation of the fully modernised Goulburn Murray Irrigation District". Accordingly, the Department of Environment, Water, Heritage and the Arts (DEWHA) advised NVIRP that it is to prepare a Public Environment Report (PER) that will determine the likely impact on Matters of National Environmental Significance (MNES) that are protected under Part 3 of the EPBC Act, including:

- wetlands of international importance;
- listed threatened species and communities; and
- listed migratory species.

Six technical reports have been commissioned by NVIRP as part of preparing the PER, and these are:

- **Technical Report #1: Sinclair Knight Merz (2009a). Northern Victoria Irrigation Renewal Project: Assessment of Hydrological Changes from the operation of the NVIRP modernised GMID - Surface Water Hydrology, Sinclair Knight Merz report (Final Version) prepared for the Northern Victoria Irrigation Renewal Project, Shepparton**
- **Technical Report #2: Sinclair Knight Merz (2009b). Northern Victoria Irrigation Renewal Project: Assessment of Hydrological Changes from the operation of the NVIRP modernised GMID - Groundwater Hydrology, Sinclair Knight Merz report (Final Version) prepared for the Northern Victoria Irrigation Renewal Project, Shepparton**
- Technical Report #3: King, A.J. and Tonkin, Z. (2009). Northern Victoria Irrigation Renewal Project: Operational impact assessment on aquatic fauna. Unpublished client report. Arthur Rylah Institute for Environmental Research. Department of Sustainability and Environment, Heidelberg
- Technical Report #4: Brett Lane & Associates (2009). Northern Victoria Irrigation Renewal Project: Operational Impact Assessment on Terrestrial Vertebrate Fauna, Brett Lane & Associates report 9056.2(2.8) prepared for Northern Victoria Irrigation Renewal Project, Shepparton
- Technical Report #5: Ecological Associates (2009). Northern Victoria Irrigation Renewal Project: Assessment of Impacts on Flora Issues of National Environmental Significance, Ecological Associates report EI001-3-D prepared for Northern Victoria Irrigation Renewal Project, Shepparton

- Technical Report #6: Hale, J. (2009). *Northern Victoria Irrigation Renewal Project: Operation Impact Assessment on Wetlands of International Importance (Ramsar Wetlands)*, Report prepared for Northern Victoria Irrigation Renewal Project, Shepparton, Jennifer Hale, Kinglake.

1.3 Role of Expert Review Panel

An Expert Review Panel (ERP) was appointed by the NVIRP and endorsed by the Minister for Environment and Climate Change (Victoria). The role of the ERP is to provide advice to NVIRP, the Minister for Water, and the Secretary, Department of Sustainability and Environment (DSE) in relation to the decision by the Minister for Planning (Victoria) that an Environment Effects Statement (EES) is not required for the NVIRP. The relevant condition of the Minister's decision is Condition 2, which determined that:

“NVIRP must appoint an Expert Review Panel, the membership and terms of reference of which are to be endorsed by the Minister for Environment and Climate Change, to provide advice on hydrological and related ecological changes due to the implementation of NVIRP”.

The ERP was established in late June 2009 and has met as required since the beginning of July 2009 to review the matters set out in the conditions specified by the Minister for Planning (Victoria).

1.4 Purpose of the Hydrological Reports

The purpose of these reports is first, to quantify the surface and groundwater changes likely to result from the operation of the NVIRP modernisation; and second, to express those changes in a form and manner that enables the ecological assessments that need to be made under the requirements of the EPBC Act. The hydrological reports are a discrete step and a platform for the ecological assessments. This is shown in the diagram (**Figure 1**).

1.5 Process for Expert Review Panel Review

This ERP advice is based on versions of the hydrological reports received prior to 1 January 2010. This advice is submitted to the Secretary of the Department of Sustainability and Environment (DSE) on the understanding that editorial changes may be made to the hydrological reports on full review by NVIRP and the DSE prior to submission of the PER to DEWHA.

NVIRP and the DSE formed a Steering Committee to define the scope and direct the consultants engaged to undertake these hydrological investigations. The ERP received early versions of these reports and presentations from Sinclair Knight Merz in December 2009. Since then there has been further iterations of the reports incorporating refinements based on feedback from agencies and stakeholders, including from the ERP.

The ERP acknowledges the expert assistance and experience of R. Michael Williams (Principal Hydrogeologist, New South Wales Office of Water) in preparing this advice and in guiding the feedback and the actual scope of the groundwater investigations. This was invaluable.

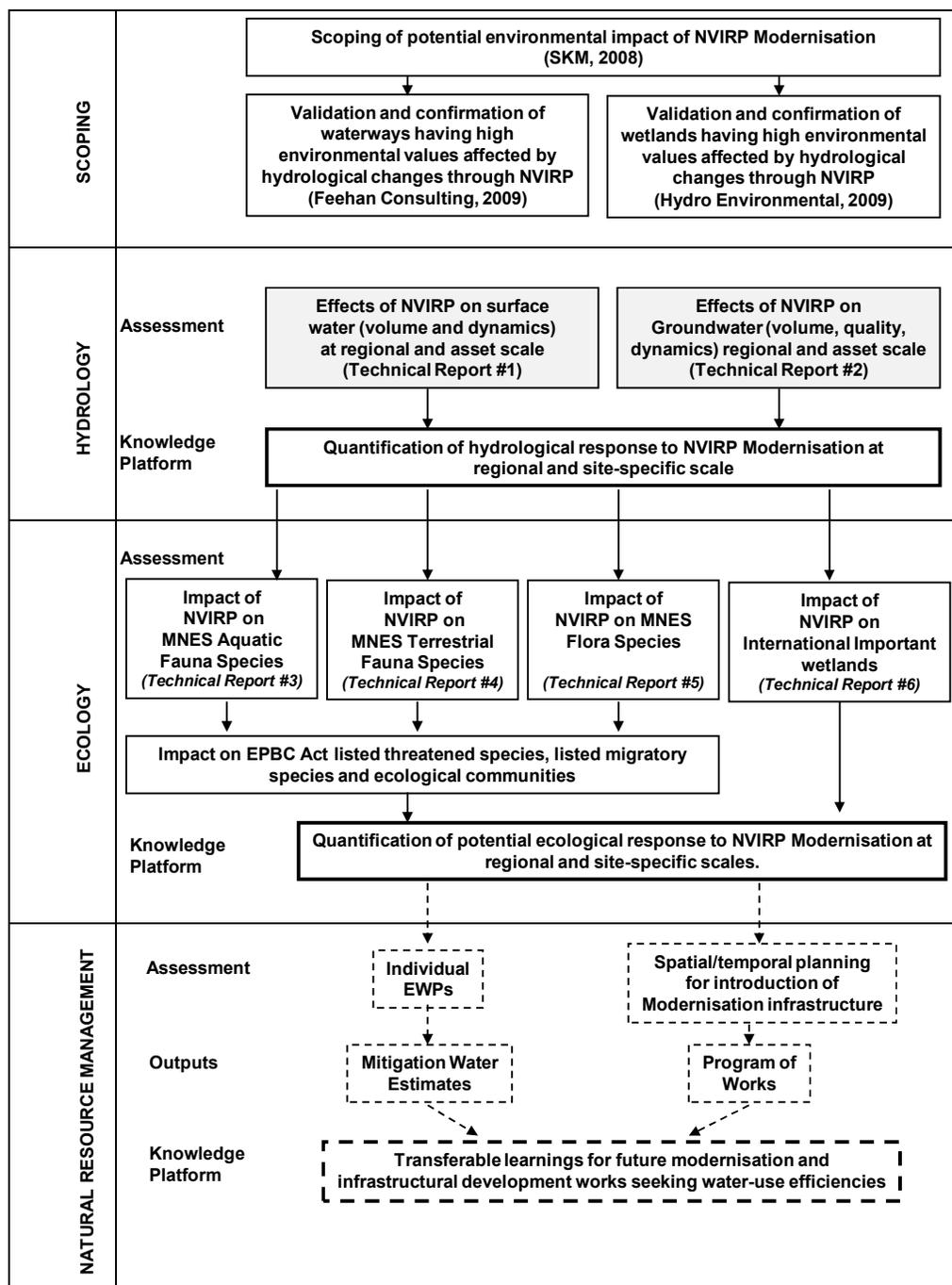
1.6 Criteria Used by the Expert Review Panel

The ERP established several criteria to guide its review of the six technical reports and to structure its advice to the Secretary of the DSE. These criteria are based on the EPBC Act Significant Impact Criteria, and on the directions given the decision by the Minister for Planning (Victoria) that no EES is required for NVIRP. The criteria were developed with an awareness of the PER Guidelines provided to NVIRP by DEWHA on 24 December 2009.

These criteria are as follows:

- (i) Comprehensiveness of the Reports
- (ii) Adequacy of the Technical Methods
- (iii) Effectiveness of the Process
- (iv) Suitability for Purpose

Figure 1: Assessment Purposes and Knowledge Platforms of PER Supporting Documentation



2. REVIEW OF THE HYDROLOGICAL REPORTS

2.1 Comprehensiveness of the Reports

These reports estimate the extent of the hydrological changes resulting from the modified operation of the NVIRP modernised GMID for the Goulburn River, the River Murray, for Ramsar sites within and hydraulically connected to the GMID and for certain areas within the GMID. The hydrological reports express the changes in ways that are relevant for subsequent ecological assessment.

The ERP notes that the reports cover the operation of the NVIRP water savings modernisation works. The Central Goulburn Irrigation Area Channels 1-4 and the Shepparton Irrigation Area channels were modernised under a separate program and are considered to be a part of NVIRP only to the extent of additional water savings derived from limited additional channel rationalisation and remediation (lining). In addition, there has been no decision as yet on whether to proceed with proposed modernisation linked to the Kerang Lakes complex within the Swan Hill region. If and when a decision is made, the project(s) would be subject to a separate EPBC Act referral process. Wetlands and waterways affected by outfalls such as the Campaspe River, Loddon River, Broken Creek and minor waterways which are within the GMID were considered at an earlier start as part of the scoping investigations (**Figure 1**). Therefore these wetlands and waterways are not considered within the hydrological reports due to ongoing detailed localised investigations (development of Environmental Watering Plans) currently underway.

Sources of uncertainty have been identified and the treatment of the uncertainty, along with the implications for the results explained. The assumptions and the limitations inherent to the methods deployed are detailed.

These reports consider only the hydrological impacts associated with the operation of the NVIRP modernisation, including the water savings to be distributed to irrigators. They do not attempt to include environmental water resulting from NVIRP or any other sources.

The reports cover all the relevant ecological aspects of the hydrological cycle which are impacted by NVIRP modernisation including, reduction in diversions to irrigation areas, reduction in outfalls from irrigation areas, potential reduction in harvesting of storing and spilling mode flow to irrigation areas, reduction in groundwater levels, reduction in discharges to rivers from groundwater, and salinity levels in rivers. The reports express the assessed hydrological changes in ways that are relevant for subsequent ecological assessments.

The ERP is satisfied that these hydrological reports have covered matters that are required for the ecological assessments and that their scope is comprehensive.

2.2 Adequacy of the Technical Methods

Spreadsheet analyses were used to estimate river flows at select locations along the Goulburn and Murray rivers, and changes were estimated as the difference in particular flow variables between conditions pre-NVIRP and conditions post-NVIRP. Alternative approaches such as using a complete hydrological model of the river-irrigation-river system is not considered practicable given the complexity of the different assumptions that would have had to be made and the time and cost that would be required to set up and validate. The ERP is of the view that the approach used is adequate and appropriate for the task.

The five step method adopted within the Surface Water Report and the incorporated techniques and assumptions are considered to be quite logical and suitable. Similarly, the identification of the separate storing and spilling mode periods and the supplying mode period for the purposes of analysis and presentation of findings is logical and appropriately useful.

The ERP notes that due to a lack of recorded flow data and high uncertainty about the potential impacts of NVIRP in the complex operating environment of the Torrumbarry Irrigation Area, the potential impacts of NVIRP on the Kerang Lakes were described based on a conceptual assessment only. This is a generally accepted approach in situations where data are not readily available.

The task of estimating changes in groundwater was quite complex because of the diversity of the situations where groundwater changes could potentially have an ecological effect. Conceptualisation of the regional landscape as three separate units was useful in showing what and where these ecological changes could occur. These units were; near channel unit, within GMID unit (west and east of Terrick Terrick Hills); and Riverine floodplain unit (adjacent to, and downstream or distant from the GMID). Different approaches and methods were developed for assessing NVIRP related changes in groundwater levels and groundwater movement for each of these landscape units and for assessing the salinity effects in rivers.

A one-dimensional distributed parameter groundwater flow model (MODFLOW) was used to determine a near channel buffer zone within which the significance of channel recharge groundwater for wetlands may need investigation. Changes to groundwater levels and river salinity effects were assessed primarily using two simulation models, along with various first principles techniques, supported by independent lines of evidence. The Analytical Spreadsheet Model was developed primarily to assess (vertical) groundwater responses to NVIRP in the within GMID unit. The Southern Riverine Plains Model (SRPM) provided the hydrogeological and groundwater setting for the GMID in the southern Riverine Plains and enabled the assessment of spatial and temporal impacts of NVIRP modernisation. The ERP sought specialist advice on the technical methods used to assess groundwater responses to NVIRP, and in particular regarding the use of the SRPM. The ERP is satisfied that the methods deployed provide a coherent basis on which to underpin the conclusions of the Groundwater Report and are suitable for the purposes for which they have been used.

The expectation to consider the range of variability was considered in different ways depending on the adopted technical methods. Where simulation was not available the approach of using two years of contrasting hydrological conditions to capture the range of environmental conditions in lieu of simulations was sensible. The methods deployed are regarded as valid and sensible and the ERP considers the findings generated should be as reliable an indicator of long term effects as might be expected.

The uncertainties of the analytical assumptions are tabulated in each report with the sources of uncertainty, their treatment and implications for results clearly set out. The treatments of uncertainty are considered by the ERP to be appropriate because they involve necessary simplification or appropriately conservative assumptions. For example, the decision not to represent some variability in outfall reduction on a daily basis is reasonable, particularly in light of the conservative assumption that the full impact of the change in outfalls is transmitted undiminished to the rivers.

The combination of all the technical methods deployed has been successful in providing appropriate outputs for ecological analyses. The identification of the changes in hydrological parameters to facilitate the ecological assessments and the techniques used to display the results using tables and figures are logical and appropriately useful.

Overall the ERP is of the view that the technical methods deployed are quite adequate, notwithstanding that some of the concepts relating to effects of reduced diversions to irrigation areas, reduced outfalls to rivers, changes in level and duration of commence to flow thresholds, changes in lateral groundwater movement, sub-surface groundwater evaporation and salinity movement can be challenging to clearly communicate and visualize.

2.3 Effectiveness of the Process

Features of the process undertaken to complete the hydrological reports included facilitating appropriate input from experienced operators of the water systems involved to test the logic and assumptions of the technical methods deployed and taking into account the needs of the report users at a sufficiently early stage. The interface between the assessment and quantification of hydrological changes and the usefulness of hydrological inputs for the assessment of associated ecological consequences while challenging, has been well handled.

The ERP is of the view that the process followed from refinement of raw hydrological data to the provision of products for ecologists to use was effective.

2.4 Suitability for Purpose

The ERP is of the view that the hydrological reports provide an appropriate assessment of the hydrological changes arising from NVIRP modernisation and are appropriate hydrological input to the assessment of associated ecological consequences.

The identification of the changes in hydrologic parameters to facilitate the ecological assessments is a vital feature of the report. The use of illustrative figures in the Surface Water Report, to provide insights into the assessment method and to explain the changes in hydrologic parameters will be of significant benefit to the general reader. Similarly, the use of hydrographs of groundwater levels with and without NVIRP and the regional groundwater elevation maps in the Groundwater Report will be of significant benefit to the general reader.

The ERP is satisfied that the hydrological reports are suitable to be appended to the PER and that they also provide important content for the assessment report that is to be prepared as a requirement of Condition 4 of the decision by the Minister for Planning that an EES is not required.

3. CONCLUDING ADVICE

The ERP concludes that together the hydrological reports have provided the information needed for ecological assessment in a form that can be used by the ecologists and is therefore appropriate for purpose. They provide readable but comprehensive technical analyses on a range of hydrological changes expected to result from the operation of NVIRP modernisation.

The work completed specifically for the Groundwater Report actively contributes to the knowledge and understanding of groundwater processes within northern Victoria. The work on defining the buffer zone near irrigation channels to help determine the potential for channel recharge groundwater to affect adjacent wetlands was an original piece of work that has contributed effectively to the ecological investigations. The Groundwater Report has added to the overall knowledge of groundwater within the Murray Darling Basin.

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